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Implementation and Evaluation of a Physical Activity and Dietary Program in Federal Incarcerated Females

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Abstract

The purpose of this 3-month quasi-experimental pilot study was to examine the effect of a physical activity and dietary education program on body mass index (BMI) and resilience. Participants were given data-storing pedometers to record their physical activity, attended classes on healthy eating, and used portion control tools from http://ChooseMyPlate.gov. MyPlate usage and commissary purchases were collected weekly. BMI and resilience scores were measured at baseline, 6 weeks, and 12 weeks. Twenty-nine female prisoners completed the study. There was a statistically significant reduction in BMI after 12 weeks ($\chi^2 = 7.56$, $p = .023$) and resilience levels increased but did not reach statistical significance ($\chi^2 = 1.66$, $p = .437$). A physical activity and dietary intervention delivered by a correctional health nurse practitioner was an efficacious approach to reducing BMI and improving resilience among female prisoners.

Keywords

physical activity, diet, obesity, resilience, female, prisoners

Introduction

According to a U.S. Department of Justice report, most prisoners (74%) and jail inmates (62%) are overweight, obese, or morbidly obese (Maruschak, Berzofsky, & Unangst, 2015). Overweight and obesity are of particular concern among female prisoners and jail inmates. Maruschak and colleagues (2015) found that female prisoners and jail inmates are more likely to be overweight or obese than their male counterparts. Gates and Bradford (2015) found that most prisoners gain weight and increase their body mass index (BMI) during incarceration; however, females gain significantly

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more weight than males. Furthermore, female prisoners and jail inmates are more likely to be obese than non-imprisoned females (Herbert, Plugge, Foster, & Doll, 2012).

Factors Associated With Overweight and Obesity in the Prison Environment

Previous studies highlight the physical environment and regimen in prisons as major contributors to weight gain and obesity (Battaglia et al., 2013; Clarke & Waring, 2012; Herbert et al., 2012; Martin et al., 2013; Plugge, Foster, Yudkin, & Douglas, 2009). For example, prisons offer few opportunities (e.g., places or time) to engage in physical activity (Herbert et al., 2012; Plugge et al., 2009) despite evidence that physical exercise programs improve inmate health (Battaglia et al., 2013; Mannocci et al., 2015; Martin et al., 2013). Inmates make food choices that are unhealthy, which leads to excess caloric intake and contributes to weight gain during incarceration. Findings from a systemic review revealed that female prisoners are served diets designed for male prisoners and that female prisoners' caloric intake grossly exceeds the recommended amount for a female (Herbert et al., 2012). In some facilities, calorie levels for male and female prisoners can vary. High-calorie snack foods purchased from the prison commissary also compound the problem (Herbert et al., 2012; Plugge et al., 2009). Interventions to promote physical activity and healthy eating behaviors in prisons are needed (Harner & Riley, 2013; Herbert et al., 2012; Martin et al., 2013; Plugge et al., 2009).

Theoretical Framework

The model of resilience (Peterson & Bredow, 2012) was adapted to use as the theoretical framework for the study. As shown in Figure 1, the model of resilience in incarcerated females posits that protective resources can bolster resilience, or the ability to recover quickly from difficulties, which in turn leads to more favorable health outcomes. Resilience has been associated with both healthy behaviors and weight management in the general population. Specifically, lower levels of resilience have been associated with higher BMI in females (Moore & Cunningham, 2012). Physical activity (Ball et al., 2013; Freak-Poli, Wolfe, Wong, & Peeters, 2014; Moore & Cunningham, 2012; Richards et al., 2015) and healthy diet (Ball et al., 2013; Lutz et al., 2017; Mouchacca, Abbott, & Ball, 2013; Rapacciuolo et al., 2016) have been shown to increase resilience in the general population. To date, no studies have examined resilience among female prisoners or jail inmates.

Through the direction of a nurse practitioner, physician assistant, or physician, the more than 34,000 nurses employed in correctional facilities in the United States (Health Resources and Services Administration, 2010) are in a position to create healthier correctional environments to improve resilience and address obesity (Droes, 1994). We hypothesize that correctional health nurse practitioners can increase female prisoners' protective resources by promoting physical activity and providing dietary education. These interventions might result in increased resilience and improved weight management among female prisoners. Therefore, this study examined the following research questions:

1. **Research question 1:** Does a 12-week physical activity and dietary intervention prevent weight gain among newly incarcerated female prisoners?
2. **Research question 2:** Does a 12-week physical activity and dietary intervention improve resilience scores among newly incarcerated female prisoners?

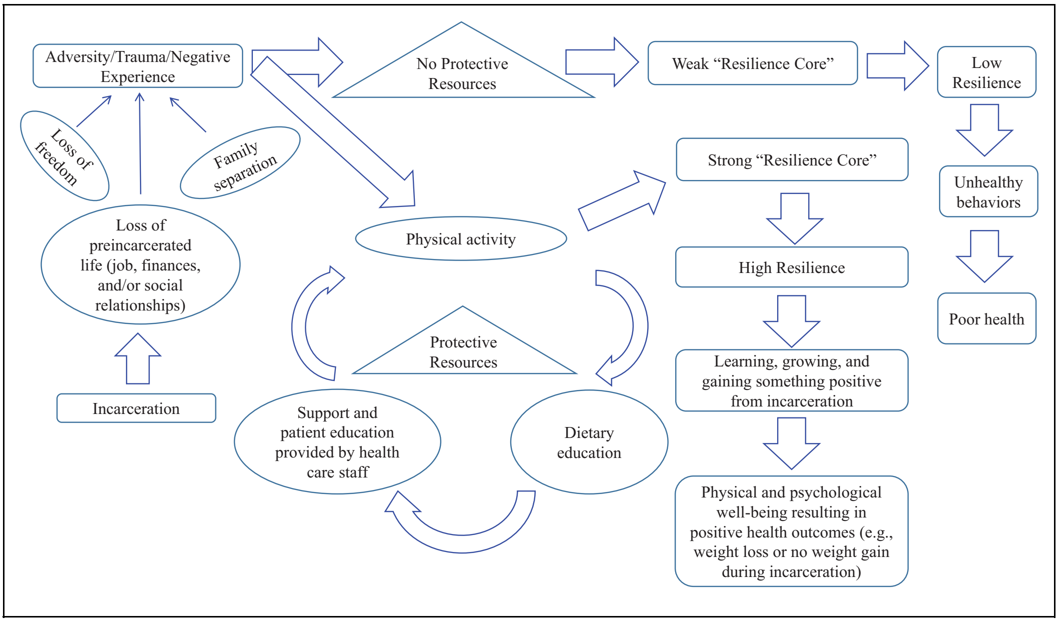

Figure 1. Model of resilience in incarcerated female inmates. Adapted from "Middle range theories: Application to nursing research (3rd ed.)." by Peterson & Bredow (2012), Philadelphia, PA: Wolters Kluwer | Lippincott Williams & Wilkins.

Method

This quasi-experimental pilot study examined the efficacy of a 12-week physical activity and diet intervention for helping newly incarcerated female prisoners improve their resilience and maintain their weight. The study setting was a female federal prison camp, located in the Northeast, that houses nearly 200 prisoners.

Sample

Thirty female prisoners were recruited for the study. Participant recruitment began after receiving Institutional Review Board approval from the Federal Bureau of Prisons. Eligibility criteria were as follows: (1) 18 years or older, (2) speak and read in English, (3) incarcerated >3 weeks but ≤ 12 months, (4) ≥ 6 months to serve sentence, (5) BMI $\geq$ 18 m/kg^2, and (6) received health clearance from the nurse practitioner who is also the principal investigator.

The incarceration lower limit ($>$3weeks) was set to ensure the prisoners had time to settle in to their prison regimen; the upper limit ($\leq$12 months) was set to capture prisoners during the period of time when they are most vulnerable and at risk for gaining weight during incarceration. The sentence limit ($\geq$6 months) was set to prevent attrition by release from prison during the study period.

Participants were recruited during a regularly scheduled intake physical examination, which was performed by the primary investigator who is a nurse practitioner. The intervention began after all 30 participants were recruited for participation.

Intervention

The intervention had four components: (1) pedometer use to motivate walking, (2) MyPlate use to motivate portion control, (3) health education, and (4) intervention monitoring and support from a nurse practitioner.

Pedometer Use to Motivate Walking

Intervention participants were given a 7-day data storing Yamax (YX) CW-701 Digiwalker pedometer for the duration of the study. Participants were instructed to wear the pedometer while awake and remove the device for showering and sleep. They were asked to work with the nurse practitioner to set weekly step count goals and to check in weekly with the nurse practitioner to record weekly step count and any pedometer issues (e.g., malfunction, missed wear).

Pedometers were chosen for use in this study because walking is considered a feasible, safe activity in a prison environment. In addition, pedometers are an inexpensive, effective tool for motivating physical activity (McCarthy & Grey, 2015). Setting and tracking step count goals using pedometers have been associated with weight loss among adults (Bravata et al., 2007; Cayir, Aslan, & Akturk, 2015; Richardson et al., 2008; Swift et al., 2012).

MyPlate Use to Motivate Portion Control

The U.S. Department of Agriculture's MyPlate method is a simple to use, no-cost tool for developing healthy eating patterns (Cunningham, 2011; Levine, Abbatangelo-Gray, Mobley, McLaughlin, & Herzog, 2012). The tool consists of a plate divided into four sections by food type (fruits, vegetables, grains, and proteins) and recommended portion size. MyPlate was used in this study to facilitate healthy eating patterns in the prison environment. The tool was introduced to prisoners in health education classes. Prisoners were then asked to use the MyPlate method when choosing food at meals. Prior studies suggest that portion control aids weight loss by reducing caloric intake (Faucher & Mobley, 2010; Kesman, Ebbert, Harris, & Schroeder, 2011; Reichard et al., 2015; Yamauchi et al., 2014).

Health Education Classes

Intervention participants were asked to attend three health education classes that lasted 60 to 90 minutes each at Weeks 1, 4, and 8 of the intervention. Participants were grouped into two classes of 15 prisoners each to ensure a small class size with opportunities for meaningful interaction. The classes were led by a nurse practitioner.

The Week 1 lesson focused on dietary recommendations and portion control as well as physical activity recommendations and how to set weekly step goals. Free teaching aids obtained from the http://ChooseMyPlate.gov website (e.g., MyPlate poster) and prison-specific visual aids (e.g., measuring cups and serving tray from the dining hall) were used to support the lesson. The Week 4 lesson focused on making healthy food selections at meals and with commissary purchases in the prison environment. Physical activity concepts learned in Week 1 were also reinforced. The final class (Week 8) reviewed the topics from the first two classes through an interactive question-and-answer game with the nurse practitioner.

Monitoring and Support From a Nurse Practitioner

Intervention participants met with the nurse practitioner weekly to allow for retrieval of the step count from participant pedometers and the MyPlate/commissary tracking form. This meeting facilitated data collection and provided social support to intervention participants. During these visits, participants were encouraged to increase their weekly step count by 2,000 steps/day until they reached the recommended 10,000 steps or more per day (McCarthy & Grey, 2015). Participants were reminded to record their daily adherence to healthy eating habits using the MyPlate tool and to record their total number of commissary foods and beverages consumed each day.

Data Collection

Demographic characteristics for each participant were captured using the Bureau Electronic Medical Records (BEMR) and SENTRY. SENTRY is a real-time information system used by the Federal Bureau of Prisons (Thompson, 2012). BEMR was used to obtain age, race/ethnicity, educational level, health status, and history of previous incarceration. Health status was determined by the number of chronic diseases. SENTRY was used to obtain incarceration length.

Process Evaluation

Intervention participants met with the nurse practitioner weekly to share their weekly step count total, MyPlate usage, and commissary usage and to report any missed data for the week. This process evaluation data allowed us to determine whether the intervention was implemented and received as planned.

Step count. Weekly step count was determined using the YX CW-701 Digiwalker pedometer. This device has a 7-day memory storage capacity that allowed for data collection of daily step counts once a week (Lee, Williams, Brown, & Laurson, 2015). Thus, all participants showed the nurse practitioner their step count on their pedometer at the end of the week.

MyPlate usage. MyPlate usage was tracked as the percentage of time the participants reported using MyPlate per week. If participants used MyPlate for all meals ($n = 21$), the score was recorded as 100%; 15 to 20 meals per week was recorded as 75%; 10 to 14 meals per week was recorded as 50%; 5 to 9 meals per week was recorded as 25%; 1 to 4 meals per week was recorded as 10%; and no meals per week was recorded as 0%. Participants were given a standard tracking sheet to record and report MyPlate usage.

Commissary purchases. Commissary purchases were defined as any food item or sugar-containing beverage purchased from commissary. Food items available for purchase included fried rice, sweets (e.g., candy and cookies), canned seafood (e.g., tuna, salmon, and mackerel), chips, processed cheese and meats, ramen noodles, tortilla wraps, pasta, salted nuts, peanut butter, and crackers. Beverages for purchase were soft drinks (e.g., soda) and presweetened flavored coffees. Participants were instructed to record and report the weekly amount of commissary foods consumed on a standard tracking form that they returned at weekly visits.

Impact Evaluation

Weight status and resilience were measured at baseline, 6 weeks, and 12 weeks (i.e., immediately following the intervention). The measures used to assess weight status and resilience are described below.

Weight status. Weight (kg) and height (cm) were measured using a digital stadiometer (Seca 220, n.d.; Seca 769, n.d.). BMI was then calculated using the formula kg/m^2 (Centers for Disease Control and Prevention, 2017).

Resilience. Resilience was measured using Wagnild and Young's (1993) Resilience Scale, which has well-documented validity and reliability (Wagnild, 2009). The Resilience Scale has been tested across a variety of age groups, ethnicities, and educational levels, making this instrument appropriate to use in a female prisoner population (Smith-Osborne & Bolton, 2013; Wagnild, 2009; Wagnild, 2014).

The Resilience Scale has 25 items that represent the five characteristics of resilience (e.g., perseverance, equanimity, meaningfulness, self-reliance, and existential aloneness). All 25 items are scored on a 7-point Likert-type scale ranging from 1 (*disagree*) to 7 (*agree*). Responses are summed for a total resilience score (range of 25–175), with higher scores indicating higher resilience. Scores $\leq$120 reflect low resilience, scores of 125 to 145 indicate moderately low to moderate resilience, and scores >145 indicate moderately high to high resilience.

Statistical Analyses

Descriptive statistics were used to summarize the data. Friedman's test was used to examine differences in BMI and resilience scores among intervention participants between baseline, 6 weeks, and 12 weeks. Wilcoxon signed rank test was used to further explore significant differences between time points. Nonparametric statistics were used since this pilot study had a relatively small sample size. Statistical significance was set at $p < .05$ for all statistical tests. IBM Statistical Package for the Social Sciences for Windows Version 24 was used for analyses.

Results

Thirty female inmates consented to participate, and 29 completed the intervention. One participant dropped out of the intervention because participating in the study interfered with her ability to complete her General Education Development (GED).

Participant Characteristics

Participants' mean age was 42.9 years ($SD = 12.0$). Forty percent ($n = 12$) were White, 33.3% ($n = 10$) were Hispanic, and 26.7% ($n = 8$) were Black. Only 13.3% of females had a previous history of incarceration, of which the average length was 33.3 ($SD = 19.3$) months. Level of education included postgraduate education (3.3%), bachelor's degree (6.7%), associate's degree (23.3%), some college (20.0%), high school diploma/GED (30.0%), and no high school diploma (16.7%). Overall health status was excellent (6.7%), good (6.7%), fair (66.7%), and poor (20.0%).

Process Evaluation

Attendance was 100% at the first education class, 96% at the second, and 72.4% at the final class. Table 1 displays the weekly averages and missing data for step count, MyPlate usage, and commissary purchases. Average weekly participant step count ranged from 6,729 ($SD = 3{,}237$) to 9,138 ($SD = 3{,}204$) steps. Missing step count data ranged from 20.7% to 65.5%. Reasons for missing step count data included pedometer malfunction or accidental resetting of pedometer when dropped ($n = 43$), lost or misplaced pedometers ($n = 16$), or not wearing pedometers as instructed ($n = 63$). MyPlate usage ranged from 41% ($SD = 23$) to 60% ($SD = 19$) and commissary purchases ranged from 8 ($SD = 7.0$) to 13 ($SD = 11$) items. As shown in Table 1, missing data was less of an issue for tracking MyPlate usage and commissary purchases than it was for step count.

Impact Evaluation

Changes in BMI

Figure 2 provides a visual of the change in median and interquartile range (IQR) for BMI over time. Median BMI was 29.4 (IQR = 7.2) at baseline, 28.7 (IQR = 7.8) at 6 weeks, and 29.0 (IQR = 8.0) at

Table 1. Weekly Averages and Missing Data for Step Count, MyPlate, and Commissary Purchases.

	Pedometer Data		MyPlate Data		Commissary Data	
Week	Step Count *M* (*SD*)	Missing Step Count *f* (%)	MyPlate Use *M* (*SD*)	Missing MyPlate Forms *f* (%)	Commissary Use *M* (*SD*)	Missing Commissary Forms *f* (%)
1	8,178 (3,920)	11 (37.9)	49 (22)	0 (0)	13 (11)	0 (0)
2	6,729 (3,237)	8 (27.6)	47 (19)	0 (0)	13 (10)	0 (0)
3	8,357 (3,296)	9 (31.0)	41 (23)	0 (0)	10 (8)	0 (0)
4	7,475 (3,123)	7 (24.1)	50 (17)	0 (0)	10 (10)	0 (0)
5	8,243 (3,047)	7 (24.1)	51 (21)	1 (3.4)	9 (8)	1 (3.4)
6	7,294 (3,041)	6 (20.7)	50 (15)	0 (0)	8 (7)	0 (0)
7	9,138 (3,204)	9 (31.0)	50 (14)	2 (6.9)	10 (9)	2 (6.9)
8	8,306 (2,635)	11 (37.9)	53 (21)	3 (10.3)	11 (9)	3 (10.3)
9	8,261 (2,428)	13 (44.8)	55 (20)	0 (0)	10 (9)	0 (0)
10	7,241 (3,033)	19 (65.5)	54 (19)	1 (3.4)	9 (9)	1 (3.4)
11	8,331 (3,192)	9 (31.0)	60 (19)	5 (17.2)	10 (9)	5 (17.2)
12	8,046 (2,484)	13 (44.8)	51 (23)	3 (10.3)	11 (10)	3 (10.3)

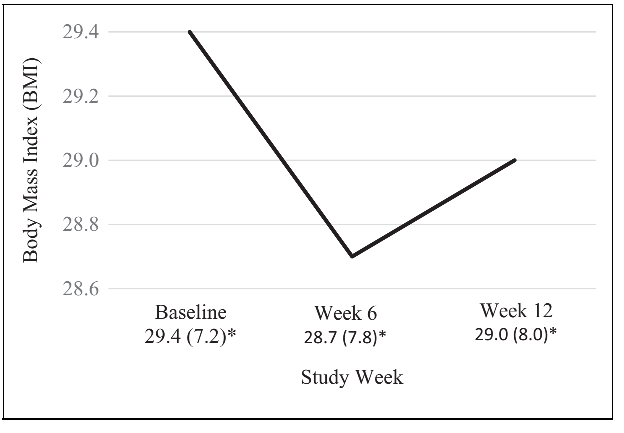

Figure 2. Median body mass index at baseline and Weeks 6 and 12.
*Median (interquartile range).

12 weeks. A Friedman test revealed a statistically significant difference in BMI between baseline, 6 weeks, and 12 weeks ($\chi^2 = 7.560, p = .023$). The Wilcoxon signed rank test revealed a statistically significant decrease in BMI from baseline to 6 weeks ($Z = -2.205$, $p = .027$) and baseline to 12 weeks ($Z = -2.031$, $p = .042$). Change in BMI from 6 weeks to 12 weeks was not statistically significant ($Z = -1.029$, $p = .304$).

Changes in Resilience

Figure 3 provides a visual of the change in the median and IQR for resilience score over time. The median resilience score was 148.5 (IQR = 22) at baseline, 149.0 (IQR = 27) at 6 weeks, and 150.5 (IQR = 27) at 12 weeks. There were no significant differences in resilience scores between baseline, 6 weeks, and 12 weeks ($\chi^2 = 1.655$, $p = .437$).

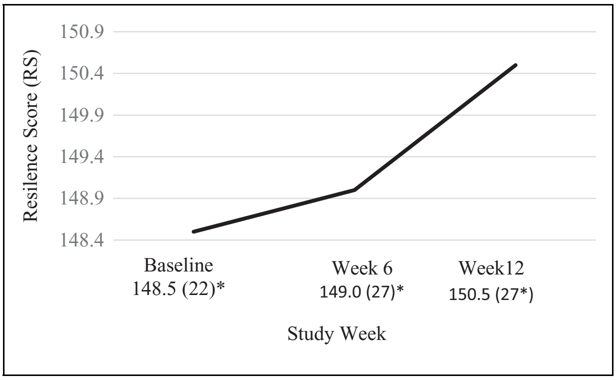

Figure 3. Median Resilience Score (RS) at baseline and Weeks 6 and 12.
*Median (interquartile range).

Discussion

We examined the impact of a physical activity and dietary intervention on BMI and resilience among females in a federal prison camp. This study makes a valuable contribution to the literature as it is the first to examine how changes in physical activity and diet can impact BMI and resilience among female prisoners.

Following program implementation, BMI decreased significantly from baseline to 6 weeks and from baseline to 12 weeks. This finding is promising as female prisoners typically gain weight upon incarceration (Gates & Bradford, 2015). The women in this study not only avoided gaining weight but even experienced significant reductions in BMI. This finding is similar to prior studies in the general population showing that interventions combining physical activity with portion control can decrease BMI (Hartmann-Boyce et al., 2014).

This is the first study to examine resilience levels among female prisoners. Baseline resilience scores ranged from 45 to 175, with the median score of 148.5 indicating that the majority of the participants had moderately high levels of resilience at baseline. Resilience levels increased over the 12 weeks; however, this change did not reach statistical significance. Lack of significance might be because participants already had moderately high resilience levels at baseline.

An important occurrence that requires further discussion was that resilience scores did not improve between baseline and 6 weeks but improved from 6 weeks to 12 weeks. A possible explanation is that the 6-week measurement period occurred at the onset of the winter "holiday season." This can be a time of more stress and loneliness for female prisoners (Fogel, 1993). Process evaluation data show that after week 6, participants' physical activity and dietary habits improved. The prison also had more social activities (e.g., increased visitation hours and holiday events). This possibly explains the improvement in resilience levels in the 12th week. It is recommended that correctional health nurse practitioners and other health care providers who work with the prison population recognize holistic approaches to care that integrate not only the physiological aspects of care but also the psychological aspect of the person (Droes, 1994). These interventions should include ways to build an individual's resilience.

Process evaluation data allowed us to detect some challenges with participants' adherence to all intervention components. Participants attended weekly nurse practitioner meetings and three education classes and used the MyPlate and commissary logs with relatively high fidelity. There were, however, issues with self-monitoring physical activity using pedometers. Specifically, participants often forgot to wear their pedometer or experienced pedometer malfunction due to dropping the pedometer. Future interventions might consider using a pedometer less sensitive to being dropped. Because of limited pedometer use, we would suggest that the observed effects were likely due to the other intervention components (MyPlate and commissary tracking, weekly meeting with nurse practitioner) rather than self-monitoring physical activity using pedometers.

Limitations

This study has several limitations. First, there was no control group, which weakens the internal validity for our study (Shadish, Cook, & Campbell, 2002). In addition, MyPlate data were self-reported, which are subject to social desirability bias (Lichtman et al., 1992), and there were some issues with implementation fidelity as outlined above. However, the collection of robust process evaluation data allows us to better explain intervention effects. The homogeneity of the population and small sample size make the findings difficult to generalize to other populations; however, this can be overcome in future research. Another possible limitation to this study is the use of the Wagnild and Young's (1993) Resilience Scale. While found to be valid and reliable in other studies, this instrument has never been used in a population of female prisoners. An instrument that is linguistically and culturally sensitive to the unique needs of female prison populations is needed (DeNisco, 2011). The preliminary findings from this study indicate that resilience may influence how individuals adapt to prison life and determine self-care behaviors.

Conclusion

The findings presented in this study make an important contribution to prison health care research. To date, there is no published literature evaluating physical activity and healthy diet interventions on weight status and resilience in female prisoners. Although the use of pedometers was limited, the study findings suggest that an intervention incorporating the MyPlate method and commissary purchase tracking with weekly correctional nurse practitioner visits might be an efficacious approach to preventing weight gain, reducing BMI, and improving resilience among female prisoners. Future research should include a larger sample size and extend the duration of the intervention. Johns, Hartmann-Boyce, Jebb, and Aveyard (2014) found that exercise and dietary programs with longer exposures (e.g., 6–12 months) resulted in greater reductions in BMI. A crossover design that enables study participants to participate in both the control and intervention group provides supporting evidence for causality while ensuring no prisoners are denied treatment. Additionally, future research should evaluate the interventions effect on BMI among participants with low, medium, and high resilience scores at baseline. This study's limited sample size did not allow for this level of analysis.

As prison health care costs rise, the greatest financial burden is on taxpayers who fund prison health care programs (Pew Charitable Trusts, 2014). Thus, it is imperative that prison systems invest in designing wellness programs both to decrease health disparities and poor health outcomes that female prisoners face while incarcerated and to promote healthy behaviors that can be sustained after their release.

Authors' Note

Opinions expressed in this article are those of the author and do not necessarily represent the opinions of the Federal Bureau of Prisons or the U.S. Department of Justice.

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Declaration of Conflicting Interests

The authors disclosed no conflicts of interest with respect to the research, authorship, or publication of this article. For information about *JCHC*'s disclosure policy, please see the Self-Study Program.

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