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Effect of Iyengar Yoga on Mental Health of Incarcerated Women: A Feasibility Study

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- ***Background:*** Incarcerated women share a disproportionate burden of mental illness. Although psychotropic medications are available to women in prison, adjunctive treatment modalities, such as Iyengar yoga, may increase psychological well-being.
- ***Objectives:*** The purposes of this study were (a) to address the feasibility of providing a gender-responsive exercise intervention within a correctional institution and (b) to observe the effect of a group-format Iyengar yoga program that met two sessions a week for 12 weeks on levels of depression symptoms, anxiety symptoms, and perceived stress among incarcerated women.
- ***Methods:*** A repeated measures design, in which each participant served as her own control, was used. Participants completed three self-administered instruments: the Beck Depression Inventory, the Beck Anxiety Inventory, and the Perceived Stress Scale before treatment (baseline) and during treatment (Weeks 4, 8, and 12). Linear mixed effects models were used to examine statistically significant changes in mental health measures over time, taking advantage of all available data.
- ***Results:*** Although 21 women initially participated in the intervention, 6 women completed the 12-week intervention. A significant linear decrease was demonstrated in symptoms of depression over time, with mean values changing from 24.90 at baseline to 5.67 at Week 12. There was a marginally significant decrease in anxiety over time (12.00 at baseline to 7.33 at Week 12) and a nonlinear change in stress over time, with decreases from baseline to Week 4 and subsequent increases to Week 12.
- ***Discussion:*** Women who participated in this program experienced fewer symptoms of depression and anxiety over time. Findings from this study may be used to improve future interventions focusing on the health outcomes of incarcerated women.

- ***Key Words:*** incarcerated women · mental health · prison · yoga

In 2008, almost 115,000 women in the United States were incarcerated in state or federal prisons (West & Sabol, 2009). Although women account for less than 10% of the incarcerated population (West & Sabol, 2009), the rate at which women are incarcerated has grown nearly 800% since 1977 (Greene, Pranis, & Frost, 2006). Women in prison suffer the same mental health problems as nonincarcerated women. Histories of addiction, victimization, poor health, and poverty make them particularly vulnerable to mental illness, including major depressive disorders and generalized anxiety disorders (Beck & Maruschak, 2001). Although inmates are provided medical and psychiatric services during incarceration, additional adjunctive treatments may increase psychological well-being further, be better tolerated, and be more cost-effective.

The primary aim of this investigation, on the basis of the gender-responsive framework outlined by Bloom, Owen, and Covington (2003), was to test the feasibility of implementing a group format exercise intervention, specifically a 12-week Iyengar yoga intervention, in a women's correctional institution. Investigators monitored (a) the ability to recruit participants within the specified period, (b) the retention in the intervention, and (c) the incidence of adverse events. Investigators also observed the effect of the intervention on the mental health outcomes (depression symptoms, anxiety symptoms, and perceived stress) of incarcerated women 35 years and older.

Incarcerated Women and Mental Illness

Incarcerated women have high rates of mental illness because of preincarceration social, environmental, and behavioral risk factors, such as limited education, poverty, homelessness, and limited access to and use of health services (Baldwin & Jones, 2000; Beck & Maruschak, 2001; Greenfeld & Snell, 1999). The World Health Organization (2007) commented that, "prisons are bad for mental health" (p. 1). Unlike male

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correctional institutions, there are fewer institutions that house women. As a result, women are likely to be confined in facilities several hours away from their homes, thus reducing the likelihood of visitation from friends and family members. Stigma and discrimination associated with incarceration may compound existing mental health issues (Schnittker & John, 2007; World Health Organization, 2007) and persist long after release.

Although psychiatric services are available to inmates, needs are often in excess of available care. In addition, little empirical data support existing treatment modalities used in prisons, many of which are not focused on gender-specific issues, such as victimization and addiction, as antecedents and consequences of mental illness. Furthermore, treatment modalities are often based on male treatment models or models that have shown success in community-based populations rather than incarcerated populations (Bloom et al., 2003; Covington & Bloom, 2006).

Depression, Anxiety, and Stress

An estimated 13% of female convicted felons entering prison have histories of major depressive disorder (Jordan, Schlenger, Fairbank, & Caddell, 1996). Not surprisingly, mental healthcare is a frequently used service in female prisons, with 22% of women in state prison using psychotropic medication and 27% receiving therapy or counseling (Beck & Maruschak, 2001). When mental illness is left undiagnosed or undertreated, self-injurious behavior and suicidality may ensue (Mumola, 2005). The average annual suicide-related mortality rate of female inmates was 32 per 100,000 female inmates in jail (2000–2002) and 10 per 100,000 female inmates in prison (2001–2002; Mumola, 2005). To a lesser extent, anxiety disorders are common among women in prison. Jordan et al. (1996) identified that 3% of women entering prison reported a lifetime history of generalized anxiety disorder and 6% reported panic disorder. Often anxiety is coupled with high levels of stress, which abounds in prison. Incarcerated women report numerous stressful life events in the year before incarceration (Keaveny & Zauszniewski, 1999) and must learn to adapt to the unpredictability of incarceration. Histories of abuse and trauma place women at risk for other anxiety disorders, including posttraumatic stress disorder. Teplin, Abram, and McClelland (1996) identified that 33.5% of women entering jail reported a lifetime prevalence of posttraumatic stress disorder, a rate that is more than three times as high as nonincarcerated women (10.4%; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995).

Iyengar Yoga

The word yoga is derived from the Sanskrit word *yuj*, meaning to yoke or to unite. According to the Ramamani Iyengar Memorial Yoga Institute (2010a), "On the spiritual plane, it means union of the Individual Self with the Universal Self. Yoga is the union of the body, mind, emotions and intellect" (p. 1). The practice of yoga, which incorporates poses (*asanas*; physical movement and postures), breathing techniques, and meditation, can be a safe form of exercise for people of all ages. The style of Iyengar yoga, which was founded by Yoga Master B.K.S. Iyengar (Iyengar, 1995), is focused on correct postural alignment, precision of movement, and correct range of motion of joints. Iyengar yoga was chosen because it encourages the use of props (mats, blankets, blocks, and belts) to enable practitioners to perform poses effectively. With the use of props, students can participate safely without fear of injury (Ramamani Iyengar Memorial Yoga Institute, 2010b). Certified Iyengar instructors are subject to a rigorous training certification program and assessment (Ramamani Iyengar Memorial Yoga Institute, 2010c). Iyengar classes may include sitting and standing poses, inversions, stretches, twists, and breathing exercises, ending with relaxation. Although Iyengar yoga has been developed to target a variety of physical and mental health problems, the intervention described here incorporated the use of a program designed to increase confidence and to reduce stress.

Iyengar Yoga and Health

Although numerous investigators have examined the effect of yoga and yoga-based exercises on mental health outcomes, many of the interventions use a variety of yoga styles emphasizing different aspects of practice. As such, it is difficult to determine what aspect of practice results in positive mental health benefits. This review will be focused on investigations that use Iyengar yoga as their main yoga intervention to target mental health outcomes.

Beddoe, Paul Yang, Kennedy, Weiss, and Lee (2009) examined the feasibility and the level of acceptability of a 7-week mindfulness-based yoga group intervention (described as combining elements of Iyengar yoga and mindfulness-based stress reduction) in 16 healthy pregnant nulliparous women (gestational age at enrollment = 12–32 weeks). They also explored the effect of this intervention on anxiety, perceived stress, and pain. Overall, participants were satisfied (94%) with the program, with more than half (63%) describing feeling more hopeful and confident, more knowledgable about stress in their lives, and better able to deal with this stress. Half of the women reported that they were taking better care of themselves because of their participation in the intervention. Women who began the intervention in the third trimester had significant reductions in perceived stress and trait anxiety. Reductions in levels of pain were most prominent for pregnant women who began the Iyengar yoga intervention in their second trimester.

Shapiro and Cline (2004) examined mood changes associated with Iyengar yoga practices (nine sessions, 90 minutes each) in healthy women and men (n = 11). They were particularly interested in examining how mood changes are affected by different poses (back bends, forward bends, and standing poses). Furthermore, they examined whether changes in mood were related to existing personality traits (depression, anxiety, and hostility). Findings from their work demonstrated that participating in the Iyengar yoga sessions resulted in increased positive moods, decreased negative moods, and increased energy-related moods before class and after class. These changes lasted approximately 2 hours after each session. The practice of backbends was associated with a greater increase in positive moods, especially in participants who were relatively hostile or depressed. Shapiro et al. (2007) later examined the efficacy of a 20-session (8-week) Iyengar yoga intervention as a complementary treatment for participants with unipolar major

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depression in partial remission. Of the 17 participants who completed the intervention, there were signigicant changes in levels of depression, anger, anxiety, and neurotic symptoms between the pretest and the posttest periods. More than half (n = 11) achieved remission levels after the intervention. Shapiro et al. noted that yoga may be a beneficial intervention for depression.

Woolery, Myers, Sternlieb, and Zeltzer (2004) examined the effect of Iyengar yoga on depression in a sample of 28 volunteers (ages 18–29 years) with mild levels of depression (as measured by the Beck Depression Inventory [BDI]). The intervention consisted of two 1-hour Iyengar yoga classes each week for 5 weeks. After the intervention, participants acknowledged a reduction in self-reported symptoms of depression (pretest = 12.77, posttest = 3.90) and trait anxiety (pretest = 49.58, posttest = 39.60). Changes in depression scores were not correlated with changes in anxiety level (R = .30, p = .41). Changes in acute mood were identified; participants reported a reduction in negative mood and fatigue after class.

Michalsen et al. (2005) examined rapid stress reduction and anxiolysis among distressed women (n = 24) who participated in a 3-month intensive yoga program. Women who participated in the intervention (n = 16), which consisted of twice-weekly 90-minute Iyengar yoga classes, demonstrated reductions in perceived stress ($p < .02$), state and trait anxiety ($p < .02$ and $p < .01$, respectively), fatigue ($p < .02$), and depression ($p < .05$). They also demonstrated improvements in well-being ($p < .01$) and vigor ($p < .02$).

Summary

An emerging body of science demonstrates a relationship between the practice of Iyengar yoga and improved mental health. These improvements might prove important for people with poor mental health and have the potential to result in demonstrable positive changes for incarcerated populations. Although meditation has been used with incarcerated populations with positive results (see Bowen et al., 2006; Samuelson, Carmody, Kabat-Zinn, & Bratt, 2007; Sumter, Monk-Turner, & Turner, 2009), a review of the literature did not yield any published data-based studies that have incorporated Iyengar yoga with incarcerated populations. This study, which addresses the feasibility and efficacy of an Iyengar yoga intervention in a correctional facility, may be of value.

Conceptual Underpinnings

Although women's trajectory both into and out of correctional institutions is different than men's, most programs offered to and policies directed at women in prison are based on male-dominant models of care, many of which do not reflect the very real and important differences between male and female inmates. Wardens working in women's prisons have acknowledged the need for gender-responsive programming with female inmates (van Wormer & Kaplan, 2006). Bloom et al. (2003) identified six gender-responsive guiding principles that should be considered when working with incarcerated women. Ways in which the intervention choice of Iyengar yoga and personal interactions with participants respected this framework are identified (see Table, Supplemental Digital Content 1, which lists the gender-responsive guiding principles, http://links.lww.com/NRES/A34).

Methods

This investigation used a repeated measures design in which participants served as their own control. Participants completed three self-administered instruments, the BDI, the Beck Anxiety Inventory (BAI), and the Perceived Stress Scale (PSS), before treatment (baseline) and during treatment (Weeks 4, 8, and 12).

Setting

This investigation was conducted at a medium-security state prison for women located in the Eastern half of the United States. Approval from the relevant institutional review boards was obtained.

Sampling Plan

Nonprobability purposive sampling was used. Because this study was part of a larger study that examined the health of older incarcerated women, eligibility criteria included English-speaking sentenced female inmates 35 years and older. Eligible women also were required to have served at least 3 months of their current sentence and had at least 6 months remaining. Pregnant and postpartum (fewer than 3 months) women, women who were not cleared medically, women who were on suicide watch or in security lockup, women who had received a disciplinary report in the month before the intervention, and women who posed flight risks were ineligible.

The Department of Corrections (DOC) generated an initial list of potential participants who met the above criteria. An invitation letter explaining the purpose of the investigation was delivered to women on their housing unit. With a desired sample size of 40 (on the basis of the expected attrition, the practicality of conducting a group exercise intervention, and security concerns), a total of 60 letters were sent to potential participants. Interested women were interviewed and consented within 1 week of receiving the letter.

Description of Intervention

Twice-weekly sessions of Iyengar yoga lasting 120 minutes in duration (4 hours total per week) were conducted by a certified female Iyengar yoga instructor. The intervention was designed for beginners by a Senior Intermediate Iyengar yoga instructor (third author) with more than 30 years of teaching experience and practice with B.K.S. Iyengar (who also served as a consultant). She is also an experienced medical researcher and has conducted yoga-related intervention research with women (Garfinkel, Schumacher, Husain, Levy, & Reshetar, 1994; Garfinkel et al., 1998; Kolasinski et al., 2005). Twenty-four yoga sessions were conducted over a period of 12 weeks. The sequencing of each session included a series of strengthening poses, balancing poses, and relaxation techniques.

Feasibility To address the feasibility of conducting Iyengar yoga in a maximum security women's prison, investigators monitored (a) the ability to gain access to the maximum security women's prison, including access to a large,

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semiprivate space to conduct the intervention; (b) the security issues and concerns related to or the result of the intervention; (c) the ability to recruit participants within the specified period; (d) the retention in the intervention; and (e) the incidence of adverse events. The above measures of feasibility were addressed by the first author who served as the liaison between the DOC and the secured access to the correctional institution. The first author was the sole recruiter for the intervention and was present for every yoga session. She also recorded participant attendance, interacted with the participants before and after each session, and received daily feedback from the DOC regarding any security issues resulting from the intervention.

Participants were asked to complete open-ended questions regarding the effect of yoga on their mental health as well as their perception of the implementation of the program. Specific questions were as follows: (a) Has yoga made you feel better emotionally? (b) Has the yoga program helped you cope with prison? (c) What did you like about the yoga program? (d) What did you dislike about the yoga program? And (e) do you think a yoga program would help most women in prison? Why or why not? Excerpts from the written responses are presented and are used to supplement quantitative data.

Variables

Participants completed three instruments to measure the mental health outcomes of depression symptoms, anxiety symptoms, and perceived stress at baseline. Later, the instruments were self-administered and distributed as part of a larger questionnaire at the end of yoga class (Weeks 4, 8, and 12).

Depression Symptoms The 21-question BDI-II (Beck, Steer, Ball, & Ranieri, 1996; Beck, Steer, & Brown, 1996) is composed of two factors representing somatic-affective and cognitive dimensions. These dimensions consist of 21 groups of statements. The participant is asked to choose the one statement that best describes the way she has felt during the past 2 weeks. The statements are rated on a 4-point scale ranging from 0 to 3. The total score is derived from adding the ratings of all items; the maximum score is 63, and higher scores correspond to higher levels of anxiety. Pilot testing was conducted with 500 psychiatric outpatients and 120 undergraduates (Beck, Steer, & Brown, 1996). In a sample of 26 psychiatric outpatients, the 1-week test–retest reliability was high (R = .93; Beck, Steer, & Brown, 1996). In a sample of 140 psychiatric outpatients, the internal consistency of the BDI-II has been reported as .91 (Beck, Steer, Ball, & Ranieri, 1996).

Anxiety Symptoms The BAI (Beck, Epstein, Brown, & Steer, 1988) is a self-report instrument comprising 21 statements of anxiety symptoms. The participant is asked to choose the one statement that describes the degree to which she has experienced each of the 21 symptoms over the past week. The statements are rated on a 4-point scale ranging from 0 to 3. The total scored is derived from summing the ratings of all items. The minimum score is 0, and the maximum score is 63. Higher scores indicate increased severity of symptoms. The reported psychometric properties are based on findings from a sample of psychiatric outpatients (n = 160). The BAI has a high level of discriminant validity, internal consistency (α = .92), and 1-week test–retest reliability, $r(81)$ = .75 (Beck et al., 1988).

Perceived Stress The 10-question PSS (Cohen, Kamarck, & Mermelstein, 1983; Cohen & Williamson, 1988) measures the degree to which situations are self-appraised as stressful. The PSS includes questions about current levels of stress and asks about feelings and thoughts during the last month. Scoring includes reversing responses to the positively stated items and then summing across all scale items. The original 14-item PSS was validated on three groups, including college students (two groups) and participants in a smoking-cessation program (one group). In the sample of participants in the smoking-cessation program, the coefficient alpha reliability was reported as .86, and the 6-week test–retest correlation was .55. In a probability sample of the United States, the coefficient alpha reliability for the 10-item scale was .78 (.75 for the 14-item scale; Cohen & Williamson, 1988).

Statistics

Subjects were assessed on mental health measures of depression symptoms, anxiety symptoms, and perceived stress at baseline and at 4, 8, and 12 weeks. Descriptive statistics (mean, standard deviation, range, and sample size) were used to quantify distributions of outcome measured on a continuum at the various time points. Linear mixed models were used to assess significant overall linear trends over time in mental health outcome measures. The linear model was used to assess trends over time because of the lack of prior knowledge regarding hypothesized outcome profiles over time. Both random intercept and slope parameters were included in these models. Likelihood ratio tests were used to evaluate significant linear trends over time. An unstructured covariance matrix was assumed for all three models. Least square mean estimates of outcome are provided for estimated outcome by assessment time point. Inferential statistics and modeling were accomplished using SAS Version 9.1.

For baseline outcome measures, visual plots were used to compare subjects who provided data beyond baseline to those subjects who dropped out. Comparisons were also made according to dropout group for race (White vs. non-White), age, education level (high school or less vs. more than high school), current depression, current anxiety, and current musculoskeletal problems. Sample sizes were small and had limited power, and thus comparisons were made descriptively and intended for hypothesis generation to be tested in a larger study.

Post hoc power analyses were performed using 100 simulation samples and mixed effects modeling for changes in outcome over time and sample sizes ranging from 6 to 10. In the worst-case scenario (n = 6), depression estimates resulted in 77% power to detect significant changes over time, assuming similar outcome variability and profiles to that observed. Anxiety and stress power estimates were low (< 25%) in the same setting and under the same assumptions.

Results

Sixty women were invited to participate in the program. Just more than one third (n = 21; 35%) consented to be in

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the investigation. The sample consisted of 21 women having a mean age equal to 43 years (*SD* = 5.2), more than 70% of whom were White (which reflected the racial composition of the institution). A quarter of the women were high school graduates, and 10% were college graduates. Their current mean sentence was 6.74 years (*SD* = 7.5), with 3.7 years served at the time of the study (Table 1). Data related to mental health diagnoses were also collected (Table 2).

TABLE 1. Participant Demographics (*N* = 21)

	n	%
Age (years)		
36–39	5	24
41–45	11	52
46–50	2	10
50+	3	14
Mean = 43 years, *SD* = 5.2 years, range = 36–56 years		
Sentence (years)		
1–3	8	38
4–5	3	14.2
6–8	3	14.2
9–10	2	9.5
>10	3	14.2
Life sentence	2	9.5
Mean = 6.74, *SD* = 7.5, range = 1 year to life		
Time served (years)		
<1	4	19.0
2	8	38
5	3	14.2
6	1	4.7
8	2	9.5
9	1	4.7
10	1	4.7
12	1	4.7
Mean = 3.7, *SD* = 3.7, range = 0.25–12		
Previous incarceration		
No	13	61.9
Yes	8	38.1
Race		
White	15	71
Black	4	19
Hispanic	2	10
Education		
Less than high school	5	24
Some high school	2	10
High school graduate	5	24
Some college	7	33
College graduate	2	10

TABLE 2. Mental Health Conditions Reported at Baseline (*N* = 21)

	n	%
Current depression		
No	5	24
Yes	16	76
History of suicide attempt		
No	14	67
Yes	7	33
Current anxiety		
No	11	52
Yes	10	48
Current bipolar		
No	17	81
Yes	4	19
Drug use before prison		
No	5	24
Yes	16	76
History of an eating disorder		
No	20	95
Yes	1	5
Current psychiatric medication		
No	6	29
Yes	15	71

Feasibility of a Yoga Intervention in a Maximum Security Women's Prison

Gaining Access to the Women's Prison Specific agencies that were instrumental to the development of this intervention included the first author's home institution, the agency that was contracted to provide medical services to prisoners (and thus would provide care to any inmate who became injured during the study), and the DOC. Early acceptance from the DOC was vital because the research team members were guests in their institution and the intervention had the potential to disrupt institutional procedures. The research protocol was presented informally to the institution's Deputy Warden who provided tentative support. The project was submitted formally to the institutional review boards. After approximately 4 months, final approval was received from all institutional review boards. The institution's Deputy Warden facilitated site access and security clearances (background checks) for the research team and approved the use of specific research equipment and materials (yoga mats and questionnaires) in prison. Gaining entry likely was aided by the first author's clinical position in the institution and respect for DOC policies and procedures.

The intervention was conducted in a large gymnasium within the institution. One female correctional officer was present at all times during the intervention. Although the gymnasium was the most appropriate site offered, the building was older than 75 years, and there was not a functioning air-conditioning system. The DOC provided several

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oscillating fans, and gymnasium doors were permitted to be opened for additional ventilation. At one point in the intervention, the hallway outside the gym underwent renovations, which resulted in noise and dust. Toward the completion of the intervention, institutional training sessions on methicillin-resistant *Staphylococcus aureus* infections were conducted in the gymnasium. The yoga group was moved to a modular building within the institution for approximately 2 weeks.

Security Issues No security issues were identified because of this intervention. Common scheduled and unscheduled security procedures that occur in correctional settings, including prison lockdowns, medical codes, *movements* (a period of 10 minutes during each hour where inmates may move from one location to another), and *standing count* (where inmates undergo a routine headcount several times a day) did not impact this intervention. This was largely due to the thorough planning that went into the scheduling of the intervention. Specifically, the intervention was scheduled so that women could walk to the gym during the morning movements. However, when the yoga session was finished, inmates had a short period (generally 10 minutes) to reach their housing unit for standing count. Inmates were particularly anxious about ending the yoga session on schedule as being late for standing count could result in disciplinary action. Often women jumped up when "count time" was announced over the institutional loud speaker. This often disturbed the final relaxation poses.

Participant Recruitment Because a group intervention was used in this investigation, the list of potential participants who met the age and sentencing criteria was generated and approved by the DOC for security clearance before our initial contact for the safety of the research team, other participants, and DOC staff. After identifying potential participants who met the inclusion criteria, the first author hand-delivered letters to inmates inviting them to participate. Initially, investigators planned to call the potential participants to the health services unit to describe the investigation and to obtain informed consent. However, this plan was changed when investigators learned that inmates might be subject to a *pat-down* search, a procedure where a correctional officer pats the inmate's clothed body, searching for any weapons. Knowing that many incarcerated women suffered sexual victimization before incarceration, investigators did not want to potentially traumatize or burden potential participants. Furthermore, investigators did not want to burden the correctional or health staff with a large influx of unscheduled visits. Instead, inmates were given appointments with the first author and scheduled into the inmate movement system. As such, they were not subject to physical searches as a matter of standard protocol.

Because of the potential for coercion, incentive gifts were not used. Investigators also identified in the consent form that participation in the intervention would not have any impact on the participant's terms or length of confinement. Women who completed the study were presented with a certificate of completion from the first author's academic institution, which was signed by the first author and the yoga teacher.

Sixty (n = 60) women received letters inviting them to participate in the investigation. Forty (n = 40) of these women came to the appointment and 21 agreed to participate in the intervention. Seventeen attended the first day of the yoga intervention. Many of the women who declined to participate cited conflicts with prison work schedules or enrollment in college courses. Several expressed interest in participating but ultimately declined because they were anticipating changes in their sentencing structure (early parole, reclassification, or transfer). A few declined to participate because they "don't do groups." They were concerned about being in a group with specific inmates for personal reasons.

Participant Retention Of the initial 17 women who attended the first day of the intervention, 6 completed the 12-week intervention. Anecdotally, work-related scheduling conflicts were factors in discontinuing the intervention; needing to work more or less time and needing to take on a new job were cited. Changes in prison programs were also important reasons for participant withdrawal. Examples included scheduling changes in the prison addiction recovery program, opportunities to participate in a new animal training program, and a conflict with canteen delivery.

Incidence of Adverse Events No reports of adverse events, including medical, psychiatric, or security-related adverse events, were identified during the course of this investigation. Although poses were tailored to avoid joint strain, with the continued application of learned yoga skills, women became more aware of their bodies and were able to participate more fully. Women with asthma were permitted to bring their rescue inhaler to the intervention, although no asthmatic events were noted.

Specific Comments From Participants About the Intervention In general, women who participated in the intervention beyond the first month identified the Iyengar yoga program as positive. Descriptive accounts from participants with regard to the five specific questions identified previously are presented (see Table, Supplemental Digital Content 2, which lists the participant accounts of Iyengar Yoga Intervention, http://links.lww.com/NRES/A35).

Descriptive Results of the Program

Descriptive statistics for the raw mental health outcome measures over the four assessment times are presented in Table 3. Unadjusted mean values for depression demonstrated a consistent decline over time from 24.90 to 5.67; mean anxiety scores decreased from baseline through Week 8 from 12.00 to 6.25 and increased at Week 12 to 7.33. Mean stress scores demonstrated a decrease from baseline to Week 4 and increased consistently to Week 12. Results from linear mixed modeling of mental health outcomes are presented in Table 4. Least square mean values for the mixed models are presented in Table 5 and visually in Figure 1. Each outcome measure was regressed on time to examine overall linear trends. For depression, there was a significant linear decline over time on BDI score ($p < .001$). Anxiety scores also decreased over time but did not reach statistical significance at the .05 level ($p = .06$). Stress demonstrated an overall linear decreasing trend over time, but least square mean profiles suggest that a nonlinear model

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TABLE 3. Descriptive Statistics for Mental Health Measures Over Time

	n	Minimum	Maximum	Mean	*SD*
BDI					
Baseline BDI	21	4	52	24.90	13.194
Week 4 BDI	9	1	25	9.78	8.348
Week 8 BDI	8	2	28	9.75	9.316
Week 12 BDI	6	0	20	5.67	7.448
BAI					
Baseline BAI	21	0	42	12.00	13.762
Week 4 BAI	9	1	17	7.22	5.652
Week 8 BAI	8	0	20	6.25	7.206
Week 12 BAI	6	2	17	7.33	6.346
PSS					
Baseline PSS	21	17	29	22.76	3.520
Week 4 PSS	9	15	29	20.00	4.000
Week 8 PSS	8	17	28	21.50	3.817
Week 12 PSS	6	17	34	22.00	6.1644

Note. BDI = Beck Depression Inventory; BAI = Beck Anxiety Inventory; PSS = Perceived Stress Scale.

may be more appropriate—mean scores drop initially and then return to baseline levels by Week 12.

Subjects who dropped out of the study after the baseline assessment were compared with those who provided data on at least one follow-up assessment on baseline mental health measures, race (White vs. non-White), age, education level (high school or less vs. more than high school), current depression, current anxiety, and current musculoskeletal problems. A visual assessment of dropout according baseline mental health status is provided in Figure 2. There is no clear or consistent pattern suggesting that baseline mental health status predicts dropout. Mean baseline depression, anxiety, and stress scores were 26.2, 11.5, and 22.8 versus 23.2, 12.7, and 22.8, respectively, for subjects dropping out (n = 15) versus those providing at least one follow-up assessment (n = 6). Dropout proportions were 6/6 versus 9/15 for non-Whites versus Whites, 10/12 versus 5/9 for subjects with equal or less than versus more than a high school education, 4/5 versus 11/16 for nondepressed versus depressed subjects via self-report, 9/11 versus 6/10 for nonanxious versus anxious subjects via self-report, and 5/9 versus 10/12 for those not reporting versus those reporting musculoskeletal problems. One-sided Fisher's exact test p values were less than .20 for associations between dropout and race, education, and current musculoskeletal problems. The mean age among both groups was 43 years.

TABLE 4. Mixed Model Parameters—Tests of Fixed Effects

	Parameter Estimate	*SE*	95% CI	*p*
Model for depression				
Intercept	22.12	2.70	16.49 to 27.74	<.0001
Week	−0.66	0.09	−0.85 to −0.48	<.0001
Model for anxiety				
Intercept	7.79	1.56	4.52 to 11.05	<.0001
Week	−0.29	0.15	−0.60 to −0.02	.0629
Model for stress				
Intercept	22.51	0.74	20.96 to 24.06	<.0001
Week	−0.35	0.13	−0.61 to −0.09	.0118*

Note. CI = confidence interval.
*p value represents overall linear decrease over time, but data suggest that nonlinear model may be more appropriate.

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Discussion

Feasibility

Investigators clearly identified that early acceptance from the DOC is required. However, during the process of our investigation, it was discovered that continued acceptance is equally important. Gymnasium renovations, methicillin-resistant *S. aureus* education and training of prison work crews, and low participant retention are some of the many reasons that it would have been easy for DOC administration to discontinue the program prematurely. Instead, this early and continued acceptance resulted in DOC administration finding solutions to solve the immediate problems and concerns. As a result, the program was able to continue despite unanticipated events.

Results suggest that many women in prison would be willing to participate in a health-related intervention. However, the uncertainty about scheduling conflicts and the potential for reclassification, early parole, or relocation to other facilities caused several women to decline to participate. Retention was equally problematic. Inmates are not captive audiences; they have opportunities to participate in other prison-based programs and work activities, most of which occur during the day. Investigators must have initial and ongoing dialogues with other prison agencies and programs to better anticipate possible conflicts. Investigators also must factor in the time of medication distribution and canteen services to avoid conflict. Also, future interventions, especially those that include physical exercise, must account for how designated shower times might affect participation. Also important to consider is the interaction between group members.

Descriptive data from eight of the participants identified the intervention as largely positive. Women commented that they felt "energized," "connected," "centered," "invincible and refreshed," "rejuvenated," and "focused" after practice. Similar Iyengar yoga programs, although not performed in correctional settings, also have demonstrated a relationship between Iyengar yoga and positive mental health outcomes (Beddoe et al., 2009; Michalsen et al., 2005; Shapiro et al., 2007; Woolery et al., 2004). Women reported they felt like they had gained knowledge that would allow them to better connect with their bodies and care for themselves. Beddoe et al. (2009) reported similar findings with pregnant women. Furthermore, two women commented that after practice, they felt "geared up" and able to "go back out to the

TABLE 5. Least Square Means Over Time

Week	Estimate	*SE*	95% CI
Depression			
0	24.90	2.88	18.90–30.91
4	10.49	2.35	5.59–15.40
8	11.86	2.96	5.69–18.04
12	7.33	2.17	2.80–11.85
Anxiety			
0	12.00	3.00	5.74–18.26
4	7.02	1.40	4.09–9.95
8	5.84	1.98	1.70–9.98
12	5.36	1.73	1.77–8.96
Stress			
0	22.76	0.77	21.16–24.36
4	20.00	1.30	17.28–22.71
8	21.45	1.22	18.90–24.00
12	22.62	3.20	15.94–29.30

Note. CI = confidence interval.

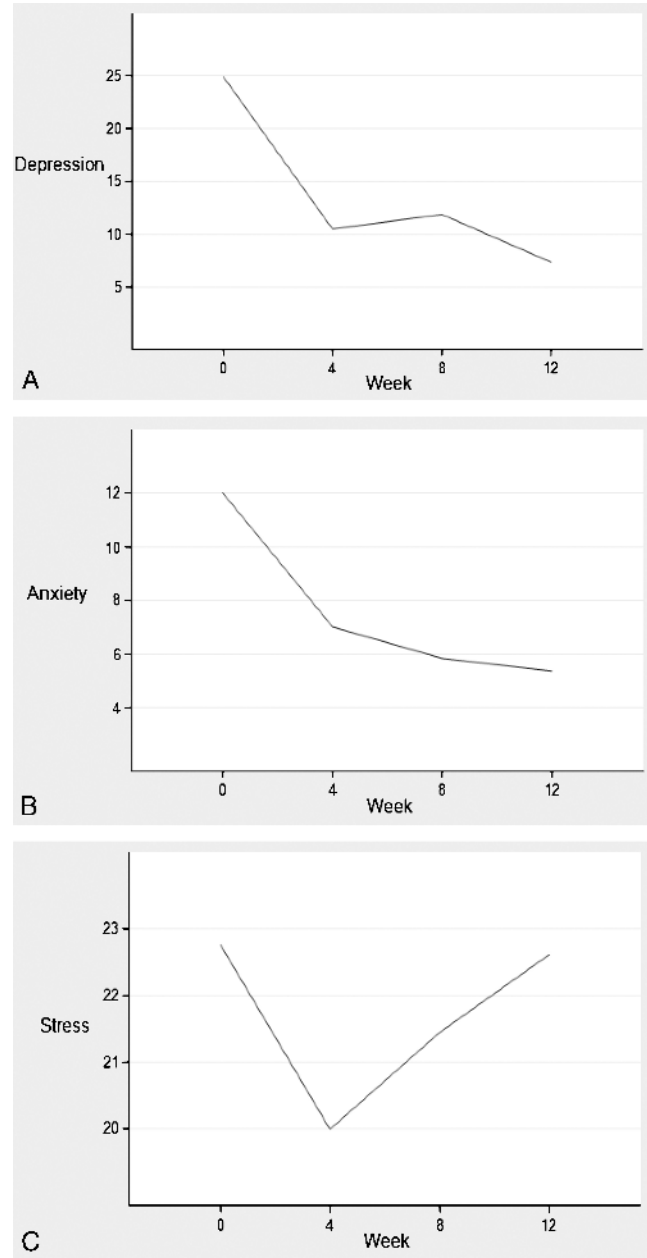

FIGURE 1. (A) Depression profile over time with least square mean estimates. (B) Anxiety profile over time with least square mean estimates. (C) Stress profile over time with least square mean estimates.

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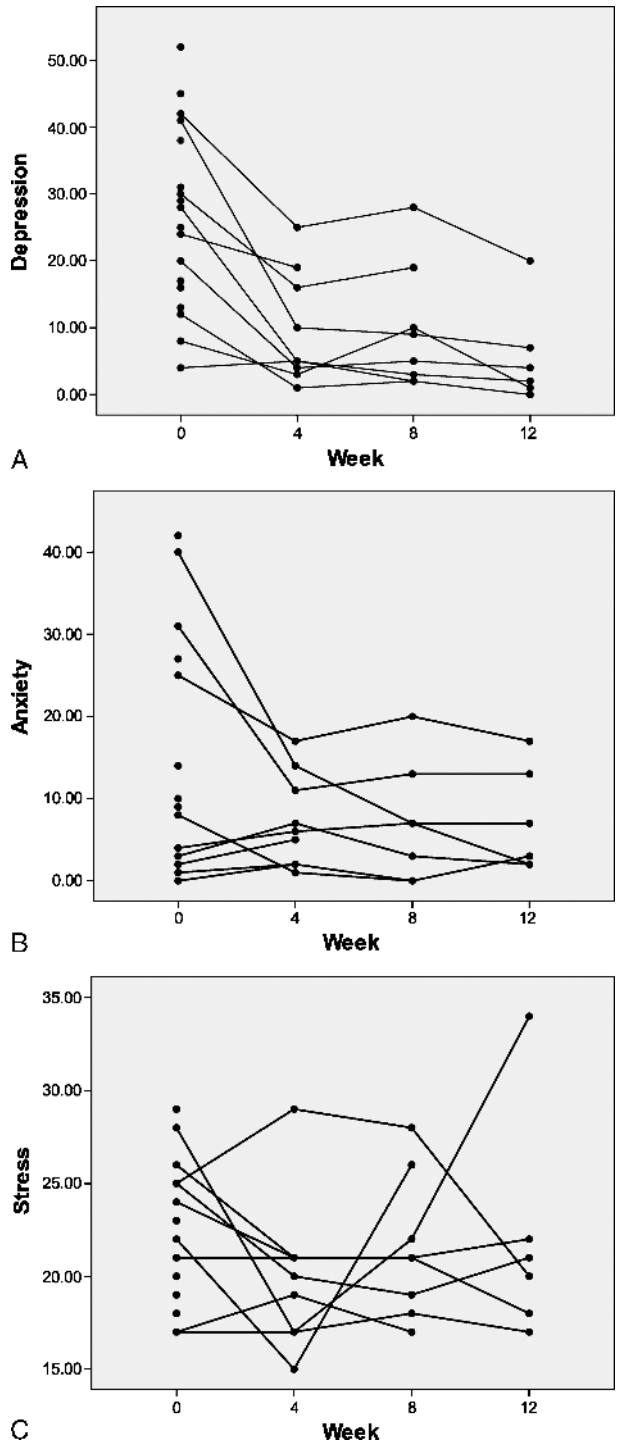

FIGURE 2. (A) Subject-specific depression over time. (B) Subject-specific anxiety over time. (C) Subject-specific stress over time.

prison'' and face ''another day in this place.'' These responses might reflect similar changes in acute mood documented by Woolery et al. (2004) and Shapiro and Cline (2004). Women also identified negative aspects of the intervention, the most common of which related to the implementation of the intervention. Specifically, issues with scheduling conflicts with work and other programs were addressed by participants.

Efficacy

Women who participated in the Iyengar yoga intervention reported a significant reduction in levels of depression symptoms and marginally significant reductions in levels of anxiety symptoms. Baseline depression values are similar or lower to mean values reported by others, suggesting that the decline in depression scores over time may not be attributed to regression to the mean. Despite participants acknowledging that their stress levels were lower, this finding was not statistically significant. This finding is contrary to the participants' descriptive responses, many of whom articulated that they did, indeed, feel less stressed because of participating in the intervention. This discrepancy might be a result of the choice of measurement instrument, the PSS (Cohen et al., 1983). Although the PSS has been used in several studies examining the effect of yoga on stress (Beddoe et al., 2009; Michalsen et al., 2005), it is likely that incarcerated women are substantially different than populations included in those studies. Furthermore, the prison environment is likely different than the environments in which both the original instrument and the subsequent studies were conducted. In addition to the obvious differences between a yoga studio and a maximum security prison, it is possible that disruptions in the specific intervention location coupled with the participants' fear of being late for standing count could have impacted stress.

Poor adaptation to incarceration can affect physical health, psychological health, relationships, and ability to carry out roles. Although women articulated that one never truly adapts to the stress of imprisonment to function in some capacity in prison, a person must assimilate to confinement. It is likely that this adaptive process is less of a dichotomous outcome of adapted versus not adapted but more likely reflects a continuum of adaptation. This continuum also may account for the lack of change in levels of stress seen in participants.

Limitations

Because the purpose of this study was the test the feasibility of conducting an Iyengar yoga-based intervention among incarcerated women, a small sample size was expected. Power was limited for detecting linear trends over time, and findings should be used for prospective intervention design. Twenty-one women consented to participate in the program, and 6 women ultimately completed the 12-week intervention. The homogeneity of the sample, mostly educated White women, might indicate a cultural bias with regard to participation. Women from other cultures may be less inclined to participate in a yoga program because it may not reflect their cultural norms. Investigators must also consider that selection bias may have occurred because many women had to consider if and how changes in schedules or work-related activities might affect their participation. High-functioning inmates, such as those with work, school, and program commitments, may be less likely to participate in interventions that might conflict with other important obligations. Finally, the results might indicate that socioeconomic barriers common in community settings may be replicated behind prison walls. For example, women who did not receive money from family members may be less able to alter work schedules to take part in health-related

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interventions. Statistically, exact p values less than .20 indicate that dropout may be higher among non-Whites, less-educated women, or those experiencing musculoskeletal problems.

This investigation did not use a control group for security concerns. As a result, there is limited ability to explore the true effect of the intervention. It is difficult to determine if the positive mental health changes were a result of the intervention or simply attention from the yoga teacher. Although feedback from participants was positive, the possibility of socially desirable responding and novelty effect cannot be ignored.

Recommendations for Research

It could be of interest to determine how personal culture affects a woman's participation in group health-related interventions. For example, it is unclear if language was a barrier to participating in the intervention. Similarly, investigators should address the possibility of racial self-segregation with regard to participating in group interventions. Future investigations should use a longer intervention period and a control group. Regardless of the type of intervention, follow-up measures immediately after the intervention (to test for acute changes in mood) should be conducted. Follow-up measures after completion of the intervention (to discern long-term effects) should also be conducted.

It is important to develop standardized measures of depression, anxiety, and stress that may be used with incarcerated populations. Tools that have shown adequate reliability and validity among nonincarcerated populations may not be appropriate for use among incarcerated populations. Questions contained in the BDI, such as the question that asked about "feelings of being punished," may be difficult to answer. It is suggested that to develop psychometrically acceptable tools, investigators continue to pilot existing tools, noting their strengths and limitations in adequately measuring the concept of interest.

Conclusions

This investigation represented a first attempt to introduce a gender-responsive Iyengar yoga program designed to improve confidence and reduce the stress of incarcerated women. The findings suggest that women who participated in this program experienced fewer symptoms of depression and possibly less anxiety. Findings from this study may be used to improve future interventions that are designed to benefit the health outcomes of incarcerated populations, especially women. ▼

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