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Exploring the Impact of a Trauma-informed Yoga and Mindfulness Curriculum for Multiple Populations: A Pilot Study

D. Richard [a], D. Rousseau [b,*], K. Umapathy [a], H. Pandya [c], G. Rousis [d], P. Peeples [e]

[a] University of North Florida, 1 UNF Drive, Jacksonville, FL 32224, United States
[b] Boston University, 1010 Commonwealth Avenue, Rm 510, Boston, MA 02215, United States
[c] SS&C Technologies, 9000 Southside Blvd, Building 700, Jacksonville FL 32256, United States
[d] University of South Florida, 4202 E., Fowler Avenue, PCD 4118 G, Tampa, FL 33620, United States
[e] The Peeples Collaborative, 1327 Walnut Street, Jacksonville, FL, United States

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ABSTRACT

Individuals with trauma experience negative mental health impacts and are at risk of poor cardiovascular outcomes. Unmanaged, these conditions may worsen, compromising healing and wellbeing. Yoga, particularly trauma-informed, may improve outcomes. The current pilot study explores the impact of a novel trauma-informed yoga and mindfulness curriculum on wellbeing in two parts. The first examined mental health (stress, mood) outcomes in four trauma-impacted populations: adults who were incarcerated (INC), individuals in recovery from substance use disorders (SU), veterans (VA), and vulnerable youth (YTH) assessing both the impact of individual class participation and impact of attending at least four curriculum sessions. For the subgroup of incarcerated individuals, impact by theme was examined. After curriculum sessions, stress was reduced, and mood improved. Across multiple sessions both the largest decreases in stress and greatest increase in mood occurred after participant in the first session. Further, a specific exploration of curriculum class impact by theme for participants who were incarcerated indicated no difference in impact by theme. The second part of this study explored cardiovascular outcomes for the population of those in recovery from substance use. Reductions in systolic blood pressure occurred immediately after the first curriculum session, and diastolic blood pressure reduced over three consecutive sessions.

Introduction

There is growing awareness of the benefits of strength-based approaches addressing the many impacts of trauma and a growing number of non-profits are providing services rooted in mindfulness and embodied movement practices. Programming seeks to share access to holistic and often cost-effective approaches to resilience building, physical health, and mental wellbeing. To sustain impact and grow programming, it becomes important to demonstrate the effectiveness of programming including impact for specific populations. The current study represents a pilot exploration of a trauma-informed yoga and mindfulness curriculum as implemented with four priority populations: people who are incarcerated, those in treatment for substance use disorders, veterans, and youth.

Yoga is associated with physical wellbeing including improvements in cardiovascular health and reduction of cardiovascular risk, specifically hypertension[1, 2, 3]. According to a systematic review of 37 randomized controlled trials of 2768 individuals, adults who practiced yoga had a systolic and diastolic blood pressure reduction[4]. Another systematic randomized control trial review by Barrows and Fleury[5] summarized nine peer-reviewed studies investigating various cardiovascular outcomes associated with yoga. Of the reviewed studies, five specifically evaluated blood pressure, and two found statistically significant improvements in systolic blood pressure compared with controls[6] and/or usual care[7].

The impact yoga has on wellbeing been well documented in studies across a variety of populations[5, 4, 8, 9]. Yoga is associated with improvements in psychiatric and mental health conditions[10, 11, 12, 13, 14], including stress[15, 16], mood disorders[15, 2], attention deficit and hyperactivity disorder[9], anxiety[8], dementia[7], post-traumatic stress disorder[17,

* Corresponding author: Danielle Rousseau, PhD LMHC, Department of Applied Social Sciences, Boston University, 1010 Commonwealth Avenue, Rm 510, Boston, MA 02215, United States.
E-mail addresses: drichard@unf.edu (D. Richard), danrou@bu.edu (D. Rousseau), k.umapathy@unf.edu (K. Umapathy), grousis@usf.edu (G. Rousis).

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[14], insomnia[2], as well as the effects of chronic pain[17, 18, 19]. The reduction of stress (both acute and chronic) through yoga has been shown to reduce other co-morbidities of disease, and improved stress is associated with increased quality of life[16, 20]. Because of these widespread benefits, clinicians increasingly are recommending yoga as a complement to psychotherapy and medical management[21].

Yoga benefits have been demonstrated across every age group as well as in specialized populations including people who are incarcerated (Auty, et al., 2015;[22, 23–25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39]), people suffering from substance use disorders ([4041, 42, 43, 44, 45, 46]), military personnel[19, 47], youth[2, 48, 20, 49], and survivors of trauma more generally[50, 17, 51, 52, 53, 54, 14]. The use of yoga specifically developed for populations with emotional, physical, or social needs related to trauma sequelae is increasing.

Given that populations with trauma may already be compromised, these studies suggest that our communities are incurring even greater costs associated with the individual's deteriorating or reduced mental and physical health status. To address this need for improving health and wellbeing outcomes among people underserved by healthcare, mental health, behavioral health and other social services, Yoga 4 Change (Y4C), Inc., a non-profit organization, developed a novel low-cost, yoga and mindfulness curriculum to address trauma and improve mental and physical health by integrating physical movement (e.g., body forms/shapes) with trauma-based thematic teachings (e.g., forgiveness, self-acceptance, vulnerability, etc.). These teachings are specifically developed for four populations, including incarcerated individuals, those dealing with substance use and behavioral health diagnoses veterans, and youth. The current program is unique in that it moves beyond a yoga only physical offering to incorporate programming that is strength-based, trauma-informed, and contains multiple components in support of holistic wellbeing.

The current study represents a pilot exploration of a trauma-informed yoga and mindfulness-based curriculum implemented with multiple populations. This study examined the impact of Yoga 4 Change's manualized curriculum with the goal of demonstrating viability generally and within four specific priority populations. To that end, we implemented two specific explorations examining the impact a trauma-informed mindfulness-based curriculum. The first examined the impact of programming on self-reported ratings of mood and stress across four populations (people in treatment for substance use, people who were incarcerated, veterans, and youth). The intent was to provide insight into the outcomes associated with the specific curriculum but also to explore comparative data on potential difference in impact across the four populations and after multiple sessions. The second part of this pilot study examined the impact of the curriculum on cardiovascular outcomes (blood pressure and heart rate) for individuals in treatment for substance use disorders. The purpose of this pilot exploration is to demonstrate viability of programming in support of curriculum development, implementation, and further controlled study.

Materials and method

Study design

This pilot observation of a novel trauma-informed mindfulness curricula was explored through two study components conducted from October 2015 to June 2016. Both studies examined the impact of class participation in a trauma-informed yoga and mindfulness program on wellbeing.

The first study component explored impact of programming on psychological wellbeing including specific examination of mood and stress for four mutually exclusive cohorts including incarcerated adults (INC), veterans (active, reserve, and inactive; VA), individuals attempting recovery or recovered from substance use disorders (SU), and youth (YTH) aged 8–18 years.

All eligible respondents attended at least one 60-minute curriculum session conducted by Yoga 4 Change at approved institutions located in Duval County, Florida; institutions were operated by the Department of Corrections (for INC) or were community-based centers (servicing SU, VA, or YTH). To be included, participants had to attend a minimum of one curriculum session and complete one or more pre-post outcome assessments during the 9-month study period. Students were novice participants. Demographic characteristics included gender and cohort. Age was not collected.

In the study exploring four populations, we examined whether the novel curriculum could have positive impacts on mental health wellbeing (stress and mood) and examined whether impact differed by specific population and across multiple sessions. Could participation in a curriculum session decrease stress and improve mood? Could the impact be seen for some populations and not others? Would impact differ for those who participated in multiple sessions? For a subset of participants who were incarcerated, we also explored impact by theme.

For the population of individuals in treatment for substance use, we additionally conducted initial exploration of potential physiological impacts. We specifically examined whether participation could impact blood pressure and heart rate and hypothesized that participation could have positive physical implications. It is our hope that these initial findings will support the work of Yoga 4 Change and lead to further controlled empirical examination of the curriculum.

Program

All program populations participated in Yoga 4 Change's strength-based trauma-informed yoga and mindfulness curriculum. Yoga 4 Change is a non-profit organization that provides a curriculum rooted in an empirical understanding of trauma that pairs trauma-informed yoga movement with thematic teachings tailored to the physical and emotional needs of each population served. The curriculum moves beyond physical yoga practice and represents a manualized tool to support wellbeing in practices that are strength-based and trauma-informed. The structure of the curriculum and each class included elements of consistency, repetition, and predictability, intentionally taking trauma into account. Each class followed a standardized arc and incorporated physical forms, meditation, and thematic discussions. Sessions begin with a guided breathing practice incorporating the designated class theme (10 min). Breathwork is followed by a physical yoga practice (mindful movement) that is intentionally trauma-informed, addresses the specific population, and incorporates the theme for the specific class session (30 - 35 min). The class concludes with a guided meditation, prompted writing, and reflection all guided by the curriculum theme (15- 20 min). The curriculum, including both practices and curriculum themes, was developed by individuals with lived trauma experience and informed by empirical research[55]. Meditative themes included goal setting, positive interpersonal relationships, optimism, and self-improvement. Elements of the program include teaching participants tools and coping strategies such as routine breath practices, body movements, and journaling that can be utilized in their daily lives. Yoga instructors chose relevant themes for trauma-informed yoga practice based on the needs of the participants in the session.

Yoga 4 Change instructors are registered yoga teachers (minimum 200-hr Register Yoga Teacher designation) and additionally receive Yoga 4 Change training that is trauma-informed, population, and curriculum specific. While the curriculum and practice are rooted in yoga philosophy, programming intentionally does not utilize Sanskrit language in cuing. The physical practice is invitational and designed to be accessible. All meditations are scripted and guided.

Outcomes assessment

The first portion of the study explored the impact of the trauma-informed yoga and mindfulness curriculum on self-reported ratings of stress and mood. Stress and mood were measured on a 10-point scale

(range of 1 = low and 10 = high). Higher stress ratings equated to less favorable status, whereas higher mood ratings equated to more favorable status. The single item stress and mood scales were used for ease and time efficiency as the assessment was administered twice (before and after programming) during each class, and program administrators did not want to put an unnecessary burden on limited class time. Ross et al.,[56] summarized the importance of incorporating patient-reported outcomes in yoga therapy to evaluate the impact of the intervention on health and wellbeing. Class instructors were educated by a single individual on how to administer the assessment tools. Instructors explained the assessment tool rating scale to the student responders prior to each administration of the instrument (pre- and post-curriculum session). For responders who struggled with literacy or understanding, instructors provided additional clarifying instructions, while attempting to minimize external influence on stress and mood ratings.

The second portion of the pilot examined program impacts on physical wellbeing as measured by blood pressure (BP) and heart rate (HR) among people in recovery from substance use disorders (SU). Blood pressure and heart rate assessments were conducted by Yoga 4 Change instructors who received prior training on the use of a calibrated manual professional sphygmomanometer and pulse rate evaluation. Blood pressure was recorded, and hypertension stage was assigned post-hoc based on the American College of Cardiology (ACC)/AHA Clinical Practice Guidelines for High Blood Pressure in adults (Whelton, 2017). Heart rate was measured in beats per minute (BPM); normal resting heart rate is 60 to 100 BPM.

Results

Demographics

During the study period, a total of 1826 participant data cards were at least partially completed by participants and coordinating staff. Participants completed self-report psychological measures and staff recorded physiological measures. Each card represented a participant's data during one of the trauma-informed curriculum sessions. However, not all participants completed all information on the cards for every session. The cards that neither contained pre-post measures for at least one outcome measure were removed ($N = 96$).

The resulting study sample included 925 unique participants completing at least one trauma-informed yoga session with Y4C between the dates of January 2016 and June 2017. A large portion of these participants ($N = 354$) completed more than one yoga session, with 100 participants completing at least 4 sessions, and one of those participants completing 20 sessions. At each session, participants completed at least one psychological measure (mood or stress) or at least one physiological measure (blood pressure or heart rate). Fifty-two participants (SU cohort only) completed sessions where both psychological and physiological measures were taken.

Including repeat sessions, the total number of observations was 1730 (see Table 1 for frequency summary across measures). Of the 1652 sessions where at least one pre-post psychological measure was taken, 863 were unique (i.e., the first psychological measure taken for that participant). Of the 185 sessions where at least one pre-post physiological measure was taken, 115 sessions were unique (i.e., the first physiological measure taken for that participant). Physiological measures were only taken within the SU cohort; therefore, cohort comparisons were not possible within physiological measures. Of the 925 unique participants, 43% represented the INC cohort, followed by 26% SU, 23% YTH, and 8% VA. The proportion of women and men in each cohort is shown in Table 2.

Table 1
Count of Sessions for Participants Completing Psychological and/or Physiological Measures.

Sessions	N
All	1730
Initial (Unique)	925
Repeat	805
Psychological Measures Taken	1652
Initial (Unique)	863
Repeat	789
Physiological Measures Taken	185
Initial (Unique)	115
Repeat	70

Statistical analysis

Pre- and post-session data were matched for each study participant within each session. Heart rate and blood pressure were measured for the SU group only. Mixed ANOVA designs were used to determine the statistical significance of the difference between the pre- and post-session means for the psychological measures of stress and mood, as well as differences across cohorts. For significant overall effects, we conducted post-hoc analyses to test differences between groups using the Fisher's Least Significant Difference (LSD;[57]) procedure because the number of groups was small in each analysis. This resulted in an effective Type I error rate of less than 0.05 for each set of post hoc analyses and the highest protection against Type II errors among post hoc procedures. Because participants could participate in multiple sessions, it was possible for individuals to contribute pre- and post-data for multiple sessions. To avoid violating the assumption of independence[58], in each analysis, for primary analyses, we used only the first recorded session for each participant, such that only one measure of pre-post data was used for each participant for each analysis. For analyses looking at the effects over multiple sessions, only participants who completed an adequate number of sessions were included. Because some participants had some missing data on some measures (e.g., participants may have completed a pre-post measure for stress but not for mood), the maximum number of available independent participant data values were used for each statistical test.

Part 1: psychological measures

Single session effects on psychological measures of stress and mood

To compare reported stress and mood outcomes for yoga participants across different populations of individuals experiencing trauma, we conducted a 4 × 2 mixed ANOVA, with participant cohort (INC, SU, VA, and YTH) serving as a between-subjects variable and time of measurement (pre; before yoga vs. post; after yoga) serving as the within-subjects variable. A significant two-way interaction would indicate that the benefit of trauma-informed yoga practice on stress and mood is different for some participant population as compared to others.

For self-reported stress, a main effect for time of measurement (pre vs. post) emerged, such that individuals after yoga practice reported substantially lower levels of stress than at the beginning, $F(1848) = 745.30$, $p < .001$, $\eta_{partial} = 0.68$, $MSE = 3.08$. Results indicated a significant between-subjects effect for cohort, $F(3848) = 5.61$, $p = .001$, $\eta_{partial} = 0.14$, $MSE = 9.77$. This main effect indicates that some cohorts reported stress at higher levels than others, when averaged over pretest and posttest measures of stress (see Fig. 1). The interaction between time

Table 2
Participants Completing Pre-Post Measures for One or More Sessions of Trauma-Informed Yoga by Reported Gender and Cohort.

Population	Female	%	Male	%	Unknown	%	Total
INC	207	52%	193	48%	–	–	400
SU	162	68%	63	27%	12	5%	237
VA	38	54%	33	46%			71
YTH	37	17%	112	52%	68	31%	217
Total	444	48%	401	43%	80	9%	925

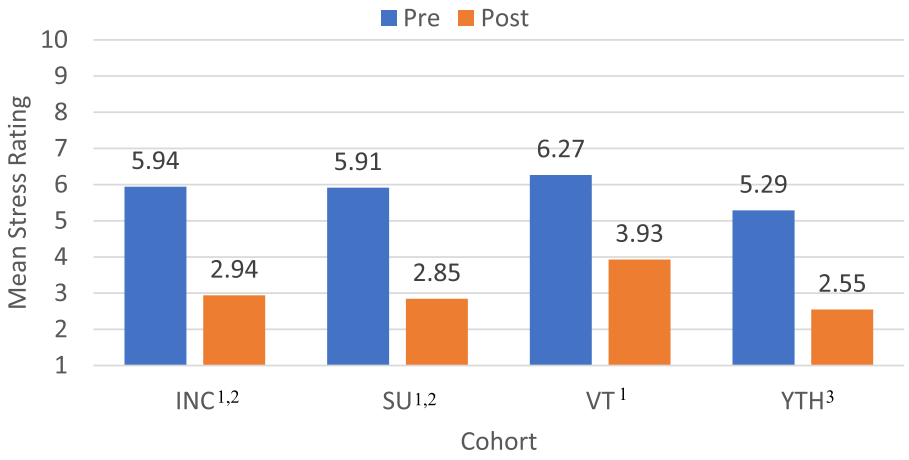

Fig. 1. Self-reported Stress Before (Pre) and After (Post) a Single Session of Trauma-Informed Yoga Practice
Note: INC = Incarcerated; SU = Substance Use; VA = Veterans; YTH = Vulnerable Youth; Differing numerical subscripts indicate significant differences between cohort groups according to LSD post hoc procedure.

of measurement and population, however, was not significant, $F(3848) = 2.01$, $p = .112$. This indicates that although some populations report more stress than others both before and after yoga, the decrease in stress after yoga is not distinguishable across cohorts. In summary, the highest levels of stress were reported for the VA cohort, and the lowest levels of stress were reported for the YTH cohort; however, all cohorts showed a consistent decrease following a single session of trauma-informed yoga practice.

A similar pattern with similar effect sizes were observed for self-reported mood, such that there was a main effect for time of measurement [$F(1503) = 211.06$, $p < .001$, $\eta_{partial} = 0.51$, $MSE = 2.93$], for cohort [$F(3503) = 4.98$, $p = .002$, $\eta_{partial} = 0.17$, $MSE = 9.38$], and no cohort by time of measurement interaction, $F < 1$ (see Fig. 2). These results indicate that the increase in mood and from pre- to post-assessment was substantial and greater than chance, yet not different across cohorts.

Multiple session effects on psychological measures

Previous research indicates that single sessions of yoga practice can have immediate benefits[59], although results may be variable. Sustained yoga practice should yield the most benefit, although many controlled trials investigating the impact of yoga practice fail to provide follow-up over time[60]. In the current study, several participants completed multiple curriculum sessions. To observe the long-term benefits of yoga practice, we compared the stress and mood changes over four sessions of yoga practice for individuals who had sufficient data to compare psychological measures over time (100 participants for stress measures and 73 participants for mood measures). To deal with missing values across these four sessions, we employed a multiple imputation method for approximately 18% of the records[61, 62]. A 2 × 4 repeated measures ANOVA revealed a significant two-way interaction between pre assessment and post assessment of stress across the four session time periods [$F(3271) = 3.90$, $p = 0.012$, $\eta_{partial} = 0.19$, $MSE = 2.50$], indicating the reduction in stress immediately after yoga sessions changed across these four sessions.

The pattern of means indicates that the largest decrease in stress occurred on the first yoga session, whereas for subsequent sessions, the stress experienced during pretest was lower, indicating lower baseline levels of stress over sessions 2–4. The pattern for mood over these same participants was similar. There was a significant two-way interaction between pre-post and session time periods for mood ratings [$F(3198) = 3.48$, $p = .020$, $\eta_{partial} = 0.21$, $MSE = 4.11$]. Again, results indicate the largest differences in mood occurring in the first yoga session, with subsequent sessions showing no significant change from pretest to posttest (see Fig. 3).

Therapeutic theme effects on psychological measures

Yoga instructors were able to select from several trauma-informed

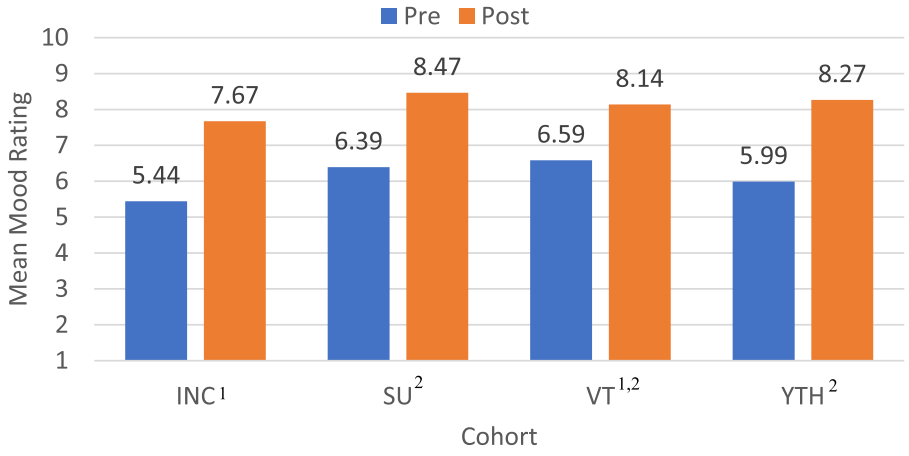

Fig. 2. Self-reported Mood Before (Pre) and After (Post) a Single Session of Trauma-Informed Yoga Practice
*Note: INC = Incarcerated; SU = Substance Use; VA = Veterans; YTH = Vulnerable Youth; Differing numerical subscripts indicate significant differences between cohort groups according to LSD post hoc procedure.

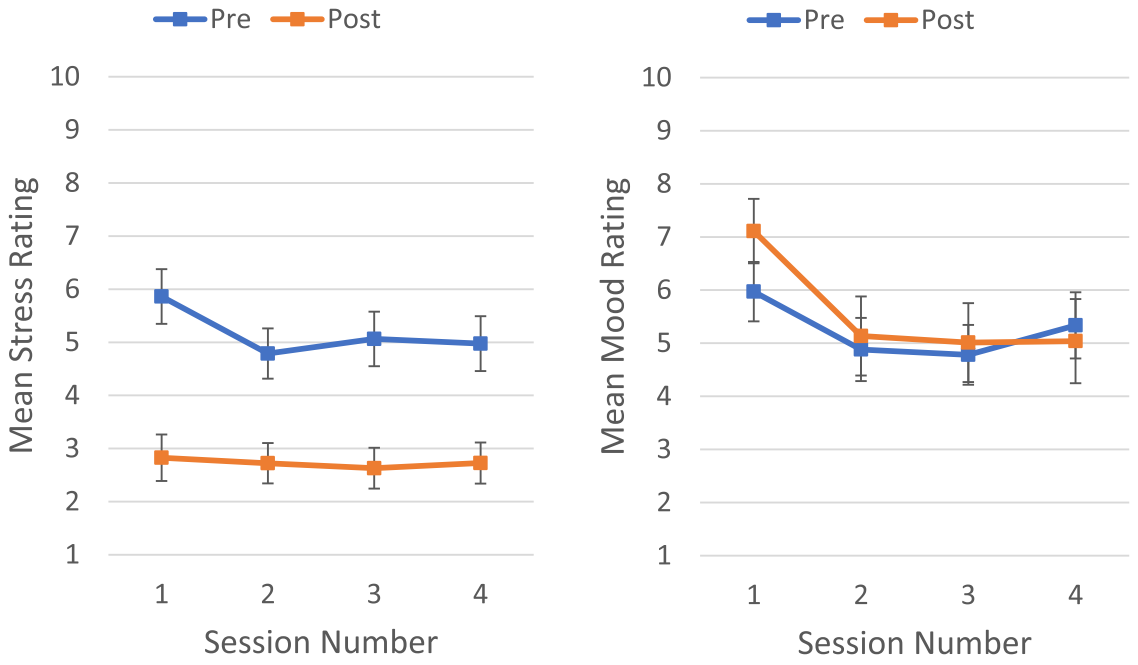

Fig. 3. Self-reported Stress and Mood Before (Pre) and Immediately After (Post) Four Consecutive Session of Trauma-Informed Yoga Practice.

themes when conducting the yoga sessions. Themes included topics such as "forgiveness", "dealing with stress", "gratitude", and "developing trust". These themes can be consolidated into major themes of positive interpersonal relationships, optimism, and self-improvement. Because yoga instructors selected themes based on needs of the cohort, not all themes were evenly distributed across therapeutic populations. Instructors selected three consolidated themes (i.e., Goals, $N = 40$; Interpersonal Relationships, $N = 52$; and Self-Improvement, $N = 90$) with a sufficient frequency within a therapeutic cohort, individuals who were incarcerated (INC), to make comparisons across themes for the psychological outcome of stress ratings (there was insufficient data for mood ratings across these themes). A 2 × 3 mixed ANOVA with pre-post assessments of stress were compared across these three consolidated theme groups showed that there was not a significant two-way interaction between theme and decreases in stress from pre- to post-assessment, $F(2178) = 1.26$, $p = .287$, $\eta_{partial} = 0.12$, $MSE = 2.14$. Thus, for individuals who are incarcerated, the benefit of the yoga session on stress ratings did not vary across these three consolidated themes.

Part 2: physiological measures

Single session effects on physiological measures

Blood pressure and heart rate were assessed for the SU cohort only. To test differences in blood pressure across pre- and post-assessment, we conducted repeated-measures *t*-tests on pre- and post-assessment Systolic and Diastolic blood pressure. Systolic BP from pre to post yoga sessions, $t(113) = -5.14$, $p < 0.001$, $SEM = 1.96$. The 10 mm Hg (7%) reduction in systolic blood pressure between pre ($M = 142$ mm Hg, $SD = 24.97$) and post ($M = 132$ mm Hg, $SD = 22.36$) yoga represents more than a third but not quite a half of a standard deviation reduction ($d = -0.43$) in this indicator. Diastolic BP did not decrease significantly between pre- ($M = 90$ mm Hg, $SD = 14.71$) and post-yoga ($M = 87$ mm Hg, $SD = 15.33$), $t(113) = -1.78$, $p = 0.078$, $SEM = 1.36$.

HR for SU participants temporarily decreased from pre- ($M = 89$ BPM, $SD = 13.00$) to post-yoga ($M = 86$ BPM, $SD = 11.51$) in the direction of more efficient heart function and better cardiovascular fitness, $t(105) = 2.62$, $p = .01$, $SEM = 1.26$. This reduction in heartrate although significantly different than chance represents a small reduction in heartrate, $d = 0.25$.

Multiple session effects on diastolic blood pressure

A drop in systolic blood pressure after a single yoga session may be expected, given that most sessions include cool-down techniques, and systolic BP is recognized as more reactive to environmental conditions. The amount of data to compare the BP of participants in the SU cohort was limited. There were 15 participants who completed three consecutive curriculum sessions where BP was collected. For these participants, we conducted a repeated-measures ANOVA with session number serving as the repeated measure and Diastolic BP at the end of the therapeutic yoga session as the dependent measure. The less reactive measure of BP should have shown benefits after multiple sessions. The main effect of session was significant, $F(2,26) = 6.14$, $p = .008$, $\eta_{partial} = 0.55$, $MSE = 844.10$, indicating that the Diastolic BP decreased between sessions (see Fig. 4). Post hoc tests indicated that the Diastolic BP for sessions 2 ($M = 52.8$) and 3 ($M = 65.9$) were significantly lower than that of session 1 ($M = 88.2$, $ps = 0.003$ & 0.022, respectively), but not statistically different from each other ($p = .241$). Thus, Diastolic BP was significantly lower on subsequent curriculum sessions. These results are in the expected direction; however, the small sample size in a single cohort (SU) limit the implications of the finding.

Discussion

With the pilot multi-site study of four different populations including 925 adults and youth, there were statistically significant and clinically meaningful improvements in psychological wellbeing (stress, mood) self-reported outcomes after exposure to one yoga classes using a trauma-informed curriculum. The study demonstrates that incorporation of a trauma-informed yoga and mindfulness curriculum decreased stress and improved mood for participants, and that participants experienced benefits regardless of treatment facility type. Interestingly, pre-session stress levels seemed to decrease over time. Our results are confirmatory to other research demonstrating that yoga is a beneficial intervention for individuals who have experienced trauma[26, 63]. Across multiple sessions both the largest decreases in stress and greatest increase in mood occurred after participating in the first session. Further, a specific exploration of curriculum class impact by theme for participants

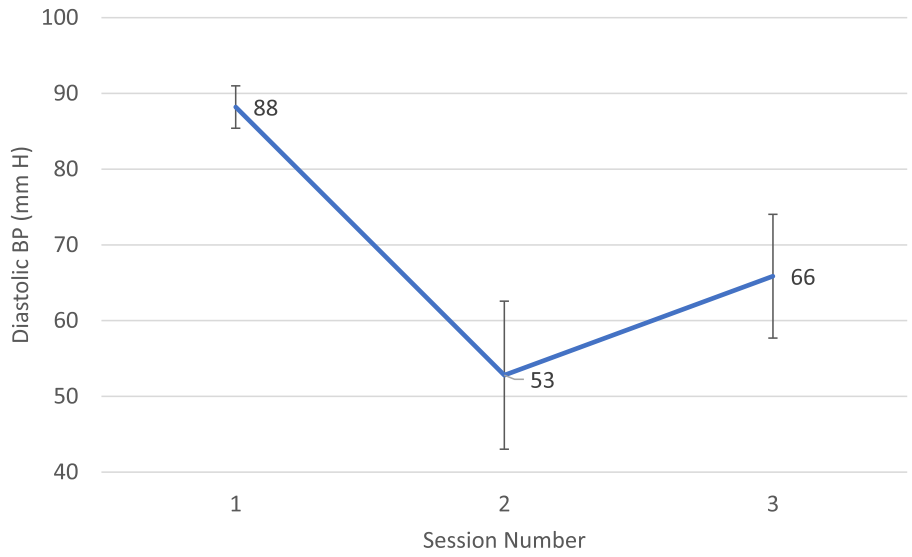

Fig. 4. Participants Post-Session Diastolic Blood Pressure across Three Session of Trauma-Informed Yoga Practice.

who were incarcerated indicated no difference in impact by theme.

Mental health outcomes such as mood and stress are important potentially modifiable endpoints among marginalized and underserved populations and may facilitate rehabilitative programs by promoting emotional regulation and behavior management. Other researchers have also found positive results on mental health with yoga. Bilderbeck, et al.[15] reported significant decreases in self-reported stress in incarcerated individuals attending 10 weeks of yoga classes. Innes & Selfe[2] showed stress, anxiety, and mood improvements among individuals with restless leg syndrome. Incarcerated women involved in the randomized controlled Yoga Prison Project in South Carolina reported significant improvement in both depression and stress levels following a 10-week, trauma-focused yoga program[26]. Numerous other studies have reported yoga effects on mental health outcomes, including mood[64], anxiety[63], depression[7], mindfulness[63], and self-compassion[63].

A goal of the current study was to determine viability of a trauma-informed curriculum integrating multiple approaches to supporting coping and wellbeing for people who have experienced trauma. Although these pilot results are encouraging, future research will include validated inventories for assessing physical and mental health outcomes, including measures of health, sleep, stress, self-compassion, anxiety, emotional awareness and regulation, and related constructs. The current findings support continued program implementation and evaluation and specifically validate the need for a controlled comparison study.

Physical wellbeing, and particularly cardiovascular health, is a public health concern, and the issue is particularly acute with certain vulnerable populations like those facing substance use, incarcerated, or veterans. With cardiovascular disease accounting for one in three deaths in US adults[65], yoga interventions offer substantial and cost-effective benefits by modifying multiple cardiovascular risk factors through improvements in blood pressure, heart rate, and physical activity. Evidence from the current pilot study supports continued examination of impacts of the current curriculum on measures of physical wellbeing. The initial findings of the reduction in diastolic blood pressure should be further confirmed with a larger sample and with more controlled testing.

The results of the current study are consistent with a large body of research demonstrating yoga's benefit in reducing cardiovascular risk factors including blood pressure[5, 4] and heart rhythm or rate[63]. Siu et al.[66] researched the effects of a 1-year yoga intervention in 182 middle-aged and older adults with metabolic syndrome and reported a significant decrease in resting aged heart rate and a decrease in systolic blood pressure[67]. Our research found a small decrease in heart rate following a single curriculum session for the substance use population. It is important to note that this outcome may be impacted by measuring blood pressure and heart rate immediately following a relaxation practice at the end of the session. More long-term evaluation of cardiac benefits to yoga practice is needed to establish the possible positive link to decreases in heart rate and blood pressure in a variety of trauma-influenced populations.

The current offering is unique in that it constitutes a distinct curriculum integrating multiple strength-based components in support of wellbeing. The yoga practiced in the Yoga 4 Change curriculum is focused on a trauma-based approach that uses cognitive, behavioral, and physical strategies during each class, adapted for the clinical cohort (INC, SU, VA, YTH). It is possible that offering multiple curriculum components and tools for coping may make the current program more accessible and impactful to a wider range of individuals. In offering a variety of tools for coping and in support of wellbeing, the curriculum examined may represent a more holistic and accessible approach. In the current study, we were able to observe similar positive impacts on stress for sessions that addressed different themes; however, further systematic investigation into the effectiveness of different themes on different populations is warranted and could produce valuable insights to the therapeutic components of trauma-informed yoga practice.

These study results should be considered along with several limitations. The study population consists of individuals residing in a single county in the state of Florida; efforts are underway to expand the research to other geographic areas, but there may be factors that are unique to this population that affect the results and potential generalizability. The exploratory nature of the current study led to multiple limitations in measurement. First, the physical health measurements of blood pressure and heart rate were limited to the SU population, thus again limiting the generalizability of findings. In addition, there were specific limitations in the tools used for assessment. Blood pressure was measured by trained assessors using manual sphygmomanometers rather than electronic blood pressure devices. Both manual and electronic devices have been clinically validated as tools to assess blood pressure[68], although it is possible that human error may be more likely within manual blood pressure assessment. Stress and mood were each measured through a one-item, non-validated scale. While this was done for ease of assessment before and after class, it does limit empirical validity and generalizability.

Another limitation is that assessment was conducted before and after individual classes and there was not measure of cumulative program impact. Future studies would benefit from a pre and post curriculum

assessment tool incorporating validated scales in addition to the pre and post class brief assessment.

Probably the most significant limitation of the study overall is the lack of randomized control comparison. The goal of the study was initial pilot exploration to indicate curriculum viability within multiple populations. Initial findings warrant further research incorporating control comparison and more rigorous research protocol. Of particular importance for testing the impacts of trauma-informed yoga practice on different trauma-relevant populations, more controlled testing is necessary.

Conclusion

Despite limitations, our study provides evidence of the benefit of a multifaceted trauma-informed yoga and mindfulness curriculum in support of physical and psychological wellbeing. For those in treatment for substance use, we noted preliminary impacts on cardiovascular health (systolic blood pressure, diastolic blood pressure, heart rate). Further, we noted evidence of the positive impact on participant-reported mood and stress for people who are incarcerated, veterans those facing substance use, and youth. Future research should examine these outcomes using validated instruments in research design that includes a control group. This study provides the hypothesis-generating basis for future study designs.

It can be challenging for nonprofits and community organizations to find support for novel intervention strategies. The current study supports the use of data collection and initial program evaluation to support the validity of a new approach. Preliminary data collection is important as it allows nonprofits to leverage initial program implementation and assessment into more rigorous study. The collection of data, even at the most basic level, can support curriculum development, ongoing program implementation, funding for implementation, and funding for more rigorous controlled comparison studies.

The current study demonstrates that curriculum development that is intentional as well as informed by both empirical data and lived experience can be impactful and potentially be associated with improved mental and physical wellbeing. Improvements in mood and stress response were statistically significant and clinically meaningful across a variety of populations and cardiovascular status was significantly improved for those recovering from substance use. The benefits of yoga and mindfulness-based curricula may translate into substantial benefits for the individual, treatment center, community, health system, and society overall. While further research is warranted, initial results suggest the value of a strength-based and trauma-informed yoga and mindfulness program as a complementary tool for supporting mental and physical wellbeing for a variety of populations. These preliminary outcomes suggest the value of further and more rigorous evaluation of programming that includes a holistic approach to wellbeing and incorporates multiple modalities of mindful and trauma-informed intervention. The current study also suggests the value of preliminary data collection for non-profit and community-based organizations in support of future curriculum development, implementation, and evaluation.

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