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Childhood Adversity and Mental Health Correlates of Obesity in a Population at Risk

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Abstract

The staggering prevalence of obesity and obesity-related health conditions takes exorbitant tolls on health care resources. This cross-sectional study with private evaluations of 636 adult inmates in a southern state prison was conducted with regressions comparing obese (body mass index [BMI] ≥ 30) to nonobese individuals to define obesity risk factors. Obese individuals more likely were female, were victims of childhood sexual abuse, suffered greater severity of childhood sexual abuse, attempted suicide, reported drug dependency, were non-Caucasian, and were older than non-obese. Psychopathy predicted lower BMI. Though obesity might be expected in victims of childhood physical abuse, traumatic brain injury, or other mental health conditions due to mobility or decision-making deficits, neither were significant. Adjusting for related variables, childhood sexual abuse remained significant. Females attempted suicide more frequently and suffered greater childhood sexual abuse.

Keywords

obesity; BMI; child abuse; childhood sexual abuse; TBI; suicide attempts

Introduction

Although reports vary by nation, adiposity, as measured by mean body mass index (BMI) has increased worldwide since 1980 (Finucane et al., 2011). Rates may be stabilizing, yet more than one third of adults and 17% of youth in the United States are obese, which is a dramatic increase since 1980, resulting in numerous health consequences (Centers for

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Authors' Note

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Disease Control and Prevention [CDC], 2015; Ogden, Carroll, Kit, & Flegal, 2014). Prison populations may be at greater risk, with 43% of a random sample of female prison inmates reported to be obese (Brewer-Smyth, 2014).

Medical care costs of obesity for U.S. adults were estimated to be as high as $147 billion, with medical costs for the obese $1,429 higher per person than for those of normal body weight, which does not include costs of reduced worker productivity (CDC, 2015). In fiscal year 2011, states spent a total of $7.7 billion on correctional health care (Pew Charitable Trusts & MacArthur Foundation, 2014). Decreasing and preventing obesity-related health conditions could decrease these costs. To address the obesity epidemic, it is critical to define correlates of obesity to inform the development of obesity prevention and intervention strategies that are specifically designed for prison populations. The aims of this study were to evaluate obesity in the prison population and assess its association with variables that are prevalent in prison populations in order to identify obesity risk factors in prisoners.

Background

BMI is a recognized reliable indicator of body fat composition (CDC, 2016). BMI in youth has been associated with having been a victim of sexual abuse, physical abuse, mental abuse, and cumulative adversity including neighborhood and other adversity during childhood (Slopen, Koenen, & Kubzansky, 2014; Veldwijk, Proper, Hoeven-Mulder, & Bemelmans, 2012). While BMI in youth has been associated with abuse, further studies are needed to investigate links between BMI in adulthood, childhood abuse, and other variables that are prevalent in prison populations.

Adult obesity could result from toxic stress (Johnson, Riley, Granger, & Riis, 2013) related to problems prevalent in prison populations including adverse childhood experiences (ACE) such as physical, sexual, or emotional abuse (Hemmingsson, 2014; Hemmingsson, Johansson, & Reynisdottir, 2014). In the general population, adult obesity risk increased with number and severity of each type of childhood abuse including physical, fear of physical, verbal, and sexual abuse (Williamson, Thompson, Anda, Dietz, & Felitti, 2002). Childhood sexual abuse (CSA) was significantly related to higher weight in lesbian women; 39% who reported CSA were obese compared with 25% who did not report CSA (Aaron & Hughes, 2007). A prospective study demonstrated that female victims of CSA were significantly more likely to be obese (Kim et al., 2015). Yet little is known about obesity in the prison population. Therefore, further study is needed to evaluate the relationship between BMI and other variables that are prevalent in male and female incarcerated populations, such as childhood abuse, drug dependency, suicide attempts, traumatic brain injury (TBI), and other mental health conditions (Brewer-Smyth, 2014; Brewer-Smyth, Burgess, & Shults, 2004; Ferguson, Pickelsimer, Corrigan, Bogner, & Wald, 2012; Steadman, Osher, Robbins, Case, & Samuels, 2009).

TBI, which might be expected in abuse victims, may contribute to obesity due to decision-making problems associated with neurocognitive deficits along with decreased mobility, which limits exercise capabilities. Neurocognitive tests and personality questionnaires that may reveal TBI sequela or other mental health conditions suggest that the critical neural systems related to individual differences in obesity are lateral prefrontal structures

underpinning self-control and striatal regions implicated in food motivation (Vainik, Dagher, Dubé, & Fellows, 2013). However, TBI was not found to be a risk factor for obesity in females in a mid-Atlantic U.S. prison sample (Brewer-Smyth, 2014). The aim of this current study was to further evaluate obesity in a larger sample of both male and female prisoners in a different geographical region while also evaluating variables that are prevalent in prison populations, such as TBI and other mental health conditions, in order to obtain findings that are more widely generalizable to prison populations.

Psychopathology, including oppositional defiant disorder and depressive disorders, has been associated with chronic obesity in youths (Mustillo et al., 2003). Mental health conditions have been related to obesity in adults (Simon et al., 2006; Smith, White, Hadden, Young, & Marriott, 2014); however, TBI and childhood adversity that are prevalent in prison populations are seldom addressed in studies of obesity and mental health. It has been proposed that weight loss may improve mental health outcomes and slow the rate of neuroprogressive disturbances due to a bidirectional relationship between obesity and psychiatric disorders (Lopresti & Drummond, 2013). Yet others reported that most mental health conditions were not associated with obesity in a longitudinal study (Henriksen, Mather, Mackenzie, Bienvenu, & Sareen, 2014). Further investigation is needed into mental health and variables that are prevalent in prison populations that could have contributed to discrepancies between these findings.

Higher BMI and negative psychological characteristics have been associated with neighborhood characteristics (Chen & Paterson, 2006). Additionally, women who reported CSA histories were more likely to report a history of multiple suicide attempts (Talbot, Duberstein, Cox, Denning, & Conwell, 2004). Suicide attempts and CSA were also related to higher BMI in female prison inmates (Brewer-Smyth, 2014). However, this study did not include male prison inmates or other forms of childhood adversity or other mental health conditions. Little is known about obesity and its risk factors in prison populations. Further studies are needed to define multivariate associations with adult obesity including various forms of childhood adversity, TBI, and other mental health conditions that are prevalent in prison populations.

Purpose/Aims

This study was built upon a convergence of theories suggesting that BMI results from a cycle of events, such as emotional and physical trauma that lead to neurobiological, physiological, psychobiological, emotional, or behavioral outcomes that could contribute to obesity (Brewer-Smyth, 2014). The purpose of this study was to evaluate obesity and its relationship to childhood adversity including childhood physical, sexual, and emotional abuse; neighborhood characteristics during childhood; TBI; suicide attempts and other mental health conditions; along with related variables in order to define risk factors for obesity in a large sample of adult men and women inmates in a southern state prison. It is particularly critical to study prison inmates because of the astronomical cost of prison health care that is increased due to obesity and related conditions. Prison also provides a setting where research participants are generally exposed to the same diet and exercise options

without all of the choices of the general public, which facilitates equal comparisons of differences between groups for key variables.

Method

Design

A cross-sectional cohort study was conducted to compare childhood adversity, suicide attempts, drug dependency, TBI, and other mental health conditions in obese (BMI ≥ 30) and nonobese (BMI < 30) inmates in a southern state prison.

Sample/Participants

Data sources and methodology are explained elsewhere (Ferguson et al., 2012). Briefly, data were collected from a one-time, private, and comprehensive in-person structured interview among 320 male and 316 female state prison inmates aged 18 years or older as a part of a study on TBI. All inmates who comprehended English, did not have disabilities that could impair their ability to give informed consent, who were arrested in the state and incarcerated in a state facility, and did not have detainers (warrants indicating future prosecution) were eligible for the study. Interviews took place in state correctional facilities between April 2009 and April 2010.

Inmates were recruited and sampled separately by gender and stratified by type of release (parole vs. sentence completion). Participants were interviewed 5 days to 6 months before release. To include inmates who would not be released or had little chance of release, a subset of 60 inmates was included who were sentenced to death, life without parole, or (for some females) life with chance of parole after 20 or 30 years, and were termed ‘‘nonreleasees.’’ Males and females were sampled separately to attain roughly equivalent samples by gender, although the actual proportions in this state’s prisons during that time were 13% female and 87% male.

Face-to-face, one-on-one interviews were conducted by trained interviewers from RTI International (formerly the Research Triangle Institute), an independent, nonprofit research and development organization. To obtain a sample size of 636 with equal proportions of males and females, the aforementioned randomized sampling scheme stratified by gender and whether or not the inmate would be released from prison was used. A total of 4,005 males and 538 females were eligible. Among males, 26 nonreleasees and 294 releasees were interviewed. Among females, 33 nonreleasees and 282 releasees were interviewed. Time to explain the study, obtain informed consent, administer a consent screener, and conduct an interview ranged from 60 to 120 minutes. The informed consent explained that the inmates could discontinue the interview at any time. The overall refusal rate was approximately 28%. Of those who participated, complete data were available for the variables of interest for this study for 629 participants.

Ethical Considerations

Each participant signed an informed consent before being interviewed, and procedures were followed in accordance with federal regulations for the conduct of research with prisoners

(Brewer-Smyth, 2008). The state Department of Corrections (DOC), research committee, and institutional review board of the principal investigator's university, an independent international research firm, and the CDC approved the study. The Office of Health Research Protection verified that the study complied with federal regulations regarding prisoner research. The CDC's Office of Scientific Regulatory Services issued the study a confidentiality certificate. All participants signed an informed consent prior to the interview.

Data Analysis

IBM SPSS Statistics version 21 was used to analyze the data. Demographics were analyzed to determine differences between those with BMI ≥ 30 (obese) and those whose BMI was below 30 (nonobese). Logistic regression was used to compare those with BMI ≥ 30 with those whose BMI was below 30 for differences related to TBI, other mental health conditions, and variables of childhood environment such as neighborhood; social support; and childhood physical, sexual, and emotional abuse, all of which could potentially influence neurodevelopment and behavior resulting in obesity in adulthood.

Measures

BMI—BMI, a frequently used reliable indicator of body fat composition, was used as an alternative for direct measures of body fat. BMI is determined by weight in kilograms divided by height in meters squared (CDC, 2016).

TBI—Trained interviewers used the Ohio State University traumatic brain injury identification method (OSU TBI-ID; Corrigan & Bogner, 2007), as described elsewhere, to elicit self-report of lifetime history of TBI. The OSU TBI-ID provides data on multiple dimensions of a person's history, including number of injuries, injury severity, effects (symptoms and functional limitations, both initially and persisting), age at injury, and time since most recent injury. Previous studies have validated its use in prison populations, demonstrate interrater and test–retest reliability, and predictive validity of summary indicators used to predict current functioning, both self-report and performance based (Bogner & Corrigan, 2009).

Childhood adversity—Questions were asked on childhood adversity, childhood socioeconomic status, childhood neighborhood environment, and adult adversity. Childhood physical, emotional, and sexual abuse questions were modified from the Early Trauma Inventory (ETI; Bremner, Bolus, & Mayer, 2007; Bremner, Vermetten, & Mazure, 2000) and from the ACE Study (Felitti et al., 1998; see Table 1). ETI is a reliable and valid measure of reported childhood trauma with documented interrater reliability, test–retest reliability, internal consistency, convergent validity, and discriminant validity (Bremner et al., 2007). Similar questions have been used in prison populations (Brewer-Smyth & Burgess, 2008; Brewer-Smyth et al., 2004).

Social support—This measurement consists of a subset of 28 questions from the Family Domain Scales of the Communities That Care (CTC) Youth Survey (Arthur, Hawkins, Pollard, Catalano, & Baglioni, 2002). They include the following subscales: Poor Family Management, Family Conflict, Attachment to Mom, Attachment to Dad, Opportunities for

Prosocial Involvement, Recognition for Prosocial Involvement, Parental Attitudes Favorable Toward Antisocial Behavior, and Parental Attitudes Favorable Toward Drug Use. All are either risk or protective factor constructs under the Family Domain Scale. Reliability values for most scales are good, averaging about .78 across all scales, and factor structures of the scales are coherent (Arthur et al., 2002). Sensitivity, specificity, and evidence for the validity of using cut points to profile communities on the risk and protective factor scales in the CTC Youth Survey have been reported (Arthur et al., 2007).

Psychopathy—Individual psychopathy was measured with the Levenson Self-Report Psychopathy Scale (Levenson, Kiehl, & Fitzpatrick, 1995). Although this is not a diagnostic tool, higher scores indicate increased probability of psychopathy. Sixteen items indicate primary psychopathy and 10 items indicate secondary psychopathy. Total score is a sum of all items. Convergent and discriminant validities were generally good when used with a prison sample (Sellbom, 2011).

Drug dependence—Participants were asked, ‘‘has a doctor or other health care person, like a nurse, told you that you have drug dependency?’’ Participants responded with yes or no. In addition, the Texas Christian University Drug Screen-II (TCUDS-II) was used to evaluate ‘‘drug use’’ defined as both illegal and prescription drugs and alcohol. TCUDS-II is reliable and effective when used to assess the severity of drug use problems (Knight, Simpson, & Morey, 2002). The TCU Drug Screen was found to have good psychometric properties and to be reliable across a variety of subgroups. Its brevity, along with being available for free download, has made it a popular screening instrument in many correctional programs. The first part of the TCU Drug Screen includes a series of questions about problems related to drug use, and the second part addresses the frequency of specific drug use prior to prison. Cronbach’s α coefficients were computed; the scale’s overall reliability was good (coefficient $\alpha = .89$), with item-total correlations ranging from .37 to .58, and individual item ‘‘yes’’ responses ranged from 10% to 39%. Across all subgroups, reliability coefficients were nearly identical, suggesting that the screen was reliable at detecting the severity of drug use, regardless of subgroup affiliation (Knight et al., 2002).

Sensation seeking—The Sensation Seeking Scale of the Zuckerman-Kuhlman Personality Questionnaire (Zuckerman, Kuhlman, Joireman, Peta, & Kraft, 1993) was used to assess individual differences in impulsivity and sensation seeking. The four-factor questionnaire’s structure, internal consistency (Cronbach’s αs > .75), convergent validity, replicating research supporting the construct validity and reliability are reported (Roberti, Storch, & Bravata, 2003). Average summed scores for impulsivity and sensation seeking were calculated separately, with higher scores indicating higher levels of these characteristics.

Aggression—Propensity for violent aggressive behavior was measured with the Buss-Perry Aggression Questionnaire (BPAQ-SF-11; Buss & Perry, 1992). Strong evidence for construct validity has been reported (Buss & Perry, 1992). This Likert scale has four subscales—Physical Aggression, Hostility, Anger, and Verbal Aggression—to make up the total Aggression score. Bryant and Smith shortened the original 28-question BPAQ to a 12-

item short form (BPAQ-SF) that resulted in improved psychometric properties (Bryant & Smith, 2001). Subsequently, the BPAQ was modified to an 11-item form, the BPAQ-SF-11 for use with mentally ill prisoners (Diamond, Wang, & Buffington-Vollum, 2005). Cronbach's αfor all scores without missing items was .89. Confirmatory factor analysis supported the four-factor structure. Tests confirmed factorial invariance across gender for all loadings and covariances. Reliabilities were adequate and comparable to previous studies of Bryant and Smith (2001) and Buss and Perry (1992). Concurrent validity was supported by high correlations between the subscales of the BPAQ-SF and several relevant subscales on the Personality Assessment Inventory. Higher scale scores indicate increased propensity for aggression.

Other mental health conditions—The Millon Clinical Multiaxial Inventory-III Subscales (Millon, Millon, Davis, & Grossman, 2006) were used to measure antisocial personality disorder, schizotypal, borderline personality disorder, anxiety, mania, and major depression. Convergent validity and discriminant validity were good for alcohol and drug dependence, moderate for major depression and delusion, and poor for thought disorder and anxiety while generally measuring constructs for which they were intended (Hesse, Guldager, & Linneberg, 2012).

Dysregulation—The Abbreviated Dysregulation Inventory (ADI; Castillo Mezzich et al., 1997; Pardini, Lochman, & Frick, 2003) was used to measure cognitive, behavior, and emotional regulation deficits that could result from TBI or other childhood trauma, leading to inability to manage and regulate behavior and emotions potentially contributing to obesity. The ADI consists of 30 questions comprising three scales with three, four, and four subscales, respectively: (1) Emotional/Affective Scale: arousability, emotional control, irritability; (2) Behavioral Scale: impulsivity, inattention, hyperactivity, aggression; and (3) Cognitive Flexibility Scale: devising a plan, implementing and maintaining a plan, benefiting from experience. Items are scored, summed, and averaged for a total score, with higher scores representing increased levels of dysregulation. Reports indicate internal consistency coefficients for each subscale (Castillo Mezzich et al., 1997).

Literacy—The Wide Range Achievement Test–Third Edition (WRAT-III), an established valid and reliable measure of literacy (Snelbaker, Wilkinson, Robertson, & Glutting, 2001; Wilkinson, 1993), was used to evaluate reading without effects of comprehension. The state DOC provided WRAT-III scores with data collected in a similar manner for all inmates. Higher scores indicate a greater number of correct word reading and pronunciations.

Smoking—Participants were asked the following two questions: ‘‘have you smoked at least 100 cigarettes in your entire life?’’ and ‘‘has smoking cigarettes caused you to develop problems that affect you today?’’ They responded with yes or no.

Results

Of the 636 adult males and females, complete data for all variables were available for 629. Of the 629, 33.4% were obese and 66.6% were not obese. However, 43.1% of females were obese with a mean BMI of 29.7, while 23.9% of males were obese with a mean BMI of

26.97. Obesity was also more prevalent for those who were not Caucasian. The study participants ranged in age from 20 to 68 years, with a mean of 36.2 years. Descriptive statistics were computed for comparisons between obese and nonobese participants (Table 2). Simple logistic regression analyses (Table 3) revealed that obese individuals were more likely to be female (odds ratio [*OR*] = 2.41; 95% confidence interval [CI] = [1.71, 3.39]); report attempted suicide (*OR* = 1.48; 95% CI = [1.01, 2.16]); report CSA (*OR* = 1.56; 95% CI = [1.09, 2.22]); report greater severity of CSA (*OR* = 1.20; 95% CI = [1.03, 1.41]); self-report drug dependency (*OR* = 1.567; 95% CI = [1.069, 2.297]); and be older (*OR* = 1.04; 95% CI = [1.02, 1.05]) than nonobese individuals. Though self-reported drug dependence was related to obesity, the TCU-II Drug Screen scores were not significantly related to obesity. Psychopathy was negatively related to obesity (*OR* = .983; 95% CI = [.969, .996]).

Childhood neighborhood characteristics, having been a witness to violence during childhood, childhood physical abuse, childhood emotional abuse, abuse during adulthood, TBI by age 15, number of TBIs by age 15, total number of TBIs during their lifetime, total number of neurological history reports, social support during childhood, and WRAT reading were all not significantly related to obesity with simple logistic regression analysis. Furthermore, mental health conditions including anxiety trait, depression, antisocial behavior, and schizophrenia also were all not significantly related to obesity. Though smoking was not significantly related to being obese, having reported health problems from smoking was significantly related to obesity.

Because obesity was found to be particularly prevalent in females, additional analyses compared the main significant variables between genders (Table 4). Adjusting for aggression, suicide attempts, smoking-related problems, age, number of TBIs per subject, psychopathy, and self-report of drug dependence, CSA remains a significant risk factor of adult obesity (*OR* = 1.677; 95% CI = [1.076, 2.613]). If included, female gender was significantly related to obesity. However, CSA is no longer significantly associated with obesity when gender is included in the model. Including gender in the model weakens the association between CSA and obesity possibly because females had a higher mean BMI and they were more likely to have been victims of CSA. Females were also more likely to have experienced greater severity of CSA, attempt suicide, and self-report drug dependency, and they had higher mean TCU Drug Screen II scores than males.

Discussion

Our findings of obesity prevalence in 33.3% of prisoners are consistent within the confidence interval of 34.9% (95% CI = [32.0%, 37.9%]) of the general population of adults who are reported to be obese (Ogden et al., 2014). However, this was not the case for females who had a mean BMI of 29.7, with 43.1% being obese, consistent with a report from another female inmate population (Brewer-Smyth, 2014). The disparities we found of increased obesity for non-Caucasian prisoners are consistent with reports from others (Houle, 2011; Leigey & Johnston, 2015; Shah, Plugge, & Douglas, 2011). This disparity in obesity can play a role in disparities of other conditions that are greater for non-Caucasians and women (Warner & Brown, 2011).

Our findings of increased risk of obesity for females and those older in age are consistent with others who reported higher rates of obesity among women compared to men in prison (Bai, Befus, Mukherjee, Lowy, & Larson, 2015; Herbert, Plugge, Foster, & Doll, 2012) and a significant increase in obesity in women in the general population aged 60 years and older over the past decade (Ogden et al., 2014). Our findings are also consistent with those from a female prison population in a mid-Atlantic state where CSA and suicide attempts were related to higher BMI, while TBIs and childhood physical abuse were not (Brewer-Smyth, 2014). This current study provides additional new information about obesity by including TBIs, other childhood adversities, and mental health conditions in the analysis with a larger sample including adult men and women from a southern state prison.

Mental health conditions were not significantly related to obesity, except psychopathy, suicide attempts, and self-reported drug dependence. Though self-reported drug dependency was significantly related to obesity, substance dependency as measured by the TCU Drug Screen-II was not. This discrepancy could be related to alcohol also being measured in the TCUDS-II. Both drug use measures were higher in females. Because drug dependence was determined by participant self-reports of behaviors prior to incarceration, it is possible that emotional eating or food addiction replaced drug addiction after incarceration. Interestingly, as psychopathy scores increased, obesity risk decreased, although the strength of association is weak. Having a history of suicide attempts, which are likely to occur as a result of CSA, also indicates risk for adult obesity. Adjusting for aggression, suicide attempts, smoking-related problems, age, psychopathy, self-report of drug dependence, and number of TBIs per subject, CSA remains significantly related to obesity in our sample. Though others reported that both severe childhood physical abuse and severe CSA were associated with roughly 90% increases in food addiction risk (Mason, Flint, Field, Austin, & Rich-Edwards, 2013), CSA was the only childhood abuse variable that was significantly related to obesity in this current study. Smoking was not related to obesity; however, having reported health problems related to smoking was a risk factor for obesity.

This sample population strengthens the study because prison inmates in both the obese and non-obese group generally had the same environmental exercise and diet opportunities, which suggests that obesity related to early life adversity could potentially result from physiological changes. Physiological mechanisms linking the stress of CSA and obesity are complex. High stress has been related to greater BMI and greater emotional eating (Tomiyama, Dallman, & Epel, 2011). Both drug-addicted and obese (or food addicted) individuals suffer from impairments in dopaminergic pathways that regulate neuronal systems associated not only with reward sensitivity and incentive motivation but also with conditioning, self-control, stress reactivity, and interoceptive awareness (Volkow, Wang, Tomasi, & Baler, 2013). The hypothalamic–pituitary–adrenal axis that regulates stress responses associated with childhood abuse and violent behavior of female prison inmates (Brewer-Smyth & Burgess, 2008; Brewer-Smyth et al., 2004) also regulates food intake, linking stress to eating (Maniam & Morris, 2012). Persistent stress exposure may alter the brain’s response to food in ways that predispose individuals to poor eating habits that, if sustained, may increase risk for obesity (Tryon, Carter, Decant, & Laugero, 2013). This could occur due to the stress of incarceration.

The weight-regulating hormones leptin, which decreases appetite, and irisin, which mediates glucose metabolism, have both been shown to likely play an important role in the pathogenesis of obesity and regulation of adiposity in individuals with early-life adversities (Joung et al., 2014). This could explain why the same diets and exercise regimens may not be equally effective in reducing obesity in all individuals. Furthermore, obese individuals have acknowledged using obesity to reduce their sexual fears (Felitti, 1993). Nonetheless, correctional health care providers must remain vigilant in promoting healthy diets and exercise for inmates in order to do the most that is possible to counter physiological and psychological outcomes of childhood stress that contribute to obesity. Evidence suggests that female prisoners are supplied with diets designed for males with a substantial excess of total energy; and both male and female prisoners were provided diets high in carbohydrates with an excess percentage energy intake as fat, while sodium intake was about 2 to 3 times the recommended intake in prisons (Herbert et al., 2012). Furthermore, prisoners in high-income countries can purchase extra snacks, which tend to be high calorie, high carbohydrate, and salt rich, which further exacerbate this problem. Though they are costly, advocating for fresh fruits and vegetables in the diets of inmates may prevent longer term costs.

The amount and types of physical activity that occurs in prisons are not well documented. Yet promoting exercise is also an area where correctional health care providers can be advocates to reduce long-term obesity-related costs.

Prevention of CSA and identification of victims as early as possible are necessary for providing an opportunity for the prevention of obesity-promoting behaviors. Confronting CSA is a difficult and complicated endeavor that goes beyond the scope of this article, though it has been addressed by others (Crosson-Tower, 2015). The high prevalence of mental health conditions and history of adversity, in addition to obesity and obesity-related ailments, underscore the physical and mental health care needs among inmates.

Limitations/Strengths

Although causality cannot be determined by this study design, these findings suggest that CSA and attempting suicide are significant risk factors for adult obesity, especially for older female non-Caucasian prison inmates. Though prospective studies are preferred over retrospective recall during onetime interviews, the cross-sectional cohort design of this study is less costly and less time-consuming. Childhood adversity such as CSA, drug dependence, and suicide attempts did, however, occur in the correct temporal sequence prior to our measurement of adult obesity. Further prospective studies are needed.

In addition, it was not possible to determine an accurate length of time that each participant was incarcerated prior to this interview. This was because some served jail or federal prison time that may not be accurately accounted for in these state prison records. Others were juveniles at the time of incarceration where information was managed differently than it was after they became adults. When an inmate is paroled then violates parole and is reincarcerated or when sentences are revised, this leads to erroneous ‘‘time served’’ estimates. Future prospective studies could address this.

This current study is, however, strengthened because participants did not know that their responses would be evaluated in relation to their BMI. Furthermore, there was no secondary gain to provide false information because inmates were informed prior to participation that their responses would have no influence on their parole or anything related to their sentence or treatment at the prison.

Conclusions

To prevent costly obesity-related health problems in prisons, it is critical to prevent and address obesity in this population by recognizing those at risk. To the best of our knowledge, this is the first study to evaluate obesity in both genders of incarcerated prison inmates and the relationship between obesity and prevalent problems in prisons, such as TBIs, other mental health conditions, and childhood adversity, in order to identify those at risk for obesity. Obesity is especially prevalent in older women who are not Caucasian. CSA is a very serious, prevalent problem that could potentially be contributing to obesity and costly obesity-related conditions throughout the life span. Suicide attempts indicate risk for obesity most likely because suicide attempts are significantly related to CSA and are indicators of self-deprecation that may result in behaviors leading to obesity, such as self-medication coping with emotional eating or food addiction. Obesity also may result from metabolic conditions and developmental neurobiology associated with CSA. Furthermore, drug dependence may have similar neurobiological pathways as food addiction, explaining links to obesity.

Based on these findings, correctional health care providers must understand that victims of CSA and those who have attempted suicide are at risk for obesity as they age, especially if they are female and not Caucasian. Obesity that can result from CSA could have both physiological and psychological mechanisms related to the stress of childhood abuse. It is therefore important to recognize those at risk and provide psychological counseling and psychiatric care for victims of childhood abuse to assist in addressing the underlying etiologies of obesity. Those at risk should be targeted with exercise programs, nutrition counseling, and regular assessment of their abdominal girth and weight. Weight management support groups may also be beneficial. To address the prison obesity epidemic, efforts must focus on preventing CSA, suicide attempts, and drug dependence, while identifying and rehabilitating those at risk, such as adult victims of CSA victims.

Further studies should be prospective in order to more accurately measure differences in diet, physical activity, and sleep, which could influence the neuroendocrine system and metabolism contributing to obesity. Further research is also needed to better understand gender and race disparities. Along with BMI, future studies should also consider metabolic syndrome and central obesity measured by abdominal girth, which could show greater links between obesity and mental health conditions. Further studies of the physiological and psychological mechanisms underlying CSA and obesity would be especially beneficial for female inmates in order to optimize modifiable risk reduction. This could identify potential physiological measures along with BMI that could be markers of obesity risk reduction for use with interventional studies.

Though it is critical to identify individuals with these risk factors for obesity in prison in order to prevent obesity, obesity was already prevalent in inmates newly admitted to a maximum-security prison, and obesity was already significantly associated with diabetes, asthma, and cardiovascular conditions in this population (Bai et al., 2015). Yet importantly, because people frequently cycle in and out of prison, contact with correctional health care providers is a public health opportunity to keep this vulnerable population healthy, especially to prevent obesity that increases the risk for many other conditions leading to health decline. The challenge is to assure that prisons promote healthy diets, adequate exercise, and counseling related to CSA and general health. The costs of failing to seize this public health opportunity could be astronomical for individuals, correctional health care systems, and society.

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Table 1

Childhood Physical, Emotional, and Sexual Abuse Measures.

Before age 18 were you . . .	
Childhood physical abuse	
1	punched, kicked, choked, shoved, slapped in the face with an open hand, or purposely burned
2	hit or spanked with an object like a belt, fly-swatter, board, cord, coat hanger or had an object thrown at you
3	tied up or locked in a closet, trunk, or other small space<1br>Total Childhood Physical Abuse score (score range: 0–3)
Childhood emotional abuse	
1	put down or ridiculed, treated in a cold and uncaring way, ignored, or told that you were stupid, ugly, no good, or unwanted
2	parent or caregiver get out of control and yell, scream, or curse at you
3	parents or caregivers failed to meet your basic needs, such as making sure you had food, clothing, shelter, etc.<1br>Total Emotional Abuse score (score range: 0–3)
CSA	
1	touched on the private parts of your body, for example, your breasts, thighs, crotch, or genitals, in a way that was unwelcome or made you feel uncomfortable
2	forced or persuaded to touch another person’s private parts or have someone rub their private parts against you
3	anyone perform, or have you perform, anal, genital, or oral sex on him or her against your will or for drugs or money
	Total Sexual Abuse score (score range: 0–3)

Table 2

Demographics.

Measure	BMI < 30 (*n* = 419)Mean ± *SD* or *n* (%)	BMI ≥ 30 (*n* = 210)Mean ± *SD* or *n* (%)	*p*
Age	35.1 ± 9.92	38.5 ± 9.72	<.001
Gender			
Male	242 (58)	76 (36)	<.001
Female	177 (42)	134 (64)	
Race			
Black	218 (52)	122 (58)	.022
White	174 (42)	66 (31)	
Other	27 (6)	22 (10)	
Employment			
Employed	258 (65)	108 (56)	.026
Unemployed	138 (35)	86 (44)	
Smoking			
Never smoked	354 (85)	167 (80)	.078
Smoked	62 (15)	43 (21)	
Substance dependency (TCUDS-II)			
Had dependency	221 (53)	125 (60)	.136
Did not have dependency	194 (47)	85 (40)	
Drug-dependency self-report			
Had dependency	85 (20)	60 (29)	.02
Did not have dependency	333 (80)	150 (71)	
CSA			
Was not abused	295 (72)	127 (62)	.015
Was abused	115 (28)	77 (38)	
WRAT-III reading level	9.1 ± 3.22	8.9 ± 3.27	.430
Traumatic brain injury	1.5 ± 1.68	1.6 ± 1.53	.540
Psychopathy	55.3 ± 12.77	52.6 ± 11.51	.012

Note. BMI = body mass index; TCUDS-II = Texas Christian University Drug Screen-II; WRAT-III = Wide Range Achievement Test–Third Edition.

Table 3

Logistic Regression Comparing Those With BMI ≥ 30 to Those With BMI < 30.

Unadjusted				
Measure	**Sig.**	**Odds Ratio**	**95% CI**	
Age	<.001	1.035	1.018	1.053
Female gender	<.001	2.411	1.713	3.393
Race: Black vs. Caucasian	.034	1.475	1.030	2.114
Race: Other vs. Caucasian	.017	2.148	1.444	4.034
Psychopathy	.012	0.983	0.969	0.996
Drug-dependency self-report	.021	1.57	1.069	2.297
Drug dependency (TCUDS-II)	.137	1.291	0.922	1.807
Severity of CSA	.021	1.204	1.028	1.409
CSA (yes/no)	.015	1.555	1.090	2.220
Suicide attempt	.043	1.477	1.012	2.157
Total aggression	.056	0.993	0.985	1.000
Verbal aggression	.003	0.945	0.910	0.980
Physical aggression	.022	0.977	0.958	0.997
Smoking	.079	0.680	0.442	1.046
Smoking-related problems	.023	1.644	1.071	2.525
Number of TBIs per subject	.539	1.032	0.933	1.141
Childhood neighborhood adversity	.914	1.005	0.914	1.106
Witnessed violence by age 18	.111	0.760	0.542	1.065
TBI by age 15	.694	0.928	0.641	1.345
Childhood physical abuse	.904	1.013	0.823	1.247
Childhood emotional abuse	.263	0.908	0.767	1.075
Childhood social support	.094	1.022	0.996	1.048
WRAT-III reading level	.429	0.979	0.930	1.031
Abuse as an adult	.096	1.155	0.975	1.369
Antisocial personality disorder	.545	0.998	0.990	1.005
Schizotypal personality disorder	.970	1.000	0.994	1.006
Borderline personality disorder	.850	0.999	0.994	1.005
Impulsivity	.157	0.904	0.786	1.040
Anxiety	.395	0.998	0.993	1.003
Depression	.860	1.000	0.995	1.005
Cognitive dysregulation	.979	0.996	0.755	1.314
Behavioral dysregulation	.323	0.878	0.677	1.137
Emotional dysregulation	.746	0.961	0.757	1.221

Note. BMI = body mass index; TCUDS-II = Texas Christian University Drug Screen-II; WRAT-III = Wide Range Achievement Test–Third Edition; TBI = traumatic brain injury.

Table 4

Gender Differences.

Variable	Females (*n* = 316) *n* (%) Mean ± *SD*	Males (*n* = 320)*n* (%) Mean ± *SD*	*p*
Body mass index	29.7 ± 6.7	26.97 ± 4.5	<.001
Obese—body mass index ≥ 30	134 (43.1)	76 (23.9)	<.001
Age	36.9 ± 9.4	35.5 ± 10.5	.07
Race: Black	140 (44.3)	204 (63.75)	<.001
Race: Other	30 (9.49)	20 (6.25)	
Race: Caucasian	146 (46.2)	96 (30)	
CSA (yes/no)	158 (51.6)	35 (11.3)	<.001
Severity of CSA	1.06 ± 1.19	0.19 ± 0.60	<.001
Suicide attempt	120 (38.2)	32 (10.1)	<.001
Psychopathy	53.6 ± 11.9	55.0 ± 12.9	.16
Drug-dependency self-report (0 = *no*, 1 = *yes*)	94 (29.75)	53 (16.61)	<.001
Substance dependency (TCUDS-II)	188 (59.70)	160 (50.5)	.02
Verbal aggression	15.2 ± 4.6	15.7 ± 4.5	.17
Physical aggression	22.0 ± 8.9	25.2 ± 7.9	<.001
Total aggression	79.1 ± 23.6	82 ± 21.6	.097

Note. TCUDS-II = Texas Christian University Drug Screen-II.