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# An Insight to Psychological Health, Health Behaviors, and Bodyweight Among Correctional Employees

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# An Insight to Psychological Health, Health Behaviors, and Bodyweight Among Correctional Employees

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Master of Science Thesis

An Insight to Psychological Health, Health Behaviors, and  
Bodyweight Among Correctional Employees

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## DEFINITION OF VARIABLES

The following variables were measured and evaluated for this research. The definition of each variable is provided for ease of reading throughout this thesis.

### **Demographic Characteristics**

*The following variables were measured as part of the self-reported extended organizational and individual health survey*

#### **Age and Gender**

**Race/Ethnicity:** The NIH categories for race and ethnicity were used to categorize participants as the following: White, Black/ African American/ African, American Indian/ Alaska Native, Asian American/ Asian, Latino/ Hispanic origin, or other (<http://grants.nih.gov/2011>).

**Education:** Participants were asked to mark their highest level of educational attainment based on the following: Less than High School, High School Graduate or GED, Some College, or College.

**Job Tenure:** Number of years employed by the department of corrections.

**Job:** Job titles were grouped into two categories: “correctional staff” and “support staff”. This categorization was based upon customary administrative divisions. Correctional staff included Correctional Officers, Lieutenants, Captains, Deputy Wardens, Wardens, and Correctional Treatment Officers. Support staff included Counselors, Counselor Supervisors, Maintenance, Maintenance Supervisors, Administration, Teachers, Chaplains, and Medical Staff.



**Shift:** Participants shift work was dichotomized to day shift (first and second shift) and night shift (third shift).

**Total Family Income:** Participants were asked which range indicated their total family income (combination of salaries, wages, investments, and rents) based on the following: \$10,000-24,999; \$25,000-49,999; \$50,000-74,999; \$75,000-99,999; and More than \$100,000).

### **Physical Characteristics**

*The following variables were measured as part of the staff conducted physical assessment*

**Body Weight:** Body weight was measured by a team of trained researchers using a calibrated Seca 700 physician balance beam scale as part of the HRA at years 1 and 3. To determine how accuracy, researchers compared measured weight to self-reported weight. The two measured were significantly correlated to each other.

**Height:** Height was measured using the Seca 700 physician balance beam scale with a height bar by a team of trained researchers.

**Body Mass Index (BMI):** BMI was calculated using baseline weight and height. The equation to calculate BMI is as follows:

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height}^2 (\text{m}^2)}$$

BMI was categorized to classify participants as “normal weight/health weight”,

“overweight” or “obese”<sup>1</sup>.

## **Health Behaviors**

*The following variables were measured as part of the self reported Health Risk Assessment (HRA)*

**Diet Quality:** Diet quality was based on 6 survey items regarding eating practices regarding the food groups; snacks, high salt foods, low/high fat foods, fruits/vegetables, whole grains, and frequency of eating breakfast. Answers were on a 4- or 5- point Likert scale and ranged from (1) ‘almost never eat the healthier options’ to (4) ‘almost always eat the healthier options’. These survey items were used to create a latent variable to represent overall diet quality to be used in statistical analyses. Higher diet quality scores represent better overall diet.

**Exercise Quality:** Exercise quality was based on 3 survey items regarding frequency of aerobic, strength building, and stretching exercise on 4- or 7-point Likert scales. Answers ranged from (1) ‘never’ to (4) ‘three or more days/week’. These survey items were used to create a latent variable to represent overall exercise quality to be used in statistical analyses, with higher exercise quality scores indicating better exercise habits.

**Sleep Quality:** was based on a single survey item question (observed variable) asking, “how often do you get 7 to 8 hours of sleep” on a 4-point Likert scale. Answers ranged from (1) ‘always’ to (4) ‘seldom or never’. This item was reverse coded so a higher score represented better sleep quality.

## Stress & Psychological Health

*The following variables were measured as part of the self reported Health Risk Assessment (HRA) and the Center for Epidemiological Studies Depression Scale (CES-D). Psychological Health was represented by both “depression” and “emotions”*

**Stress:** Perceived stress was created from 6 survey items with “yes” or “no” responses that serve as possible indicators of stress chosen based on experience in the correction setting and a review of literature.. Questions were similar to those asked on the General Health Questionnaire (GHQ) <sup>2</sup> and assessed an individual’s number of stress signals. These survey items were used to create a latent variable to represent overall stress to be used in statistical analyses, with higher stress scores indicate higher stress levels.

**Depression:** Depression was based on 10 Center for Epidemiological Studies Depression Scale (CES-D) survey items, each question having a 4–point Likert scale assessing frequency and severity of feelings to assess depression risk <sup>3</sup>. Answers range from ‘rarely’ or ‘none of the time’ (1) to ‘all of the time’ (4). These survey items were used to create a latent variable to represent overall depression to be used in statistical analyses with a higher score representing more depression.

**Emotions/Mood:** Emotions (termed Mood in chapter 2) was created from 6 survey items resembling the psychological health profile of the SF-12 <sup>4</sup>. Answers were on a 6-point Likert scale and ranged from (1) ‘none of the time’ to (6) ‘all of the time’. These survey items were used to create a latent variable to represent overall emotions to be used in statistical analyses with a higher emotions score representing more positive emotions.

## ABSTRACT

**Background:** Correctional employees present a poor physical and mental health profile including high rates of overweight/obesity, poor health behaviors (diet, exercise, and sleep quality), high stress levels, and poor psychological health (e.g. high rates of depression, suicide, and divorce). Worse, correctional employees deny their stress and negative emotions as their occupational culture discourages expressing negative characteristics that would make one appear weak and deters seeking psychiatric help. Correctional employees are in need of effective health promotion efforts that address determinants of employee health with an all-inclusive view (mental/emotional/behavioral). **Purpose:** The purpose of this study was to assess if stress and/or psychological health (depression and emotions) serve as predictors of health behaviors and bodyweight among correctional employees. The proposed theoretical Psychological Health, Behavior, Bodyweight (PBBW) model was tested for mediating relationship between psychological health and bodyweight via health behaviors. Furthermore, the study sought to assess underreporting of stress and negative emotions, which may provide evidence of emotional detachment and/or concealing of negatively stigmatized characteristics. **Methods:** This was a cross sectional study of correctional employee (n=317) health utilizing research staff conducted physical assessments (height, weight, and body mass index) and self-reported surveys (stress, psychological health, and health behaviors). Structural equation modeling was used to create latent variables from self-reported survey items to test the mediating relationships among variables of interest. In testing for underreporting, non-normality of responses to stress and emotions were assessed via

visual assessment of histograms and tests of skewness and kurtosis. **Results:** The proposed Psychological Health, Behavior, Bodyweight (PBBW) model was supported suggesting that psychological health and stress may affect bodyweight via health behaviors. In addition, results suggest correctional employees underreport characteristics such as stress and negatively worded emotions that may be stigmatized. **Conclusions:** Correctional employees are suffering from stress and negative emotions, which appear to adversely affect health behaviors and bodyweight. Correctional culture may inhibit concession of weakness and pursuit of emotional health. Interventions should address stress and psychological health in efforts to promote healthy behaviors and ultimately healthy bodyweight.

## **INTRODUCTION**

### *1.1 Overview*

There are a total of four chapters in this thesis. Chapter one serves as an introduction to the research. Chapters 2 and 3 are manuscripts that utilize cross-sectional physical and self-report survey data on correctional employees. This dataset comes from a larger research project conducted by the Center for the Promotion of Health in the New England Workplace (CPH-NEW) to assess correctional employee health and safety and assess participatory action interventions at the worksite. Each manuscript has an introduction, methodology, results, discussion, conclusion, and reference section. The manuscript in Chapter 2 has been submitted for publication in the Journal of Workplace Behavioral Health. The manuscript in Chapter 3 is in preparation for submission in the online Advances in Obesity, Weight Management & Control.

### *1.2 Background*

The World Health Organization has recognized obesity as an epidemic worldwide and within the U.S.<sup>5</sup> Currently 68.8% of U.S. adults are considered overweight or obese<sup>6</sup>. Obesity has been associated with increased all-cause mortality and multiple comorbidities including hypertension, type-2 diabetes, dyslipidemia, coronary heart disease, stroke, gallbladder disease, osteoarthritis, respiratory problems such as sleep apnea, and certain types of cancers including endometrial, breast, prostate, and colon

cancers. By one estimate, obesity contributes to approximately 112,000 preventable deaths yearly <sup>7</sup>. In addition, obese individuals are often subject to social stigmatization and elevated rates of psychological problems <sup>8</sup>.

Factors influencing overweight and obesity are numerous and varied. The differential between calories consumed and calories expended via physical activity is a major driver of bodyweight. Genetics, metabolism, behavior, environment, and culture appear to be important influences as well. The Surgeon General's Vision for a Healthy and Fit Nation 2010 states that identifying determinants of healthy behaviors and making changes to the environment are likely effective means to address the epidemic of obesity<sup>8</sup>. This report notes health behaviors of physical activity and diet have been identified as key modifiable risks for prevention and control of obesity and health. Stress has been recognized to contribute to excess bodyweight, increase intake of calories, and decrease of motivation for practicing health behaviors effecting overweight/obesity <sup>9-12</sup>. Interventionists have advised the inclusion of social and physical environmental factors in addition to an individual's behavior <sup>8,13</sup>. One such environment is the work environment.

Obesity poses an economic burden with an estimated medical care cost from obesity reaching \$147 billion in 2008, equating to 9.1% of all medical spending <sup>14</sup>. Obese employees are more costly to employers via increased healthcare costs <sup>15</sup> and absenteeism costs which together are estimated to be \$400-2,000/year more for an obese employee compared to a normal-weight employee<sup>14</sup>. Worksite wellness programs have been commended as a successful means to address employees' overweight and obesity rates and their associated costs <sup>16</sup>. Worksites have been identified as an ideal

setting for health promotion interventions as employees spend a large portion of their day at the workplace <sup>17</sup>. However, workplace health promotion success depends on employee participation and program intensity, and weight loss is often difficult to sustain <sup>18</sup>.

Current obesity interventions are inadequate and challenged by participant noncompliance <sup>19</sup>. For example, one meta-analysis found 5 years after an initial weight loss, only 23.4% of the initial weight loss was maintained <sup>20</sup>. Similarly, in an effort to compare diets of varying macronutrient content, it was found that within six months participants had little compliance to any of the diets and no differences could be seen between the diets <sup>21</sup>. Therefore, although healthy behaviors and weight loss are known benefits for health and well-being, promoting these behaviors has proved difficult. Research is needed to better understand factors that both promote and inhibit healthy behaviors and healthy bodyweight.

Stress and psychological health may be factors that influence practicing of healthy behaviors and effect bodyweight status. In particular, both cross sectional and longitudinal studies <sup>22,23</sup> have documented an association between work stress and increasing risk for obesity <sup>24-26</sup>. Research exploring mechanisms have confirmed a clear association via physiological mechanisms by which stress increases hypothalamic-pituitary-adrenal (HPA) axis activity and metabolic disturbances including obesity and metabolic syndrome <sup>27-30</sup>. Long-term exposure to stress hormones, mainly cortisol, have an effect on the body's fuel metabolism which is associated with increased visceral adipose tissue and upper-body obesity <sup>31</sup>. Increased cortisol secretion, a marker of stress, significantly predicts decreased dietary restraint, which in turn



changes dietary behaviors (e.g. increased calorie intake, decreased nutritional quality of diet)<sup>32</sup>. Perceived stress has been shown to affect health behaviors. Chronic stress has been associated with comfort and binge eating<sup>33</sup>, preference for higher fat, energy dense foods<sup>34,35</sup>, reduced physical activity<sup>36</sup>, and increased sedentary behaviors<sup>37</sup>. It has been proposed that the association between stress and obesity may be a result of maladaptive and unhealthy coping strategies that make the individual temporarily feel better<sup>38</sup>. Stress may also be a contributing factor to development of negative psychological health outcomes (negative emotions, depression, anxiety, insecurity, decreased self-esteem and self-worth, powerlessness), and cause increased sensitivity to stress<sup>39</sup>.

Psychological health (e.g. depression and mood states) appears to effect health behaviors and bodyweight<sup>16,17,84</sup>. Depressive symptoms have been linked to central obesity<sup>40</sup>. Individuals with higher levels of depression have a tendency to eat during periods of negative-emotions, report lower physical activity, and have higher adiposity levels<sup>41</sup>. Negative emotions have been linked to poor eating habits<sup>42-44</sup>. Adults with negative mood<sup>90</sup>, depression<sup>45</sup>, anger, hostility, and aggression<sup>46-48</sup> have reported poorer sleep. It has been proposed that the mechanism by which psychological health and stress are related to weight status may be an indirect effect via health behaviors<sup>49-</sup>

56.

Correctional employees are an occupational group with poor physical and psychological health profiles<sup>57</sup>. They are an occupational group in great need of effective health promotion efforts. Correctional employees have rates of overweight and obesity that are higher than the national averages<sup>58</sup> and elevated rates of chronic diseases compared to

adults in other occupations (myocardial infarctions, high blood pressure, diabetes, asthma, and ulcers)<sup>59</sup>. Poor health behaviors in correctional employees include poor diet, snacking on low nutrient foods<sup>60</sup>, low levels of physical activity, sedentary lifestyle, and poor sleeping habits<sup>57</sup>. Correctional employees are exposed to high levels of workplace stress<sup>61</sup> stemming from factors such as hierarchical organization, contact with incarcerated inmates and fear for personal safety, and long and unpredictable work hours<sup>62-66</sup>. The prevalence of mental health issues is elevated<sup>67</sup> including high levels of depression<sup>68</sup>, poor work-family balance, perception of a short life expectancy, and high rates of suicide<sup>69</sup>. Occupational factors at the workplace make this an occupation with high job demands and low job control. According to the theoretical Demand-Control (DC) model of occupational stress<sup>70,71</sup>, jobs characterized with high demands (mental workload)<sup>72</sup> and low job control (decision authority and skill discretion)<sup>73</sup> result in job strain, increasing the risk of psychosomatic health problems and exhaustion<sup>74</sup>, inability to cope with challenges faced at work, and ultimately physiological and emotional reactions leading to physical and mental health disorders<sup>75</sup>.

Although correctional employees and other law enforcement professionals are recognized to have high rates of stress and negative psychological health, they commonly under-report stress and symptoms of stress<sup>32,53-55</sup> and experience emotional detachment<sup>76</sup>. Such conflict may be a result of a work culture which promotes a “macho” image and concealing of negative “weak” emotions and stress. This occupation often requires display of a detached attitude while refraining from showing the emotions one may truly be feeling<sup>77</sup> and ultimately leading to emotional detachment for one's own emotions and isolation from other individuals<sup>32,55</sup>. It has been reported that

correctional officers are not well equipped with coping responses and therefore internally cope with intense and negative emotions<sup>65</sup> and may turn to negative coping mechanisms such as alcohol and poor diet practices. The gap between prescribed emotional fronts and ones true emotions is called emotional dissonance<sup>78</sup>. Emotional dissonance is noted as a source of stress, and the inhibition of expressing emotions is a predictor of poor physical health and illness<sup>77,79</sup>.

Overweight/obesity prevention and treatment programs focus on increasing behavioral control of diet and exercise, however these efforts have poor long-term impact<sup>39,80</sup>. The National Institute of Occupational Safety and Health (NIOSH) Total Worker Health (TWH) initiative calls for a comprehensive view of employee health (behavioral, mental, and physical) rather than relying on solely changing individual's lifestyle behaviors (e.g. diet and exercise). This initiative endorses addressing work and organizational factors and barriers to healthy behavior practices<sup>13</sup>. Such factors have been proposed to increase obesity risk through a mediation effect by health behaviors. Hence, they may serve as target areas to improve prevention and treatment programs to increase healthy behaviors and ultimately healthy bodyweight.

### *1.3 Purpose*

The purpose of this research is to gain a better understanding of correctional employee psychological and physical health status as predictors of health outcome such as overweight and obesity. Stress and psychological health (depression and emotions) are assessed as predictors of health behaviors (diet, exercise, and sleep quality) and ultimately bodyweight. A mediating affect from health behaviors is proposed.

Underreporting of the negatively stigmatized characteristics of stress and emotions is also assessed within the population of correctional employees to provide evidence for emotional detachment.

#### *1.4 Specific Aims\**

- 1) To create latent variables that account for measurement error, allowing an accurate assessment of constructs from measured self-reported survey items (stress, psychological health, and health behaviors).
- 2) To assess if stress and emotions are predictive of health behaviors.
- 3) To propose and test a theoretical model; the Psychological Health, Behavior, and Bodyweight (PBBW) Model, representing the mediated relationship between stress and psychological health and bodyweight via health behaviors.
- 4) To assess for underreporting of stress and emotions amongst correctional employees.

*\*Terms listed in the specific aims are further elaborated upon in the Methods sections*

#### *1.5 Hypotheses*

- 1) Latent variables with good model fit will be created from self-reported survey items.
- 2) Both stress and emotions will be predictive of health behaviors (diet, exercise, and sleep quality).

- 3) The proposed Psychological Health, Behavior, and Bodyweight (PBBW) Model will be supported by the data suggesting a mediating relationship by which psychological health and stress effect health behaviors and ultimately bodyweight.
- 4) Underreporting will be evidenced by non-normal response distributions to stress negatively worded emotions.

### *1.6 Significance*

Correctional employees present a poor health profile including elevated rates of overweight/obesity, poor health behaviors, poor psychological health, and high levels of occupational stress. Stress and poor psychological health may be negatively impacting employee health behaviors and ultimately bodyweight. Unfortunately, the culture of corrections breeds a “macho” persona in which correctional employees are resistant to indicating their stress and negative emotions, and to seek psychological help. Without effective coping mechanisms correctional employees likely turn to negative practices to cope (e.g. alcohol, poor dietary choices, and sedentary behaviors) <sup>12,38,57,81,82</sup>. The significance of this research is two-fold. First, it seeks to further the understanding of determinants of healthy behaviors, and body weight, in order to inform future health promotion efforts. Proposed relationships between stress, psychological health, health behaviors, and ultimately body weight are tested. A positive relationship between these variables will raise awareness for the need to address employee stress and psychological health profiles in order to promote better health behaviors and body weight. Second, it assesses underreporting of negatively stigmatized characteristics, which may provide insight into more accurate means of assessing correctional employee stress and psychological health and shed light on the issue of emotional labor

and emotional detachment in this population. Ultimately, this work will add to the available knowledge of workplace health promotion efforts in high-stress occupations.

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### **Psychological Health, Behavior, and Bodyweight (PBBW) model: An evaluation of predictors of health behaviors and body mass index (BMI)**

Journal of Workplace Behavioral Health (Submitted for review)

#### **2.1 ABSTRACT:**

*This study proposes and tests the theory driven Psychological Health, Behavior, and Bodyweight (PBBW) model. The model hypothesizes an indirect relationship between psychological health and bodyweight, mediated by health behaviors. Correctional employees (n=317) completed physical assessments and self-report surveys that measured body mass index (BMI), perceived stress, psychological health (overall mood and depression), and health behavior (diet and exercise quality). Structural equation modeling evaluated the relationships between variables to test the model. Results supported the PBBW model suggesting that both psychological health and stress affected bodyweight and that the effect of psychological health on bodyweight was mediated by health behaviors.*

*Key words: Psychological Health, Stress, Health Behavior, Bodyweight, Correctional Employees, Employee Health, Structural Equation Modeling*

#### **2.2 INTRODUCTION:**

Currently, one-third of the United States population is overweight and an additional one-third is obese <sup>83</sup>. Obesity is a recognized risk factor for multiple adverse health conditions <sup>1</sup> and poses an economic burden on the individual, the employer, and the nation's health care costs <sup>15,84,85</sup>. Finkelstein (2010) estimated that employers paid an additional \$75 billion dollars per year for obesity related medical costs. Much of this cost is associated with the increased premiums paid by both the employees and employers. Hence, employers have a strong motivation to promote healthy behaviors in their employees <sup>86</sup>.

Multiple factors have been identified in the development of overweight/obesity and associated chronic diseases. They include environmental, social, behavioral, cultural, physiological, genetic, and metabolic factors <sup>1</sup>. Acquired behaviors including dietary selection and physical activity are considered two of the major contributors to bodyweight <sup>87-89</sup>. Additionally, emotional characteristics have been related to both bodyweight and health behaviors <sup>90</sup>. For example, a negative mood may negatively affect eating patterns <sup>42-44</sup>, however the mechanistic pathway through which this association occurs is not well understood and merits study. Also of importance is the recognition that reverse associations may also occur. For example, the relationship between depression and obesity may be bi-directional, with both obesity resulting in depression and with depression resulting in obesity <sup>55,56,91</sup>. Stress and mood states such as depression may serve as risk factors of obesity through a mediated behavioral processes <sup>28,35,50-53,55,56</sup>. Furthermore, among adults, work stress has been associated with increased levels of obesogenic habits such as poor diet <sup>92</sup> and low physical activity <sup>93,94</sup>, and increased risk of weight gain, abdominal obesity <sup>95</sup>, and metabolic syndrome

<sup>96</sup>. However, the relationship between work stress and weight gain are not fully understood and mechanistic processes must be elucidated <sup>97</sup>.

The theoretical Demand-Control (DC) model endeavors to explain occupational stress with two main components, job demands and job control (decision latitude) <sup>70,71</sup>. Job demands are the mental workload and arousal needed to carry out a job task <sup>98</sup> and decision latitude represents an employee's autonomy in making decisions on the job (decision authority) and the extent of skills used by the employee on the job (skill discretion) <sup>73</sup>. The DC model hypothesizes that job strain results from the combination of high job demands and low decision latitude, increasing the risk of psychosomatic health problems and exhaustion <sup>74</sup>. The consequence of occupational stress is the inability to cope with the challenges of the work, which may lead to physiological and emotional reactions and serve as pathways of physical and mental health disorders <sup>75</sup>.

Occupational factors related to corrections make this occupation one characterized by high job demands and low job control <sup>99</sup>, putting employees at high risk of job stress and associated adverse consequences.

Compared to the general U.S. population, correctional employees have higher rates of overweight (86.6% vs. 66%) and obesity (55.8% vs. 32%) <sup>58</sup> and higher rates of chronic disease when compared to employees in other occupations (myocardial infarctions, high blood pressure, diabetes, asthma, and ulcers) <sup>59</sup>. Correctional employees are exposed to exceptional workplace stresses <sup>61</sup>. Sources include contact with incarcerated inmates, personal safety concerns, hierarchical organization, and extended and unpredictable work hours <sup>62-66</sup>. Correctional employees have shown elevated prevalence of depression <sup>68</sup>, poor work-family balance, perceived shortened life

expectancy, and high rates of suicide <sup>69</sup>. Correctional employees also report poor health behaviors including poor diet, snacking on low nutrient foods <sup>60</sup>, low physical activity, sedentary behaviors, and poor sleep patterns <sup>57</sup>.

The high rates of overweight and obesity in corrections indicate a need for highly effective workplace health promotion programs <sup>58,100</sup>. Traditionally, workplace health promotion programs have a narrow focus of changing individual's lifestyle behaviors off-the job (e.g. diet, exercise). The National Institute for Occupational Safety and Health (NIOSH) Total Worker Health (TWH) Initiative recognizes the need to integrate occupational health and safety efforts with workplace health promotion, noting that health interventions should have a comprehensive view of employee risk profiles (behavioral/mental/physical health) rather than compartmentalized approaches. The sponsoring organization for this study, the Center for the Promotion of Health in the New England Workplace (CPH-NEW), (<http://oehc.uchc.edu/healthywork/index.asp>) is a NIOSH TWH Center and endorses the principle that effective programs require addressing other work and organizational factors and barriers to practicing healthy behaviors <sup>13</sup>.

The theory driven multivariate analysis for understanding predictors of obesity is stimulated by a literature that is dominated by approaches that test a single or few predictive variables <sup>101-103</sup>, which may not provide a comprehensive and multifactorial view. Consequently, development and evaluation of theory-driven, multivariate statistical models are useful for better understanding of obesity and for developing effective interventions. Behavioral researchers can utilize available and more advanced



statistical techniques to establish mediation effects of factors contributing to obesity in high stress workplaces<sup>104-106</sup>.

A comprehensive theoretical model entitled: the Psychological Health, Behavior, and Bodyweight (PBBW) model is proposed for statistical confirmation. We tested the PBBW model on data collected from a sample of correctional employees. The determinants of bodyweight identified by the PBW model (psychological health, health behaviors, stress) were used in a series of structural equation model (SEM) tests to evaluate the fit of the PBBW model to the correctional employee sample data and to determine if the proposed mediations predict bodyweight. Although relationships between psychological health, health behaviors, and obesity may be bi-directional, the purpose of this model is to test the theory that psychological health impacts health behaviors and ultimately bodyweight.

## **2.3 METHODS:**

### **2.3.1 Design:**

This was a cross-sectional observational study.

### **2.3.2 Participants:**

The study setting was two correction facilities in the same Northeastern State, matched on inmate population, security level, size, and workforce demographics. Participation was voluntary and open to all employees of the two facilities. All participants were required to sign a consent form approved by the Institutional Review Board (IRB). Analyses were done on individuals who completed a comprehensive self-reported

Health Risk Assessment (HRA) survey, an extended organizational and individual health survey, and underwent physical testing (n=317).

### 2.3.3 Procedure:

Cross sectional physical and survey assessments were conducted to better understand correctional employee health and safety. Research began with engagement of line officers and supervisor union leadership. Following this Department of Corrections administration including wardens and deputy wardens were contacted. After one year of preparation and engagement with such individuals survey and physicals were conducted to initiate a multi-year intervention.

Researchers received extensive assistance from DOC employees and supervisors to schedule visits during working hours and determine a location within the facility for physical assessment and survey data collections. All assessments were conducted in private space protected from inmate or other employee scrutiny. Advertisements were provided (flyers, roll call announcements) and a \$25 financial incentive was administered for each assessment (survey and physical) to increase participation. A team of researchers spent approximately two months at each correctional facility collecting surveys and physical assessment data.

### 2.3.4 Measurements:

Self reported data from two surveys and research staff conducted physical assessments were utilized. All self-reported survey items used are listed in Table 1. These survey items were used to create latent construct variables (Please see Data Analysis for

explanation of latent constructs).

**Table 1:** Survey Items from Self-Report Surveys (HRA and CES-D)

Construct	Survey Item	Scale & Changes Made <sup>3</sup>
<b>Diet Quality<sup>1</sup></b>		
Breakfast	How often do you eat breakfast, more than just a roll and a cup of coffee?	1= every day 4=seldom or never <i>Reverse coded</i>
Snacks	How often do you eat snack foods between meals (chips, pastries, soft drinks, candy, ice cream, cookies)?	1= three or more times/day 4= seldom or never
Salt	How often do you add salt to your foods or eat salty foods (chips, pickles, soy sauce)?	1= seldom or never 4= nearly every meal <i>Reverse coded</i>
Fat Intake	Indicate the kinds of foods you usually eat (high fat and low fat examples)	1= nearly always eat high fat 4= eat mostly low fat ( <i>collapse numbers 4 and 5</i> )
Breads and Grains	Indicate the kinds of breads and grains you usually eat (refined and whole grain examples)	1= nearly always eat refined 4= eat primarily whole <i>Collapse numbers 4 and 5</i>
Fruits and Vegetables	How many servings of fruits and vegetables do you eat daily?	1=1 or less 4=4 or more <i>Collapse numbers 4 and 5</i>
<b>Exercise Quality<sup>1</sup></b>		
Exercise	How many days per week do you engage in aerobic exercise of at least 20 to 30 minutes duration (fitness walking, cycling, jogging, swimming, aerobic dance, active sports)?	1=none 7=seven <i>Collapse into 4 categories: (None, 1-2, 3-4, 5+)</i>
Strength Exercise	How many times per week do you do strength-building exercises such as sit-ups, pushups, or use weight training equipment?	1=none 4=3 or more
Stretching Exercise	How many times per week do you do stretching exercises to improve flexibility of your back, neck, shoulders, and legs?	1=none 4=3 or more
<b>Overall Mood<sup>1</sup></b>		
	How much of the time during the past four weeks... Have you felt calm and peaceful Did you have a lot of energy Have you felt downhearted/blue	1= none of the time 6= all of the time   <i>Reverse coded</i>

**Stress<sup>1</sup>**

Have you been a happy person  
Have you felt worthless,  
inadequate, or unimportant  
Did you take the time to relax  
and have fun daily

Reverse coded

0=no

1=yes

Minor problems throw you for  
a loop  
You find it difficult to get  
along with people you used to  
enjoy  
Nothing seems to give you  
pleasure anymore  
Feel frustrated, impatient, or  
angry much of the time  
Feel tense or anxious much of  
the time

**Depression<sup>2</sup>**

1=rarely or none of the time

4= all of the time

I was bothered by things that  
usually don't bother me  
I had trouble keeping my mind  
on what I was doing  
I felt depressed  
I felt that everything I did was  
an effort  
I felt hopeful about the future  
I felt fearful  
My sleep was restless  
I felt happy  
I felt lonely  
I could not "get going"

Reverse coded

Reverse coded

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<sup>1</sup> HRA <sup>107</sup>

<sup>2</sup> CES-D Scale <sup>3</sup>

<sup>3</sup> Changes Made: changes to variable scales enabling use as latent variables (Please see Procedure for data cleaning for more detail)

***Weight Measures:***

Height and weight were measured. A calibrated Seca 700 physician balance beam scale was used to measure weight to the nearest 0.1 kg and height was measured to the nearest mm. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared and categorized <sup>108</sup>.

#### *HRA:*

The Personal Wellness Profile™, Health Risk Assessment (HRA) <sup>107</sup> which is a 39 question survey assessing participants' self-reported weight, physical activity, nutrition, overall mood, stress, safety, substance use, chronic disease, overall health, health history, and readiness to change was utilized for the study. This HRA is a commonly used tool for use in workplace wellness programs and has been certified by the National Committee for Quality Assurance <sup>109</sup>. Additionally, participants completed an extended organizational and individual health survey. From this survey a subsection containing a 10-item survey from the Center for Epidemiological Studies Depression Scale (CES-D) <sup>3</sup> was used to assess depression level.

#### *Health Behaviors:*

*Diet quality* was based on 6 HRA survey items on 4- or 5-point Likert scales, with 5 points compressed to 4 items for normalization. Survey items assessed food consumption category and frequency (daily consumption of fruits and vegetables, breads/grains, fat, snacking, added salts, and frequency of eating breakfast). Responses could range from 'almost never make the healthier choice' (1) to 'almost always make the healthier choice' (4). Higher diet quality score indicated better overall diet quality.

*Exercise quality* was assessed with 3 survey items, each having a 4-point Likert scale. Questions asked frequency of weekly engagement in aerobic exercise, strength-building exercises, and stretching exercises. Again, multi-item responses in the HRA were compressed to four items. High scores represented better exercise quality.

*Stress:*

*Overall stress* was assessed with 6 HRA items each providing for a “yes” or “no” response. Questions assess presence of stress signals and resemble those on the General Health Questionnaire (GHQ)<sup>2</sup>. Higher scores indicate higher reported stress levels.

*Psychological health:*

Two variables were assessed to represent psychological health: *overall mood* and *depression*. The *overall mood* variable was created from 6 HRA survey items each relying on a 6-point Likert scale. Questions resemble the psychological health profile of the SF-12<sup>4</sup>. Answers range from ‘none of the time’ (1) to ‘all of the time’ (6), with higher score representing more a positive mood.

*Depression* was based on 10 Center for Epidemiological Studies Depression Scale (CES-D) survey items, each question having a 4–point Likert scale assessing frequency and severity of feelings to assess depression risk<sup>3</sup>. Answers range from ‘rarely’ or ‘none of the time’ (1) to ‘all of the time’ (4), with a higher score representing more depression.

### 2.3.5 Data Analysis

Health Risk Assessments were scanned using the Wellsource Inc. Data Processing Package<sup>107</sup>. Data from the HRA, CES-D, and physical assessments were transferred to

Microsoft Excel, and IBM SPSS™ version 21.0 software <sup>110</sup> for analysis. Descriptive statistics were developed for all variables. All analyses were conducted on dependent variables with and without outliers for sensitivity analysis purposes (assessed as  $\pm 3$  SD away from the mean). Normality of all dependent variables was assessed and confirmed using visual assessment of quartile probability plots and histograms. All binary variables were coded as 0 and 1 to allow for regression in path analyses. Variables were reverse coded if needed. Multiple indicators for diet and exercise quality were collapsed into a smaller number of categories so they could be used in latent variable analyses. Prior to collapsing categories chi-square analyses were performed to ensure there was no variability in outcome between the categories being collapsed.

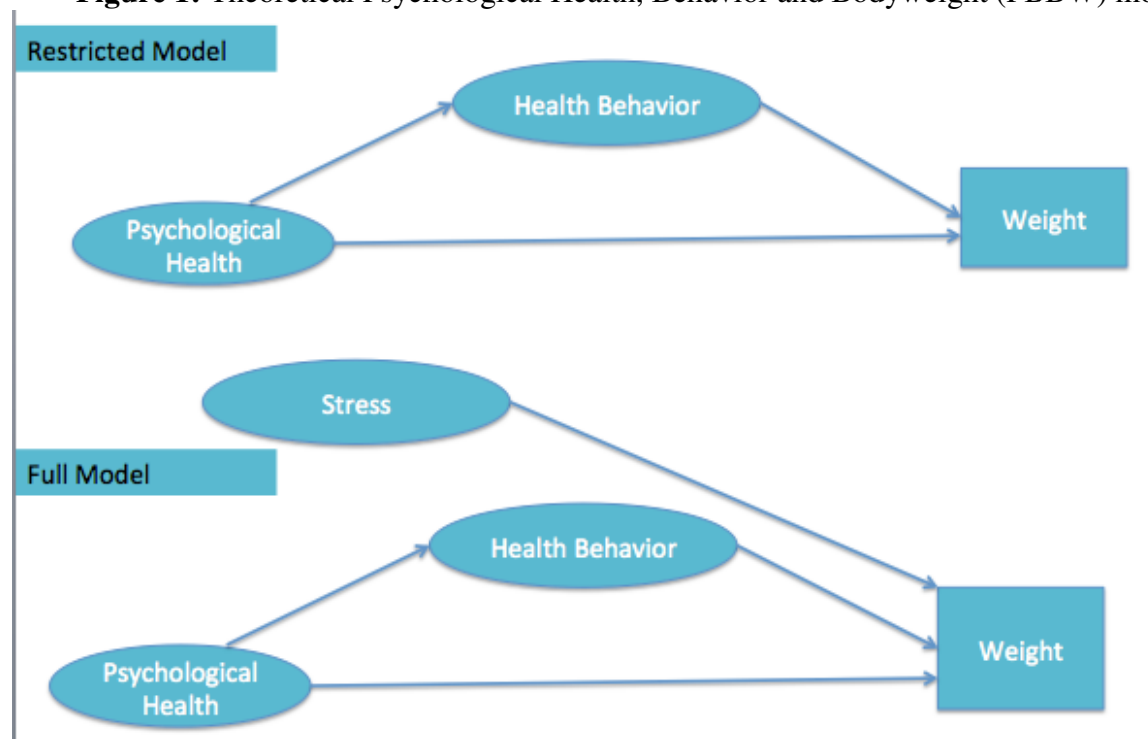
#### *Model Testing:*

The Psychological Health, Health Behavior, Bodyweight (PBBW) model is a structural model with latent variables (Figure 1). The latent variables in this analysis were: depression, overall mood, diet quality, exercise quality, and stress. Each latent variable has multiple directly measured observable variables (individual survey items) that serve as indicators of the latent variable construct. Structural equation modeling (SEM) was used to examine associations between latent constructs and the principle dependent variable -- body mass index (BMI).

As indicated in Figure 1, the PBBW model identifies psychological health, health behaviors, and stress as determinants of bodyweight. Psychological health encompasses an individual's self-reported emotional state. In this study both overall mood and depression were used to represent psychological health. For the purpose of the PBBW model, health behaviors are those behaviors that are hypothesized to be

influenced by psychological health and to affect bodyweight. In this study diet and exercise quality were used to represent health behaviors. Bodyweight, in the model is a simple outcome, with the presumption that the direct health behavioral cause (diet and exercise) is affected by psychological health. These three factors (psychological health, health behavior, and bodyweight) represent the restricted PBBW model. A full model, with the addition of stress as a moderator of bodyweight, is also theorized. Stress is an assessment of self-reported stress signals. This study tested if adding stress to the model (full model) better predicts bodyweight.

**Figure 1:** Theoretical Psychological Health, Behavior and Bodyweight (PBBW) model



As illustrated in Figure 1 the PBBW model predicts that better diet and exercise quality will result in reduced bodyweight and that poorer diet and exercise quality will result in



higher bodyweight. We further hypothesize that the model expands on a single explanatory factor approach, by proposing an indirect relationship between psychological health and bodyweight, in which psychological health effects bodyweight through the mechanism of health behaviors. The assumption is that health behaviors will mediate the relationship between psychological health and bodyweight and the direct path between psychological health to bodyweight will be insignificant. Correspondingly, an individual with poorer psychological health scores will have a higher bodyweight, as their health behavior quality is reduced. Thus, the PBBW model is a comprehensive, multivariate, theory-based approach to conceptualizing predictors of bodyweight.

#### *Latent Variables and Structural Equation Models:*

In this analysis structural equation modeling (SEM) was used to examine the hypothetical PBBW model on this dataset. Latent variable approach using structural equation modeling is based on work by Joreskog, Keesling, and Wiley <sup>111-113</sup> and has been widely promoted by Bentler, Bollen, and Muthen <sup>114-118</sup>. After assessing data for normality, a 2-step process begins, as explained by Buhi (2007). In step 1 a measurement model is used to assess latent variables; constructs not measured directly but represented by representative scales (survey items). Step 2 involves testing structural models to examine the underlying relationships between the latent constructs tested in the measurement model and other (observed) variables proposed by the theory. The rationale for using latent constructs is their ability to capture measurement error and explain constructs that cannot be directly measured <sup>119</sup>. How well the survey

items (indicators) measure the latent constructs is assessed by the shared variance from correlations/covariance among multiple survey items (indicators)<sup>120</sup>. Structural models account for the direct, indirect, and total effects among factors<sup>121</sup>.

Following step 1 of the SEM process, latent variables were built to create the measurement part of a structural equation model used to test the PBBW model. All analyses for latent variables and structural models were conducted using Mplus version 7.11<sup>122</sup>. All measurement and structural models were assessed for model fit. Model fit determines the degree to which the structural model fits the sample data by assessing how well the model reproduces the observed covariance matrix (how similar the model-implied covariance matrix is to the empirical covariance matrix)<sup>123</sup>. Model fit was assessed via the root mean square error of approximation (RMSEA)<sup>124</sup>, the comparative fit index (CFI), and the Tucker Lewis index (TLI)<sup>125</sup>. These indexes assess how well the hypothesized model fits with the observed data and calculates the rejection rates for specific models. Cut-offs used were 0.06 for RMSEA, 0.95 for CFI, and 0.95 for TLI<sup>126</sup>. Decision to include indicators for latent variables was made by assessing their factor loads, p-value for significance, and model fit indexes. Latent variable modifications were made (e.g. remove indicators, covary errors among indicators) to find the latent variable with the best model fit to be used for analyses.

Finally, step 2 involved structural equation model testing to evaluate the hypothesized PBBW model (structural relationships between stress, psychological health, health behaviors, and BMI) (Figure 1). Model fit indices (chi-square), which account for model complexity, were assessed to compare the restricted model (containing only psychological health, health behavior, and BMI) and full model (additionally containing

stress) to determine which competing model structure might offer a better explanation of the data. A significant chi-square value signifies that the full model fits better to the data. A non-significant chi-square value indicates both models have equal fit, therefore the restricted model should be accepted for being more parsimonious<sup>116,123</sup>. Four good-fitting models that support the PBW model are discussed below.

## **2.4 RESULTS:**

### *Participant Characteristics:*

Gender distribution was unequal with a greater percentage of males (72.6%) than females, although the proportions accurately depict the corrections workforce. A majority of participants were white (80.4%). A majority had either graduated high school (67%) or graduated college (32.7%). More than three-quarters (76.5 %), were correctional staff with the remainder support staff (23.5%). 59.4% worked first shift, 29.2% worked second shift, and 11.4% worked third shift. Average tenure was  $13.17 \pm 9.69$ . Only 12% of participants were in the normal weight range, the majority being overweight or obese with an average BMI of  $30.62 \pm 5.51$  (Grade I obese) and average body weight of  $204.25 \pm 46.47$  pounds.

### *Latent Variable Factor Analysis:*

All latent variables and indicators are depicted in Table 2. When model fit was not adequate (see Data Analysis), modification indices were used until adequate fit was

obtained. Table 3 illustrates model fit and steps used to improve model fit for all latent variables.

**Table 2:** Latent variables and survey item indicators

Latent Variable	Indicator	Standard Estimate	p-value
<i>Health Habits</i>			
Diet Quality <sup>1</sup>	Snacks	0.332	0.000**
	Breads/grains	0.606	0.000**
	Fruits/Vegetables	0.428	0.000**
	Fat intake	0.782	0.000**
Exercise Quality <sup>1</sup>	Stretching	0.784	0.000**
	Strength Exercise	0.907	0.000**
	Aerobic Exercise	0.753	0.000**
	Stress <sup>1</sup>	0.121	0.000**
Stress <sup>1</sup>	Difficult to get along with people I used to	0.138	0.000**
	Nothing gives me pleasure anymore	0.153	0.000**
	I can't stop thinking about my problems	0.190	0.000**
	I feel angry much of the time	0.223	0.000**
Mood <sup>1</sup>	I feel tense/anxious much of the time	0.853	0.000**
	Energy	1.002	0.000**
	Relaxed	0.986	0.000**
	Calm & peaceful	0.984	0.000**
Depression <sup>2</sup>	Happy	0.984	0.000**
	Downhearted & Blue	0.687	0.000**
	Worthless	0.384	0.000**
	Bothered by things that don't usually bother me	0.602	0.000**
Depression <sup>2</sup>	Trouble keeping my mind on what I was doing	0.499	0.000**
	Felt depressed	0.555	0.000**
	Felt everything was an effort	0.478	0.000**
	Felt hopeful about the future	0.242	0.000**
Depression <sup>2</sup>	Felt fearful	0.334	0.000**
	Sleep was restless	0.520	0.000**
	Happy	0.435	0.000**
	Lonely	0.386	0.000**
Depression <sup>2</sup>	Could not "get going"	0.386	0.000**

\*p<0.05.; \*\*p<0.01.; <sup>1</sup> HRA ; <sup>2</sup> CES-D Scale <sup>3</sup>

**Table 3** Latent Variable Model Fit with comparison of model fit before and after improvements were made

	Number of Indicators	X <sup>2</sup> P- value	RMSEA	CFI	TLI	Changes to improve model fit
Diet Quality	<b>6</b>	0.007	0.069	0.950	0.917	
Diet Quality (final)	<b>4</b>	0.280	0.029	0.997	0.992	Remove indicators
Exercise Quality (final) <sup>1</sup>	<b>3</b>	0.000	0.000	1.000	1.000	
Stress	<b>6</b>	0.042	0.055	0.940	0.900	
Stress (final)	<b>5</b>	0.361	0.017	0.996	0.993	Remove indicator
Overall Mood	<b>6</b>	0.000	0.137	0.926	0.877	
Overall Mood (final)	<b>6</b>	0.173	0.038	0.995	0.990	Covary indicators
Depression	<b>10</b>	0.000	0.073	0.923	0.901	
Depression (final)	<b>10</b>	0.011	0.045	0.972	0.962	Covary indicators

<sup>1</sup> Just identified models do not have accurate model fit information and modifications were not possible.

After assessing model fit, 2 of the 6 diet items (eating breakfast and salt intake) were not effective in the latent variable model and therefore were removed. All three variables associated with exercise quality fit the model. Ultimately, 5 of the 6 stress items were included with the statement “minor things throw me for a loop” not being meaningful. Overall mood variable was indicated by all six indicators, and depression was indicated by all 10 indicators with good model fit criteria.

#### *Structural Equation Model: Psychological Health-Health Behavior-Bodyweight (PBBW) Model:*

Four examples of models to assess the theoretical PBBW model were tested (substituting overall mood and depression & substituting diet quality and exercise

quality). Model fit criteria for all models with both full and restricted model results are listed in Table 4. One example model with its factor loading (regression coefficient) and associated p-values are represented in Figure 2. For all models tested model fit was adequate (criteria discussed in data analysis section) with both psychological health variables and both health behavior variables fitting into the model. The PBW model was first assessed as a restricted model containing three variables: psychological health, health behavior, BMI, and not stress. The mediated structural hypothesis of the PBBW model was supported, showing significant indirect effects. Psychological health related significantly to health behaviors but did not directly relate to BMI at the specified level of significance. Furthermore, health behaviors significantly and negatively predicted BMI. Results were consistent with the hypothesis that psychological health indirectly affects BMI through health behaviors. For example, better mood significantly predicted better diet quality, resulting in lower BMI (indirect effect:  $p = 0.0013$ ). Good model fit and statistically significant indirect effects were found in all models.

Next, the PBBW model was assessed as a full model containing all four variables; psychological health, health behavior, BMI *and stress*. The full models also demonstrated good fit to the sample data and indirect effect (mediation) by health behaviors. Chi-square difference testing was done to evaluate if the full model (containing stress) or restricted model (without stress) better explained BMI, as previously presented in the section on Statistical Analysis. For both models, when overall mood was used as the psychological health latent variable, the addition of stress explained BMI better than the restricted model alone ( $\Delta \chi^2$  chi-square difference:

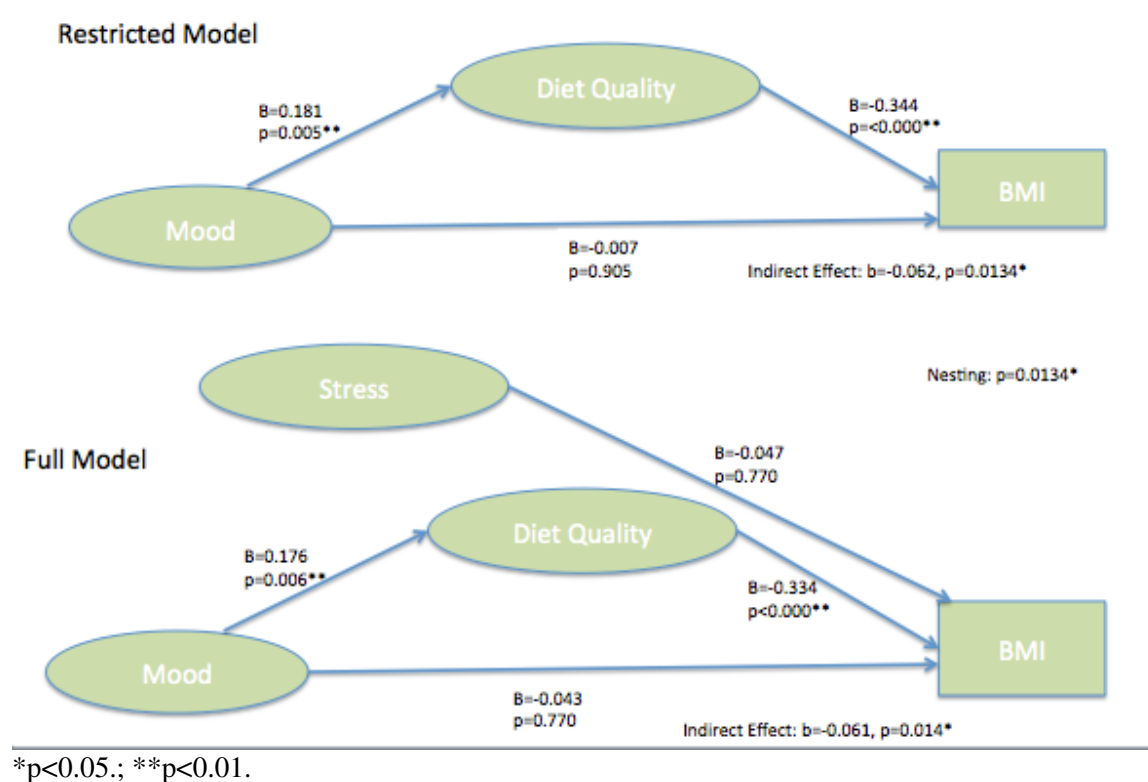
52.76.51/130.78,  $p=0.0134$  and 62.16/146.05,  $p=0.0013$ ). When substituting depression as the latent variable of psychological health, chi-square difference tests only approached significance ( $\Delta \chi^2$  chi-square difference: 125.12/229.77,  $p=0.0573$  and 97.44/199.34,  $p=0.0836$ ). Lack of statistical significance suggests that both the full and restricted model explain the same amount of variance in predicting BMI. Since the PBBW model appears to work with or without the inclusion of stress as a direct effector on BMI, parsimony would suggest its exclusion.

**Table 4:** Structural Model Fit Indices and Indirect Effects

Model		RMSEA	CFI	TLI	X2	X2 p-value	Indirect Effect P-value	Nesting (p-value)
Mood-DQ-BMI	Restricted	0.035	0.984	0.978	55.514	0.0523	0.013*	0.0134*
	Full	0.039	0.963	0.955	144.807	0.0015	0.010*	
Mood-EQ-BMI	Restricted	0.058	0.966	0.95	60.260	0.0013	0.005**	0.0014**
	Full	0.054	0.94	0.925	154.907	0.0000	0.006**	
Depression-DQ-BMI	Restricted	0.043	0.952	0.941	136.080	0.0005	0.023*	0.0836
	Full	0.042	0.933	0.922	255.201	0.0000	0.026*	
Depression-EQ-BMI	Restricted	0.036	0.969	0.962	103.254	0.0114	0.029*	0.0573
	Full	0.04	0.944	0.935	218.897	0.0001	0.034*	

DQ=Diet Quality, EQ=Exercise Quality; \* $p<0.05$ .; \*\* $p<0.01$ .

**Figure 2:** PBBW model with the variables: overall mood, diet quality, and BMI



## 2.5 DISCUSSION:

This research proposed and tested a novel theoretically driven statistical model; the Psychological Health, Health Behavior, Bodyweight (PBBW) model (Figure 1). This model was developed based on previous research linking psychological health, health behaviors, and bodyweight. To our knowledge, the PBBW makes a unique contribution by interrelating all of the aforementioned factors in a comprehensive model. The PBBW model hypothesizes that good overall mood and low rates of depression are critical for good health behavior and maintaining a normal bodyweight. Furthermore, the results support the presumption that the relationship between psychological health measures and bodyweight is mediated by health behavior (e.g. diet and exercise quality). A second hypothesis in the PBBW model was that high stress negatively impacts bodyweight, assuming an individual with poor psychological health and/or high stress



will have more difficulty practicing healthy behaviors and maintaining a healthy bodyweight. This is a situation often reported in occupational stress research

12,92,93,127,128 .

Overall the analysis of the PBBW model on this dataset of correctional employees suggested that psychological health plays a role in effecting health behaviors (diet and exercise quality) and ultimately BMI. The restricted model showed that higher depression and more negative overall mood was negatively associated with health behavior quality (poorer diet and exercise quality), and that health behaviors were in turn negatively related to body mass index (BMI). The direct relationship between psychological health and BMI were non-significant as was hypothesized. The full model (incorporating stress's effect on BMI) provided additional information. When overall mood (rather than depression) is used to represent psychological health, the addition of stress explained more variation in BMI than the restricted model alone. When using depression rather than mood to represent psychological health, the addition of stress was not significant and the restricted model was more parsimonious. A possible explanation for stress's non-significance impact when using depression may be the overlap in survey items between the three different surveys (mood, depression, and stress). Overall, both the restricted and full PBBW were supported with different variables used. Future investigations of this model with other datasets should considered testing both the restricted and full model to find the most appropriate and informative model.

We found that correctional employees are heavier than the general population, based on BMI 12.3% of participants were normal weight, 37.9% were overweight, and 49.8%

were obese. In comparison data from the National Health and Nutrition Examination Survey (NHANES), of the US population 31.2% are normal weight, 33.1% are overweight, and 35.7% are obese <sup>83</sup>. This fact appears to confirm the observation that epidemic overweight/obesity in the U.S. is worse in high stress workplaces such as corrections <sup>57,58</sup>, first responders <sup>129</sup>, and police <sup>130</sup>.

Currently, approaches to preventing obesity in general, and specifically in high stress occupations, appear to be inadequate. A deeper and more comprehensive understanding of the behavioral, emotional, and physical factors that influence obesity would seem essential for vulnerable workforces. Results from this empirical test of the PBBW model suggests that health behaviors (e.g. diet and exercise) affect obesity, an observation that has been well established in previous research <sup>13</sup>. For example, one weight loss intervention with correctional employees found nutrition knowledge and exercise confidence (preconditions for behavior change <sup>131</sup>) predicted 73% of the variation in weight change and 68% of the variation in waist circumference change <sup>58</sup>. Additionally, Faghri (2012) found an educational approach to nutrition and physical activity effectively increased healthy behaviors and resulted in significant weight loss among correctional employees <sup>100</sup>. Although individual health behaviors involving exercise and nutrition affect obesity, it is unlikely that obesity in vulnerable occupations can be addressed by encouraging individual lifestyle change alone. Unfortunately, individual lifestyle change has been the traditional workplace health promotion focus to address obesity <sup>13</sup> and this may be a reason for the limited success of long-term behavior change interventions for weight loss <sup>51</sup>.

Literature on the negative effects of job stress is compelling. One researcher noted that workplace stress might be as bad for the heart as smoking and elevated cholesterol <sup>132</sup>. Work stress has also been related to reduced leisure time activity, obesity, and tobacco and alcohol consumption and has been recognized as detrimental to health and well-being <sup>127,133-135</sup>. As NIOSH and the CDC have observed, health risks from job stress arise when there is a discrepancy between job demand and a worker's ability to control their work process because of environmental, organizational and behavioral barriers. High work demands coupled with low decision latitude, a characteristic of corrections work <sup>99</sup>, may result in high levels of job strain, which has been associated with increased risk of coronary disease <sup>136,137</sup>. A study by Kouvonen (2007) found that among Finish public sector employees, job strain was associated with co-occurrence of adverse health behaviors (smoking, heavy drinking, obesity, and low physical activity) that contributed to preventable chronic diseases <sup>138,139</sup>. A cross-sectional study by Barrington (2012) had similar findings, with higher reported stress being associated with lower levels of eating awareness, physical activity, and walking. Interestingly, McCarty (2009) found that employees reporting high stress had 46% higher health care costs compared to employees reporting lower levels of stress, reporting that the negative health outcomes associated with job related stress and the associated costs make addressing employee stress a large priority <sup>61</sup>. In our study, although the proposed PBBW model did not have sufficient power to show a statistical effect of stress on bodyweight, the full model explained more variance than the restricted model. A possible reason for insignificant findings may be limitations in the survey items utilized. This suggests that using other indicators of psychological function and mental health in

addition to survey items is important to further understand the impact that stress has on health outcomes.

Additionally, the PBBW model found significant relationships between psychological health and health behaviors. Previous research has had similar findings <sup>42-44</sup>. Mood can alter food choice <sup>140</sup>, with a positive relationship between negative mood and increased eating <sup>43</sup>. Negative mood states result in altered food preferences for highly-palatable foods and disinhibiting effects on eating <sup>141</sup>. Obese individuals with negative mood affect have increased vulnerability to overeating, suggesting that an individual's mood influences their ability to resist eating, with those characterized with negative affect having a harder time resisting dietary temptations <sup>142</sup>. In addition, depressive symptoms have been related to lower levels of physical activity, lower self-efficacy for physical activity <sup>143-145</sup>, and poorer dietary habits <sup>91,146</sup>. One explanation may be that individuals with poor health behaviors are expressing adaptation or a coping response to stressors <sup>147</sup>. Finally, Ferrer (2011) conducted research on emotions and decision-making and found that emotions likely play a critical role in obesity-related behaviors, yet are rarely addressed in behavior change attempts. Therefore, emotional education interventions may be useful in addressing obesity-related behaviors <sup>148</sup>.

In the PBBW model, after controlling for mediation by health behaviors, there was no significant direct relationship between psychological health and BMI. There was a significant indirect relationship, suggesting that psychological health may affect BMI by altering health behaviors. Multiple meta-analyses have recognized that depression and depressive symptoms are positively related to obesity <sup>50,52,55,56</sup>. A longitudinal study reported that adolescent girls with depressive symptoms in early adolescence (age 11-

14) had five times the likelihood of being obese four years later <sup>149</sup>. Interestingly, employees reporting poor emotional health have elevated health care cost compared to employees without poor emotional health (70% higher for those reporting depression, 147% higher for those reporting psychosocial problems) <sup>133</sup>. One possible mechanism has been proposed in a meta-analysis by Faith (2002) suggesting that health behaviors serve as a causal link, where psychological factors are related to physical activity and eating habits, which in turn effect weight gain <sup>90</sup>. A study by Beydoun (2010) also suggests that exercise serves as a mediator between the depression and obesity link in women <sup>150</sup>. Both studies' findings correspond well with the hypothesized PBBW model.

Although previous research has noted a relationships between stress, psychological health, heath behaviors, and bodyweight, and has proposed a mediating effect of health behaviors between the psychological health→ bodyweight link, to our knowledge no such empirical test has been conducted. Therefore, the PBBW is the first empirically tested, theoretically backed model to explain these relationships. In a similar study, Knottinen (2010) assessed mechanisms in which depression affects obesity <sup>41</sup>. They concluded that higher rates of depression were related to higher tendency to eat during negative emotions and lower self-efficacy in continuing physical activity when facing barriers.

Overall, our findings suggest psychological health affects diet and exercise quality, which ultimately effects bodyweight. Therefore, an individual with poor psychological health (e.g. depression) may understand the need to make healthy behaviors however their psychological health has strong effect on their health behavior decision making, preventing the individual's from making healthy decisions.

### *Limitations:*

This study has several limitations. Although height and weight were measured by trained staff, other variables were based on self-report which tends to results in either over or under reporting of health behaviors<sup>151</sup> and in corrections, underreporting of stress/emotional problems has been noticed<sup>61</sup>. Additionally, the psychological health and stress survey items had similarities and overlaps in content and this may be contributing to insignificant findings. Typically the survey items used represent overall stress, depression, and mood. In the present study we assumed that as employees spend significant amount to their waking hours at work (almost 2/3 of waking hours), and since they completed these survey at work, these items should illustrate stress and psychological health as a result of employment as well. It is argued that due to the large amount of hours spent in the workplace, the environment and experiences at work are a large contributor of an employees overall stress, depression, and mood, therefore these survey items are considered as adequate to represent employee stress and psychological health. In addition, all participation was voluntary; therefore our sample may not fully represent the population of correctional employees, however demographic data supports our sample as a good overall picture of the true population. The cross-sectional study design only allows for exploring associations, therefore direction and causality cannot be determined. Although poor psychological health may effect diet and exercise quality, the reverse association may also occur as research has provided evidence for a bidirectional association between depression and obesity<sup>55,56,91</sup>. Longitudinal studies will need to examine reverse effects and causality Nonetheless, the strengths of this research in addressing a high priority population and utilizing advanced statistical techniques to explore relationships offers good insight to the research

community. Although the PBBW model was supported, it may not be applicable to all individuals; therefore further variables representing individual characteristics should be tested as moderators in the model (e.g. sex, age, tenure, job category, eating awareness) and apply the PBBW model to other populations utilizing different measures of psychological health and health behaviors.

## **2.6 CONCLUSION:**

The identification of vital determinants of bodyweight and how these factors interrelate to affect health behavior is critical to develop effective interventions. This model suggests that psychological health and stress are important when considering health behaviors and weight status. Obesity interventions should consider the effects of psychological health and stress on health behaviors, especially in populations with poor psychological health and high levels of stress (e.g. correctional employees). Moreover, health promotion professionals should be educated on the links between psychological health and health behaviors and should pay close attention to health behaviors of employees working in high stress occupations. These issues likely concern other occupations, especially those in high stress work environments.

The proposed PBBW model provides a more comprehensive view of associations that have been tested separately. Adequate model fit with the use of multiple latent variable combinations; psychological health (mood and depression) and health behaviors (diet and exercise quality), suggests the robustness of this model. It is plausible this model could be used on additional data sets that utilize similar variables in place of psychological health and health behaviors. The model appears to work with or without

the inclusion of stress's effect on BMI. Therefore, the model could be used whether or not the theoretical question involves stress. For further validation, the PBBW model should be tested on additional datasets using parallel measures and should be evaluated for its ability to produce effective weight management interventions.

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## **Psychological Health and Overweight and Obesity Among Correctional Employees**

### **3.1 ABSTRACT**

*Correctional employees are recognized to underreport stress and stress symptoms and are known to have a culture that discourages appearing “weak” and seeking psychiatric help. This study assesses for underreporting of stress and emotions. Additionally, it evaluates the relationships between stress and emotions on health behaviors.*

*Correctional employees (n=317) completed physical assessments and self-report surveys that measured body mass index (BMI), perceived stress, emotions, and health behavior (diet, exercise, and sleep quality). Stress and emotions survey items were evaluated for under-reporting via skewness, kurtosis, and visual assessment of histograms. Structural equation modeling evaluated the relationships between stress/emotion and health behaviors. Responses to stress and negatively worded emotions were non-normally distributed where as responses to positively-worded emotions were normally distributed. Emotion predicted diet, exercise, and sleep quality where as stress predicted only sleep quality. As stress was a poor predictor of health behaviors and responses to stress and negatively worded emotions were non-normally distributed it suggests correctional employees are under-reporting stress and negative emotions.*

*Key words: Stress, Emotion, Health Behavior, Correctional Employees, Structural Equation Modeling*

### 3.2 INTRODUCTION

Almost 69% of U.S. adults are considered overweight or obese<sup>1</sup>. Obesity predicts increased risks of morbidity and mortality<sup>2-5</sup> and elevated medical costs<sup>6</sup>. Health behaviors have been identified as key determinants of bodyweight (e.g. diet and exercise)<sup>5,7-9</sup>. Stress and poor psychological health such as negative emotions, depression, and anxiety may also be risk factors for obesity by promoting poor health behaviors. Emotional characteristics have been related to both bodyweight and health behaviors. For example, multiple studies suggest that negative emotions (e.g. negative mood) may negatively affect eating patterns<sup>10-12</sup>. In addition, elevated stress is related to poor sleep quality and duration<sup>13</sup>. Furthermore, poor sleep quality has been related to psychosocial health including negative mood state<sup>90</sup>, depression<sup>14</sup>, anger, hostility, and aggression<sup>15-17</sup>.

Work stress also has been associated with unhealthy lifestyle behaviors such as poor dietary practices<sup>18</sup> and low levels of physical activity<sup>19,20</sup>, thus contributing to weight gain, abdominal obesity,<sup>21,22</sup> and metabolic syndrome<sup>23</sup>. Chronic work stress has serious adverse implications on employee health and well-being<sup>24-27</sup> and has been significantly associated with rises in plasma cortisol level, coronary heart disease<sup>25</sup>, high blood pressure, high blood sugar<sup>28</sup>, and psychological issues such as anxiety and depression<sup>29-32</sup>. Furthermore, occupations characterized with high job strain (high work demands and low decision control) have been associated with increased risk of depressive symptoms, and those characterized with high job strain coupled with low social support are associated with psychological distress, job dissatisfaction, and negative emotions<sup>31,33</sup>. Additionally, chronic psychological distress and negative work experiences may negatively impact an individual's personality, resulting in a persistently negative outlook<sup>34</sup>.

Correctional employees have elevated rates of overweight and obesity when compared to national U.S. averages (86.6% and 55.8%, respectively), vs. (69% and 32%, respectively)<sup>35</sup>. Likewise, correctional employees report poor health behaviors including

poor diet, snacking on low nutrient foods<sup>36</sup>, low physical activity, sedentary behaviors, and poor sleep patterns<sup>29</sup>. Correctional employees are also recognized for high rates of occupational stress and depression<sup>34</sup>. Unfortunately, the poor psychological health profiles of correctional employees appear to perpetuate poor health behaviors and ultimately contribute to overweight/obesity. For example, in a focus group study correctional employees reported that job related stress was a major contributor to poor dietary practices<sup>29</sup>. Therefore, addressing stress and emotions within corrections may enhance health-promoting efforts. Hence, the purpose of this study was to examine the prevalence of reported stress, negatively worded emotions (e.g. feeling blue or worthless), and positively worded emotions (e.g. feeling calm or happy) amongst a group of correctional employees and compare responses to assess for under-reporting and possible evidence of emotional labor and emotional dissonance. Further, researchers examined if reported stress and overall emotions had an effect on reported health behaviors (diet, exercise, and sleep quality). Drawing attention to emotional labor and dissonance experienced by correctional employees and the effects of employee stress and emotions on health behaviors will bring better awareness to understanding the determinants of health among employees.

Law enforcement personnel are an occupational group with higher health risks compared to working adults in other occupations<sup>37</sup>. The contributing effect of work stress to health for correctional employees rests on the presence of multiple sources of daily stress including the hierarchical structure, work environment (poor staff to inmate ratios, required overtime, and shift work), contact with incarcerated inmates, low social support, negative public image, work overload, role ambiguity, low skill discretion, and a job-demands-control imbalance and effort-to-reward imbalance<sup>34,36,38-42</sup>. The constant sense of personal endangerment affects correctional employees<sup>24,43</sup>. Correctional work is associated with high levels of adverse emotions, and with elevated prevalence of mental health issues<sup>44</sup> that include perception of a short life expectancy, high suicide rates<sup>45</sup>, and high rates of depression<sup>46,47</sup>.

The term emotional labor describes the management or modification of emotions when occupation requires prohibited expression of certain feelings while concealing other

emotions<sup>48,49</sup>. This may take the form of faking, enhancing, or suppressing certain expression to achieve the desired emotional anterior<sup>50</sup>. Emotional labor has been associated with adverse psychosocial states and measures, including burnout<sup>51,52</sup>, job stress and self-alienation<sup>49,52</sup>, depression, cynicism, role alienation<sup>53</sup>, emotional numbness<sup>54</sup>, and job tensions<sup>55 51</sup>. When emotional labor results in a conflict between required emotions and true emotions, the result has been termed as 'emotional dissonance'. The larger the gap between required emotions and true emotions, the more likely an employee is to experience stress, job burnout, and psychological separation from ones self<sup>56,57</sup>.

Although law enforcement, including work in corrections, is noted to be a high-stress occupation, law enforcement personnel commonly under-report stress levels and stress symptoms<sup>37,58-60</sup>. This reported phenomenon provides a basis for testing the emotional labor construct and hypothesis<sup>37,60</sup>. The resulting emotional detachment from both self and other is associated with poor family relationships (e.g. marital disruption and divorce)<sup>37,61,62</sup> and has been observed in police officers<sup>63</sup>, military personnel<sup>64</sup> and correctional officers<sup>65,66</sup>. These occupations all require the display of a detached attitude during emotionally challenging situations (e.g. conflict, aggression, manipulation) while refraining from displaying actual feelings<sup>63</sup>. For example, military personnel are characterized as "macho" and being immune to the challenges and traumas they are "just part of the job". Individuals who do not keep up this "macho" description are identified as "lacking in moral fiber". Seeking psychiatric help is viewed with a negative stigma and therefore military members generally do not seek such help for fear of appearing weak<sup>64</sup>. Furthermore, exposure to life-threatening events, a common experience for law enforcement personnel, can also result in feelings of detachment, emotional numbness, and interfering with an individual's ability to function as they used to<sup>67</sup>.

Correctional officers also may need to display various emotional fronts during in specific situations (e.g. friendly/supporting, anger/toughness, and/or concealing distress and weakness)<sup>68</sup>. In corrections work, expression of emotions and feelings has been characterized as an occupational hazard and low-status "women's work"<sup>69</sup>. Although

confronted with many stressful situations, correctional officers have are limited in coping by the primacy of security and procedures. Therefore, correctional employees have few tools to decompress when faced with stressful situations and must internally cope with intense and negative emotions while being required to appear calm and emotionally detached <sup>70</sup>. Among correctional officers, this emotional dissonance has been noted as a source of stress <sup>63</sup>. Denial of occupational stress and its consequences have cited as sources of feelings of helplessness and alienation <sup>71</sup>.

Due to emotional detachment, correctional officers may not realize detrimental consequences (e.g. negative behavioral patterns and emotional instability) of traumatic. Alarmingly this inability to express negative emotions and inhibition of emotions are strong predictors of poor physical health and illness (e.g. high blood pressure & cancer) <sup>50,63</sup>.

Overall, occupational stress in law enforcement personnel is seen as a problem for employers by adversely affecting the psychological, emotional, and behavioral health of employees <sup>72-74</sup>. Emotional dissonance has many detrimental effects on employee health including increased stress. Therefore, both emotional dissonance and the acute and chronic stressors of law enforcement occupations must be effectively understood and addressed. Furthermore, given the tendency for law enforcement to deny feelings of weakness (e.g. stress & emotions), it is not surprising that many studies note these populations to underreport stress and stress related symptoms <sup>24,60,75</sup>.

Addressing stress and emotions within corrections may enhance health-promoting efforts. Hence, the purpose of this study is examination of the prevalence of reported stress, negatively worded emotions (e.g. feeling blue or worthless), and positively worded emotions (e.g. feeling calm or happy) amongst a group of correctional employees and compare responses to assess for under-reporting and possible evidence of emotional labor and emotional dissonance. Drawing attention to emotional labor and dissonance experienced by correctional employees and the effects of employee stress and emotions on health behaviors will bring better awareness to understanding the determinants of health among employees.

### **3.3 METHODS:**

#### 3.3.1 Design:

This was a cross-sectional observational study.

#### 3.3.2 Participants:

Data collection was conducted at two correctional institutions in the same Northeastern State. Prior to data collection members of the research team met with Wardens and Union representatives on multiple occasions to discuss the best practices and procedures for encouraging participation. All employees of these facilities were invited for voluntary participation. Volunteers were recruited with flyers posted in the facilities and roll call announcements conducted by research staff and supervisory lieutenants. After being informed about study requirements and having time to discuss questions with research staff, participants signed a consent form approved by the Institutional Review Board. Surveys and physical assessments were conducted in secure locations within each facility. Participants were financially compensated for each portion of the assessment they participated in (survey & physical assessment) for a maximum of \$50. Research staff spent approximately two months at each site. Administration was fully informed of all study procedures and gave their support and encouragement to employees for participation. Three hundred and seventeen employees completed the questionnaire and the Health Risk Assessment (HRA).

#### 3.3.3 Measurements:

Data from the Health Risk Assessment (HRA) self-report survey and a physical assessment were utilized (variables further discussed below). While there were several survey instruments available from data collection, we elected to restrict use to the HRA for this analysis, because of its simplicity and generalizability. The HRA tool is commonly used in workplace wellness programs and has been certified by the National Committee for Quality Assurance <sup>76</sup>. All survey items used are listed in Table 1.

**Table 1:** Survey Items from Self-Report Health Risk Assessment Survey (n=317)

Construct	Survey Item	Scale & Changes Made <sup>2</sup>
<b>Diet Quality</b>		
Breakfast	How often do you eat breakfast, more than just a roll and a cup of coffee?	1= every day 4=seldom or never <i>Reverse coded</i>
Snacks	How often do you eat snack foods between meals (chips, pastries, soft drinks, candy, ice cream, cookies)?	1= three or more times/day 4= seldom or never
Salt	How often do you add salt to your foods or eat salty foods (chips, pickles, soy sauce)?	1= seldom or never 4= nearly every meal <i>Reverse coded</i>
Fat Intake	Indicate the kinds of foods you usually eat (high fat and low fat examples)	1= nearly always eat high fat 4= eat mostly low fat <i>Collapsed numbers 4 and 5</i>
Breads and Grains	Indicate the kinds of breads and grains you usually eat (refined and whole grain examples)	1= nearly always eat refined 4= eat primarily whole <i>Collapsed numbers 4 and 5</i>
Fruits and Vegetables	How many servings of fruits and vegetables do you eat daily?	1=1 or less 4=4 or more <i>Collapsed numbers 4 and 5</i>
<b>Exercise Quality</b>		
Exercise	How many days per week do you engage in aerobic exercise of at least 20 to 30 minutes duration (fitness walking, cycling, jogging, swimming, aerobic dance, active sports)?	1=none 7=seven <i>Collapsed into 4 categories: (None, 1-2, 3-4, 5+)</i>
Strength Exercise	How many times per week do you do strength-building exercises such as sit-ups, pushups, or use weight training equipment?	1=none 4=3 or more
Stretching Exercise	How many times per week do you do stretching exercises to improve flexibility of your back, neck, shoulders, and legs?	1=none 4=3 or more

<b>Overall Emotion</b>	<i>How much of the time during the past four weeks...</i>	1= none of the time 6= all of the time
	Have you felt calm and peaceful? (Calm)	
	Did you have a lot of energy? (Energy)	
	Have you felt downhearted/blue? (Blue)	<i>Reverse coded</i>
	Have you been a happy person? (Happy)	
	Have you felt worthless, inadequate, or unimportant? (Worthless)	<i>Reverse coded</i>
	Did you take the time to relax and have fun daily? (Relaxed)	
<b>Stress</b>		0=no 1=yes
	Minor problems throw you for a loop (Minor)	
	You find it difficult to get along with people you used to enjoy (Getting Along)	
	Nothing seems to give you pleasure anymore (Pleasure)	
	Unable to stop thinking about my problems (Stop)	
	Feel frustrated, impatient, or angry much of the time (Anger)	
	Feel tense or anxious much of the time (Tense)	

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All survey items from HRA <sup>107</sup>; <sup>2</sup> Changes Made: changes to variable scales enabling use as latent variables (Please see Data Analysis for more detail).

### *Physical Assessment*

Trained research staff measured height and weight with a calibrated Seca 700 physician balance beam scale, measuring weight to the nearest 0.1 kg and height to the nearest mm. Height and weight measures were used to calculate body mass index



(BMI) (weight in kilograms divided by height in meters squared) and classified based on Centers for Disease Control and Prevention (CDC) recommendations <sup>77</sup>.

### Health Risk Assessment

This study utilized the Wellsource ® HRA- The Personal Wellness Profile™, a survey utilizing 39 questions in Likert scale form to assess multiple dimensions of participants self-reported health. For this study, responses to nutrition, physical activity, stress, and emotions were assessed. Survey items were used to create an overall latent variable score for each health behavior, stress, and overall emotion.

### *Health Behaviors*

Three health behaviors were assessed based on self-reported answers to HRA questions (diet, exercise, and sleep quality).

*Diet quality* score was calculated from 6 survey items assessing how often the participant ate from each food group; snacks, high salt foods, low/high fat foods, fruits/vegetables, whole grains, and frequency of eating breakfast. Because survey roots used either a 4 or 5-point Likert scale, all questions were normalized to a 4-point scale prior to analysis. Answers ranged from (1) 'almost never eat the healthier options' to (4) 'almost always eat the healthier options'. Higher latent diet quality scores represent better overall diet.

*Exercise quality* score was based on 3 survey items assessing frequency of aerobic, strength building, and stretching exercise on 4- or 7-point Likert scales, with all items normalized to a 4-point scale. Answers ranged from (1) 'never' to (4) 'three or more days/week', with higher latent exercise quality scores indicating better exercise habits.

*Sleep quality* was based on a single question asking, "how often do you get 7 to 8 hours of sleep". Answers on a 4-point Likert scale ranged from (1) 'always' to (4) 'seldom or

never'. This item was reverse coded so a higher latent score represented better sleep quality.

### *Stress*

A perceived stress latent variable was created from 6 survey items with "yes" or "no" responses. Higher latent scores indicate higher stress levels.

### *Overall Emotion*

Overall an emotion latent variable was created from 6 survey Two questions were considered negatively worded emotions (feeling blue and feeling worthless) and four were considered positively worded emotions (feeling energy, calm, happy, and relaxed). Answers were on a 6-point Likert scale and ranged from (1) 'none of the time' to (6) 'all of the time'. Responses were reverse coded as needed so that a higher latent overall emotion score representing more positive overall emotion.

### 3.3.4 Data Analysis:

Data from HRAs and physical assessments were transferred to Microsoft Excel and IBM SPSS™ version 21.0 software <sup>78</sup>. Frequencies and histograms were used to assess the prevalence of each stress signal and emotion. To assess under-reporting of stress and emotions each was evaluated for non-normality in responses. Determination of non-normality was based on recommendations by Kim 2013 who states that for samples of  $n > 300$  histograms and the absolute value of skewness and kurtosis should be utilized. An absolute skew of  $> 2$  or an absolute kurtosis  $> 7$  is a reference value to determine substantial non-normality <sup>79</sup>. Analyses were conducted on dependent variables with and without outliers evaluated as  $\pm 3$  standard deviations from the mean <sup>80</sup>. To allow for creating latent variable (explained below) all binary variables were coded as 0 and 1, variables on Likert scales were reverse coded if needed, and categories of variable

survey items were normalized. Variables were assessed for missing values. All variables had 100% response rate besides 3 emotions questions, which had 3 missing responses. Therefore these individuals were not used in analyses involving emotions.

### *Latent Variables and Structural Equation Models:*

Next, we used Structural Equation Modeling (SEM) <sup>81-83</sup> to make latent variables (stress, overall emotion, diet quality, and exercise quality) and test for relationships between these variables. Latent variable indicators are listed in Table 2. All analyses for latent variables and structural models were conducted using Mplus version 7.11 <sup>84</sup>. The SEM procedure used was based on recommendations by Buhj 2007 <sup>85</sup>. Latent constructs that could not be directly measured were represented by directly measured survey items (indicators), by assessing the shared variance between correlations/covariances of the indicators. Measurement models used to create these latent constructs increased statistical accuracy by capturing measurement error <sup>86</sup>. After creating latent constructs, structural models were created to assess the relationships between the various latent constructs (stress, overall emotions, diet quality, and exercise quality) and directly reported or observed constructs (sleep quality and BMI). All measurement and structural models were assessed based on model fit to the data (how well the data fits they hypothesized relationships) as represented by the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the Tucker Lewis Index (TLI). Rejection criteria was: >0.06 for RMSEA, <0.95 for CFI, <0.90, and <0.95 for TLI <sup>87</sup>. In cases of inadequate model fit, latent variables were altered by either co-varying indicators or removing non-meaningful indicators (determined by factor loads and p-value (Table 3).

**Table 2:** Latent variables and survey item indicators

Latent Variable	Indicator	Standard Estimate	p-value
Diet Quality	Snacks	0.332	0.000**
	Breads/grains	0.606	0.000**
	Fruits/Vegetables	0.428	0.000**

Exercise Quality	Fat intake	0.782	0.000**
	Stretching	0.784	0.000**
	Strength Exercise	0.907	0.000**
Stress	Aerobic Exercise	0.753	0.000**
	Getting Along	0.121	0.000**
	Pleasure	0.138	0.000**
	Stop	0.153	0.000**
Emotion	Anger	0.190	0.000**
	Tense	0.223	0.000**
	Energy	0.853	0.000**
	Relaxed	1.002	0.000**
	Calm	0.986	0.000**
	Happy	0.984	0.000**
	Blue	0.687	0.000**
	Worthless	0.384	0.000**

\*p<0.05.; \*\*p<0.01.; Please refer to Table 1 for more detailed description of response answers.

**Table 3:** Latent Variable Model Fit with comparison of model fit before and after improvements were made

	Number of Indicators	X <sup>2</sup> P-value	RMSE			Changes to improve model fit
			A	CFI	TLI	
Diet Quality	6	0.007	0.069	0.950	0.917	
Diet Quality (final)	4	0.280	0.029	0.997	0.992	Remove indicators
Exercise Quality (final) <sup>1</sup>	3	0.000	0.000	1.000	1.000	
Stress	6	0.042	0.055	0.940	0.900	
Stress (final)	5	0.361	0.017	0.996	0.993	Remove indicator
Overall Emotion	6	0.000	0.137	0.926	0.877	
Overall Emotion (final)	6	0.173	0.038	0.995	0.990	Covary indicators

<sup>1</sup> Just identified models do not have accurate model fit information and modifications were not possible

### 3.4 RESULTS:

#### *Participant Characteristics:*

Descriptive analysis indicated that a majority of corrections employees reported no/few stress signals, with the percent reporting no stress signals ranging from 81.4- 91.2%

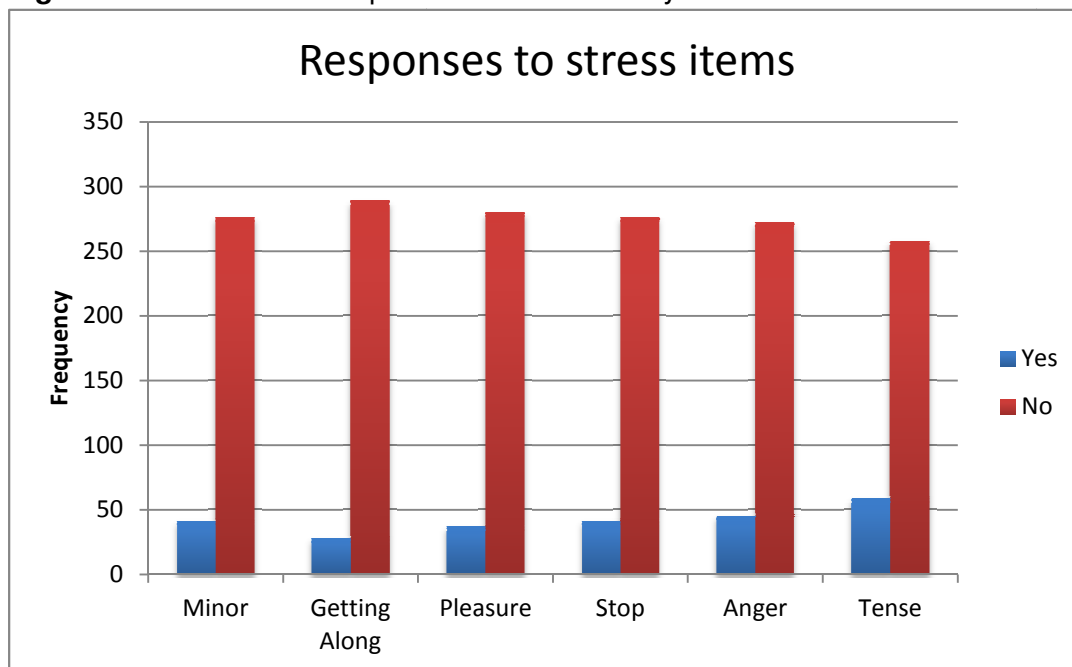
depending on the signal. Of the 6 stress signals, percentage of participants who reported not having the signal were; 81.4%, 85.8%, 88.3%, 87.1%, 87.1%, and 91.2% (Table 4). All 6-stress signals had a large skewness (1.621 to 2.915), with 5 of the 6 survey items being above the reference value for non-normality. Please see the histogram in Figure 1 for the distribution of all stress signals.

**Table 4:** Participant Report of Stress Signals

Stress Signal	No		Yes		Normality	
	n	%	n	%	Skew	Kurtosis
Minor	276	87.1	41	12.9	2.22*	0.945
Getting Along	289	91.2	28	8.8	2.915*	6.54
Pleasure	280	88.3	37	11.7	2.399*	3.778
Stop	276	87.1	41	12.9	2.22*	2.945
Anger	272	85.8	45	14.2	2.062*	2.264
Tense	258	81.4	59	18.6	1.621	0.63

\*Non-normality base on: absolute skew >2 or absolute Kurtosis >7; Please refer to Table 1 for more detailed description of response answers.

**Figure 1:** Distribution of responses to stress survey items



The 6 responses to emotions survey items, as listed in Table 5, were coalesced from 6 responses to 3 (all or most of the time, some of the time, little or none of the time). When comparing responses to negatively worded emotions (worthless, blue) vs. positively worded emotions (happy, calm, energetic, taking time to relax) a smaller

percentage of participants reported having a negative feeling. Both negative emotions had a large skew (skewness of -0.924 to -2.060) indicating a non-normal distribution with a majority of participants reporting rarely having the negative emotion. In contrast, reporting of the 4 positive emotions was more evenly distributed with a more proportionate distribution of participants responding to having the given emotion all of the time, some of the time, and little or none of the time (skewness of 0.169 to -0.556). See Figures 2. For the negatively worded emotion of feeling downhearted/blue only 2.8% of individuals reported feeling the negative emotion a majority of the time. In comparison, for the positively worded emotion of feeling happy, 10.4% of individuals report not feeling happy a majority of the time. The implication is that responses to positively worded questions differ from negatively worded questions, even when the construct is similar.

**Table 5:** Participant Report of Emotions

Emotion			<i>Normality</i>		<i>% Reporting (Frequency of emotion)</i>		
	Mean	SD	Skewness	Kurtosis	Infrequent <sup>1</sup>	Moderate <sup>2</sup>	Frequent <sup>3</sup>
Energy <sup>a</sup>	3.77	1.218	-0.234	-0.737	16.5	50	33.5
Calm <sup>a</sup>	3.84	1.236	-0.291	-0.966	18.4	43.1	38.6
Blue	4.95	1.088	-0.924	0.283	70.7	26.5	2.8
Happy <sup>a</sup>	4.19	1.197	-0.556	-0.543	10.4	38	51.6
Worthless	5.39	1.097	-2.06*	3.957	83.4	12.5	4.1
Relaxed <sup>a</sup>	3.46	1.378	0.169	-1.029	28.3	41.4	30.3

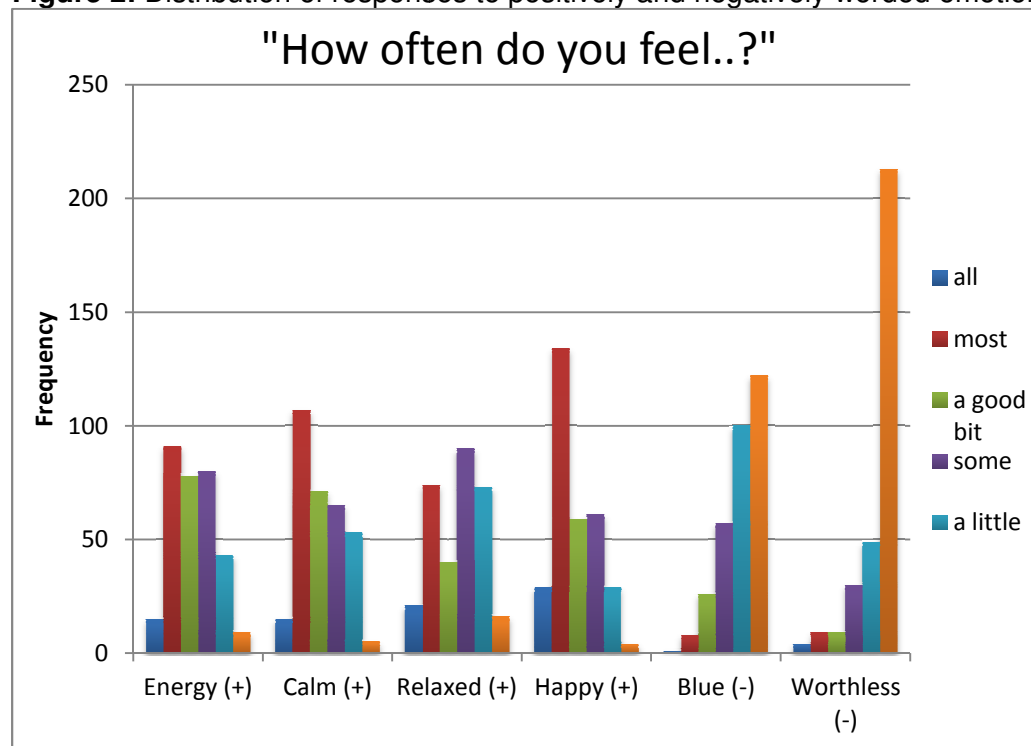
\*Non-normality base on: absolute skew >2 or absolute Kurtosis >7;

<sup>a</sup>Reverse coded so that higher values represent better overall emotion for data analysis;

<sup>1</sup>Little of none of the time (1-2); <sup>2</sup>Some of the time (3-4); <sup>3</sup>All or most of the time (5-6).

Please refer to Table 1 for more detailed description of response answers.

**Figure 2:** Distribution of responses to positively and negatively worded emotions



(+) indicates a positively worded emotion; (-) indicates a negatively worded emotion. Histograms show left hand skew with negatively worded emotions and more normal distribution with positively worded emotions.

SEM analysis results are depicted in Table 6. These show that higher self-reported stress had no effect on diet or exercise quality, but negatively effected sleep quality ( $\beta = -0.23$ ,  $p = 0.001$ ). Overall emotion directly affected all three health behaviors; diet ( $\beta = 0.163$ ,  $p = 0.006$ ), exercise ( $\beta = 0.163$ ,  $p = 0.006$ ), and sleep quality ( $\beta = 0.318$ ,  $p < 0.001$ ), with positive emotion resulting in better health behaviors. These results suggest that reported overall emotion might be a more meaningful in predicting health behaviors than reported stress.

**Table 6:** Stress & Overall Emotion's Effects on Health Behaviors

	Standardized Estimate	S.E.	P-value
<i>Stress</i>			
Diet	-0.112	0.077	0.144
Exercise	-0.119	0.083	0.152
Sleep	-0.230	0.069	0.001**
<i>Overall Emotion</i>			
Diet	0.163	0.059	0.006**
Exercise	0.322	0.065	0.000**

Sleep	0.318	0.068	0.000**
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\*p>0.05.; \*\*p>0.01.

### 3.5 DISCUSSION:

The use of SEM allowed assessing if stress and/or overall emotion was predictive of health behaviors. Results suggest a relationship between emotions and health behaviors, with a more positive mood or better overall emotion related to better diet, exercise, and sleep quality. On the other hand, stress was related only to sleep quality but not diet and exercise quality. These results indicate that overall emotion was a more meaningful predictor of health behaviors than stress in this population. One inference is that rather than relying on self-reported stress alone as a predictive variable, it may be useful to assess multiple stress and emotion related variables since the suitability for a particular population cannot be assumed. The importance of understanding the study population before administering surveys is implicit. Another inference is that previous research in this population tells may have under-reported adverse reactions to work and to emotional health.

Previous studies also have found a positive relationship between emotions and health behaviors<sup>10,11,88</sup>. Gibson (2006) found mood can alter food choices and suggested that eating may calm stressed “nerves” through hedonic sensory qualities that elicit pleasure<sup>89</sup>. In human laboratory research, negative mood states have been related to altered preferences for highly-palatable foods<sup>90</sup> and to a disinhibiting effect on eating<sup>91,92</sup>. Udo (2013) found non-obese participants had less resistance to eating during negative mood induction than positive mood induction<sup>12</sup>. A meta-analysis by Knottinen (2010) examined relationships between depression/depressive symptoms and obesity. Higher levels of depression were related to a tendency to eat during negative-emotions, to lower self-efficacy for physical activity when facing barriers, lower reported physical activity, and higher levels of adiposity<sup>93</sup>. Finally, the link between emotions and sleep quality has been noted in previous research. Stewart (2011) found adults with higher reported negative affect had poorer sleep quality<sup>94</sup>. Furthermore, poor sleep quality has been associated with depression<sup>14</sup>, anger, hostility, and aggression<sup>15-17</sup>.



The relationship between stress and health behaviors is controversial<sup>95,96</sup>. Some studies have found certain types of stress including work stress to be associated with obesity-related behaviors among adults (e.g. diet and exercise quality)<sup>97-100</sup>. However, other studies have failed to show a relationship between stress and dietary changes, similar to our own study<sup>101-103</sup>. This maybe due in part to the differences in responses to stress. A meta-analysis captured this ambiguity with approximately 40% of individuals increasing their intake, 40% decreasing their intake, and 20% reporting no change their intake and eating behaviors in response to perceived stress<sup>104</sup>. Interestingly, individuals who were in the higher range of normal weight or who were overweight generally increased their intake with stress, whereas those who are underweight or in the lower end of normal weight typically did not increase their intake or decreased their intake<sup>105</sup>. Additionally, those individuals who were “emotional eaters” tended to have cravings for and increase their intake of high-fat/sweet and rewarding/comfort foods in response to stress. There is evidence that individuals who use food as a reward in stressful times or negative mood states tend to decrease awareness of calorie intake and food restriction in the presence of stress<sup>100</sup>. Women’s dietary practices may be more influenced by stress than is the case for men<sup>89,100</sup>. As our study population was largely male, this may be a reason for not finding a significant relationship. Our study failed to find an association between the effect of stress and exercise. Similarly, Conroy (2007) found only a modest association between leisure physical activity and stress levels<sup>106</sup>.

Another reason for not finding a significant relationship between stress and diet and exercise quality in our study may be the small range of the responses to perceived stress. In one worksite obesity prevention study it was hypothesized that stress would affect risk for obesity through bio- behavioral processes.<sup>102</sup> The authors found a relationship between higher stress levels and lower levels of eating awareness, physical activity, and walking, but no relationship between stress levels and BMI or diet quality were seen. The authors suggested that this might be because the range of reported stress scores in the sample was too small to detect associations. The average stress

scores were not consistent with the expected highly stressed population <sup>100</sup>. Future studies should address possible moderators of the perceived stress-health behavior relationship (e.g. overweight and obesity, sex, eating behavior domains) <sup>100,107</sup>.

Our study did find a relationship between stress and sleep quality. The link between stress and sleep quality was also seen in a study by Kashani (2012) who found that higher levels of stress were correlated with significant disturbances in sleep duration and quality <sup>108</sup>. Hemmingsson (2014) stated that sleep patterns are adversely affected by chronic exposure to stress <sup>109</sup>.

Although correctional work is recognized as a high stress occupation, in this study the self-reports of stress and negatively worded emotions were very low. These findings would imply that this is a population that is rather unstressed. However, this is in conflict with the well-supported idea that corrections is a high stress occupation <sup>34,37,65</sup>. This conflict has been found in previous studies <sup>29,112</sup>, suggesting that correctional employees under-report stress and emotions (particularly negatively worded emotions). In contrast, in our study responses to positively worded emotions had a more uniform distribution, possibly signifying more accurate reporting. Although they are asking very similar questions more participants admit to not feeling happy (possibly because it is a positively worded emotion) where as a much smaller percentage of participants admit to feeling downhearted/blue (possible because it is a negatively worded emotion). Interestingly, these results suggest correctional employees may more accurately report positively worded emotions, but are less likely to report negatively worded emotions

These results suggest that correctional employees may be underreporting stress and negatively worded emotions. This may conceivably be a result of job prescribed emotional labor in which employees are expected to refrain from displaying stress and emotions to prevent the appearance of weakness. Correctional employees are often expected to display certain emotions while on the job such as appearing strong and tough in stressful situations ,even if these emotions are at odds with their true emotions <sup>68</sup>. This may be a reason why correctional employees, and law enforcement employees

in general, have been noted to underreport signs of weakness of stress and stress related symptoms.

Under reporting has been reported in other studies as discrepancies between reported levels of stress and physiological levels of stress. Given the reliance of many investigators on surveys and psychosocial assessment, the discrepancy is a potential serious barrier to valid results. Cheek (1983) found that objective stress measures (e.g. physical illness and high divorce rates) in correctional officers suggest high job stress. In contrast, correctional officers reported they were not especially stressed or tense. Although corrections officers denied their stress and its consequences (physical, emotional, interpersonal, and occupational), they readily reported stress-related problems in their colleagues, noting that correctional work is indeed stressful yet reporting that they themselves did not feel the effects of this stress. The authors concluded that correctional officers attempt to hold in their emotions and deny their weaknesses <sup>112</sup>. Morse et al (2011) found that correctional officers' surveys indicated high levels of stress-related symptoms (hypertension, alcoholic consumption) and that a majority of employees were concerned about their personal safety (almost 66%). However, these same employees reported confidence in managing the demands of the job. The authors concluded that the conflict between stress-related symptoms and reported stress may have resulted from a false perception of adequately managing stress <sup>29</sup>. McCarty (2009) found similar discrepancies between physiological and self-report levels of stress, and suggested that when assessing correctional employee stress, physiological measures should be utilized if possible (e.g. cortisol, dehydroepiandrosterone (DHEA), cholesterol, triglycerides, fasting glucose levels, 10-min resting electrocardiogram, heart rate variability, and blood pressure) <sup>24,113</sup>. In the world of corrections and law enforcement emotional honesty is potentially harmful <sup>69</sup>. Therefore, correctional employees may be concealing their emotions so that they are not overwhelmed with the stress and demands of their jobs.

### **3.6 CONCLUSION**

Overall, law enforcement personnel face difficult situations in which they experience negative emotions, may have little training on stress reduction skills to regain psychological and physiological equilibrium<sup>37</sup>, and may refrain from expressing true emotions. Seeking psychiatric assistance can be seen as a weakness<sup>116</sup>. Due to the negative physical, behavioral outcomes, and mental health implications emotions and possibly emotional labor it is important to address occupational stress and negative emotions in law enforcement personnel. Particularly, efforts to educate law enforcement employees on the risks of stress and withheld emotions and on effective ways to cope may be helpful in alleviating emotional turmoil. Training employees in managing their emotions has been recommended<sup>63</sup>. Lourel (2008) advised that high stress occupations such as law enforcement should have counseling and psychological support, and that employees should be provided with regular debriefing support to prevent psychological disturbances and promote overall health and well-being<sup>114</sup>. Moreover, health care professionals should pay extra attention to the physiological and physical health of patients who work in high stress occupations. Finally, emotions have been noted as central to decision making<sup>117</sup> and can be highly predictive of health behaviors<sup>118,119</sup>, however they are rarely addressed in social-cognitive interventions<sup>120</sup>. Future interventions would benefit from considering the influence of stress and emotions on participant health behaviors, and understanding the unique stressors that may be inhibiting healthy behaviors. Occupational health psychology may offer direction to psychiatric assistance and to health promotion efforts.

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## **CONCLUSION**

### *4.1 Summary*

This research was conducted to further explore the possible effects of psychological health and stress on both health behaviors and body weight status in the high stress occupational group of correctional employees. Use of advanced statistical techniques allowed testing the theoretical Psychological health, Health behavior, and Bodyweight (PBBW) model. Findings supported that psychological health (depression and emotions) predicted health behaviors of diet, exercise and sleep quality, and in turn affected bodyweight status. Stress appears to have had a moderating effect on this relationship, although not statistically significant. Overall, these findings suggest psychological health and stress should be targets when designing effective health promotion interventions and treatments. As much of the stress and poor psychological health this population faces is likely due to factors on the job, such factors should be addressed to help alleviate stress and negative psychological health and ultimately promote more healthy employees.

The findings of the manuscript addressing underreporting of stress and negative emotions has important implications. Although correctional employees, and law enforcement employees in general, are known to have high stress and negative emotional health, they often deny and underreport these characteristics. The result is a group of individuals facing large amounts of stress with minimal coping mechanisms, therefore turning to unhealthy behaviors as a means to cope. Ultimately this occupational culture appears to be negatively affecting correctional employees mental

and physical health. Therefore, this culture should be addressed by bringing awareness to the issues of stress and negative emotions, teaching employees effective coping mechanisms, and encouraging seeking psychiatric help and emotional support when needed. These approaches could be implemented in employee training, mentoring, and supervisor support. Incorporating this into the work culture may then decrease stress and negative emotions, resulting in better health behaviors, lower bodyweight, and ultimately healthier employee and benefitted employers.

Future studies to validate the PBBW are needed by testing the model on other datasets with parallel variables and testing its efficacy in developing effective health promotion efforts. The model could be tested on additional corrections data sets and other high stress working populations. Future studies may also test additional variables in the model such as possible moderators of relationships (e.g. gender, eating characteristics, etc.). Structural Equation Modeling proved to be useful and can be recommended in health behavior research to allow for better understanding of the numerous and complex variables related to health behaviors and obesity. As correctional employees and law enforcement employees in general appear to deny and/or censor their stress and negative psychological health and because these factors affect employee health it would be beneficial to address these factors through awareness efforts, education on effective coping mechanisms, and encouragement of seeking emotional and psychiatric support when necessary. Occupational factors contributing to stress and psychological health should be addressed and alleviated where possible. Finally, as law enforcement personnel appear to underreport stress and emotions, it would be beneficial to incorporate multiple measurements of these factors including multiple subjective

assessments and objective measures where possible (e.g. cortisol, dehydroepiandrosterone (DHEA), cholesterol, triglycerides, fasting glucose levels, 10-min resting electrocardiogram, heart rate variability, and blood pressure)<sup>1,2</sup>.

#### *4.2 Implications*

The results of this work add to the literature assessing for effects of stress and psychological health on health behaviors and ultimately bodyweight. The results can help inform future workplace health programs by targeting both stress and psychological health as precursors to healthy behavior practices. Additionally, it raises awareness that correctional employees might be hiding and/or unaware of their stress and negative emotions. This has implications into how these factors affect health behavior and also into how these factors are assessed in research studies.

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