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Is exposure to family member incarceration during childhood linked to diabetes in adulthood? Findings from a representative community sample

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Abstract

Objectives: Diabetes is a prevalent and serious public health problem, particularly among older adults. A robust literature has shown that adverse childhood experiences contribute to the development of health problems in later life, including diabetes. Family member incarceration during childhood is an under-investigated yet increasingly common adverse childhood experience in the United States. The purpose of this study was to investigate the relationship between family member incarceration during childhood and diabetes in adulthood, while considering the role of gender as well as the impact of a range of potential confounds.

Methods: A large representative community sample of adults aged 40 and older (n = 8790 men, 14,255 women) was drawn from the Behavioral Risk Factor Surveillance System 2012 optional adverse childhood experiences module to investigate the association between family member incarceration during childhood and diabetes. For each gender, nine logistic regression analyses were conducted using distinct clusters of variables (e.g. socioeconomic status and health behaviors).

Results: Among males, the odds of diabetes among those exposed to family member incarceration during childhood ranged from 2.00 to 1.59. In the fully adjusted model, they had elevated odds of 1.64 (95% confidence interval = 1.27, 2.11). Among women, the odds of diabetes was much lower, hovering around 1.00.

Conclusion: Findings suggest that family member incarceration during childhood is associated with diabetes in men, even after adjusting for a wide range of potential risk factors (e.g. sociodemographics, health behaviors, healthcare access, and childhood risk factors). Future research should explore the mechanisms linking family member incarceration during childhood and long-term negative health outcomes in men.

Keywords

Diabetes, endocrinology, risk factors, gender, adverse childhood experiences, incarceration

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Introduction

Diabetes mellitus is an increasingly common and serious public health problem, particularly among older adults. Approximately one-quarter of American adults over age 65 have diabetes and almost half have prediabetes.[1] Diabetes is a chronic disease associated with inflammation and metabolic dysfunction and is characterized by chronic hyperglycemia (high blood sugar) secondary to impaired insulin production, secretion, and/or sensitivity.[2] There are two predominant persistent types of diabetes. Type 1 is far less prevalent, typically develops in childhood or adolescence, and is

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an idiopathic autoimmune disorder wherein pancreatic beta cells, which produce insulin, are destroyed by one's own immune system.[2] The vast majority (approximately 95%) of all cases of diabetes are type 2, which typically onsets in mid to late life and involves a combination of hepatic or peripheral insulin resistance and beta cell dysfunction, contributing to an inability to suppress glucose production, inadequate glucose uptake, and relative insulin deficiency.[2,3]

Diabetes is among the leading causes of death for those over age 65 and projections suggest the prevalence of diabetes in the United States will at least double over the next three decades, with up to one-third of citizens diagnosed with the disease by 2050.[4,5] Diabetes also represents a substantial economic burden. In 2012, in the United States, the estimated combined direct and indirect costs associated with diagnosed diabetes was approximately US$245 billion annually, which fails to account for the less tangible yet substantial psychosocial burden, including effects on patients' quality of life and impacts on loved ones.[6] Given the magnitude of this problem and significant impacts on mortality and morbidity, further research to better understand etiological risk factors for diabetes is warranted.

Whereas sociodemographic, familial, and proximal lifestyle and physical health risk factors for diabetes have been identified (e.g. being older, obese, sedentary, or of a non-European American race or ethnicity increases risk of type 2),[5] far less is known about distal influences. However, over the past two decades, a body of literature has demonstrated that adverse childhood experiences (ACEs) including neglect, abuse, and household difficulties not only disrupt a child's experience of stability, safety, and nurturance, but also contribute to the development of various health problems in adulthood.[7–9] While there has been limited empirical investigation of the relationship between early adversities and diabetes, a recent systematic review and meta-analysis of seven studies totaling over 87,000 participants found that exposure to certain ACEs—specifically, physical and sexual abuse, neglect, and wartime evacuation and separation from parents—increased the risk of developing diabetes later in life by 32% on average, with neglect having the strongest impact and physical abuse the lowest among these ACEs.[10]

Exposure to the incarceration of a family member during one's childhood is an under-investigated yet increasingly common ACE for children in the United States. The prevalence of incarceration has dramatically increased in recent decades,[11] and many state and federal inmates are parents of youth under the age of 18.[12] Although the experience of family member incarceration during childhood (FMIC) may have beneficial aspects in terms of reducing child exposure to parental criminal activity and associated risks, the impact of incarceration itself is disruptive to family stability, including marriages, jobs, and housing.[13] Improving the understanding of the long-term biopsychosocial and physical health impacts of FMIC can help inform clinical approaches to assessment and intervention with FMIC-exposed individuals, as well as criminal justice reform.

A growing literature supports the link between FMIC and both psychosocial and physical health outcomes. Recent investigations suggest that FMIC predicts a variety of health concerns related to inflammation, such as asthma, elevated cholesterol,[14] and myocardial infarction.[8]

Early adverse experiences may influence later life health outcomes via interwoven biopsychosocial processes that unfold over the course of development.[7] Because "health is not a state but a lifetime achievement,"[15] the life-course approach is a useful theoretical framework for understanding pathophysiology, particularly for diseases with multiple etiological influences that interact over the course of development. The life-course model helps to identify exposures at critical developmental stages that may elevate disease risk in later life and informs early intervention efforts and the development of policies that can improve health trajectories.[16]

Current theories of biological impacts of stressors support the expectation that ACEs would increase the risk of diabetes in later life. In particular, Hertzman's theory of biological embedding proposes that early adversities can disrupt the development of systems involved in stress and inflammation response (e.g. the hypothalamus–pituitary–adrenal axis), chronically altering the individual's metabolic and inflammatory responses to stressors (e.g. as indexed by elevated C-reactive protein),[17] which can in turn lead to organ system dysfunction and pathology.[18] While the etiology of diabetes is not fully elucidated, emerging literature implicates the contribution of inflammatory processes in insulin resistance and metabolic dysfunction.[19] Further supporting this perspective, ACEs have been shown to be associated with dysregulated stress responsivity in adulthood, including elevated inflammation,[15] which in turn appears to contribute to the development of metabolic disorders, including diabetes.[20] Furthermore, oxidative stress, defined as an imbalance between the production of free radicals (reactive oxygen species) by subcellular components (e.g. mitochondria) and their neutralization by antioxidants, is similarly associated with both early adversity and with the pathogenesis of type 2 diabetes.[21,22]

Despite the prevalence of incarceration in the United States, few studies on ACEs have considered the experience of FMIC as a potential risk factor for physical health problems in later life.[8] For instance, the aforementioned systematic review of ACEs and diabetes did not report on any studies examining FMIC.[10] Furthermore, much of the existing research on the role of ACEs in diabetes is based on clinical samples and does not control for a number of potentially confounding variables.[7,23] One recent study on health effects of parental incarceration in young adults (mean age 28.8 years; n = 15,701) did consider diabetes.[14] Parental incarceration was common in this sample (12.5%), predominantly of fathers (85%). However, no association was observed between parental incarceration and diabetes, perhaps because diabetes prevalence was quite low (2.6%), although parental incarceration was associated with other

more prevalent physical health effects (e.g. elevated cholesterol, asthma, migraines).[14]

There is growing evidence that ACEs may differentially impact long-term health outcomes based on gender, with impacts being stronger for men.[8,24] Men appear to be especially vulnerable to biological embedding of early adversities and they exhibit more cortisol reactivity to stress than do women.[25,26] In addition, studies suggest that stress is associated with a reduction in testosterone levels in men and that the cortisol-to-testosterone ratio is associated with insulin resistance syndrome.[27,28] Furthermore, men are incarcerated in the United States at much higher rates than women, and the majority of these men have children under age 18.[12] Incarceration interferes with the ability of fathers to maintain contact with children,[29] and loss of contact with fathers may be particularly impactful on their sons,[30] interfering with emotion regulation and ability to cope with daily stressors into adulthood. Men who experienced paternal absence in childhood tend to have elevated cortisol levels, in contrast to women who experienced paternal absence.[31] Finally, girls and women are more likely to pursue psychosocial support following adversities than are boys and men.[32]

Objectives

Based on the conceptual and empirical foundations discussed above, the purpose of this study was to investigate the relationship between FMIC and diabetes in adulthood using a representative community sample of adults, while considering the role of gender as well as the impact of various potential confounds, detailed below, on these relationships. Our goal was to test two hypotheses: (1) FMIC will be associated with diabetes even after controlling for many of the known diabetes risk factors and (2) the FMIC–diabetes relationship will be stronger for men than for women.

Diabetes risk factors

Younger adults are more likely to experience FMIC as a result of growing rates of incarceration in the last 40 years.[33] Also, African Americans and Hispanics experience more FMIC exposure than non-Hispanic Whites.[34] Gender, race, and age are all related to diabetes risk. Men have a higher prevalence of type 2 diabetes than women, and the prevalence of diabetes tends to peak among individuals aged 65 and older.[3] Those from historically underrepresented and underserved racial and ethnic groups experience diabetes at greater prevalence compared to non-Hispanic Whites, with the highest risk reported among Aboriginal people.[3] FMIC is associated with lower levels of education and lower average household income in adulthood.[35,36] There is likewise an association between lower socioeconomic status (SES) and type 2 diabetes prevalence.[37] The same relationship exists for educational attainment and risk of type 2 diabetes.[38]

FMIC has been linked to high levels of cigarette smoking in adulthood,[39] and smoking increases the risk of developing diabetes.[40] Some research supports a link between FMIC exposure and obesity as well as lower physical activity,[41] although other research has not observed such associations.[33] Obesity is known to contribute to type 2 diabetes development.[42] Sedentary lifestyle is also associated with diabetes, independent of obesity.[43] FMIC predicts early adulthood depression.[14] Research has shown a bidirectional association between diabetes and depression.[44]

Children exposed to FMIC experience other difficult circumstances at home, some of which are directly or indirectly related to the incarceration of a family member. Problems with impulse control, substance use problems, and domestic violence are more common among men who ultimately are incarcerated,[45] and incarceration itself can also lead to the development of substance use disorders and depression.[46] Parental depression appears to be inversely associated with diabetes-related outcomes in adulthood. For instance, living with a depressed mother or father is associated with having a lower body mass index (BMI) in middle adulthood.[47] Paternal depression is likewise associated with better glucose control, as indicated by lower glycosylated hemoglobin levels.[47] To our knowledge, no prior studies have looked specifically at the relationship between parental substance abuse and diabetes risk in adulthood. However, exposure to parental alcoholism has been linked to adult obesity.[48] Additionally, witnessing parental domestic violence increases the likelihood of being diagnosed with diabetes and obesity in adulthood.[47,49]

Marriage can provide socioemotional support with physical health benefits, particularly for men.[50] However, to our knowledge, the relationship between marital status and FMIC has not previously been the focus of empirical investigation, thus it is unclear what role FMIC may play in marriage. A large prospective study reported increased risk of type 2 diabetes onset among widowed men compared with married men.[51] Neither divorced/separated men nor never married men had an elevated risk of incident type 2 diabetes compared with married men.[51] Widowhood has similarly been shown to be predictive of diabetes status in cross-sectional Australian cohorts.[52] In contrast, other prospective research has not found marital status to predict diabetes among obese men and women.[53]

Those who are exposed to FMIC likely experience reduced access to a primary doctor or health insurance because FMIC has deleterious socioeconomic effects on the family.[34] The relationship between medical care access and diabetes may be multifaceted. Previous research has suggested that adults with diabetes have higher rates of health insurance coverage compared to those without diabetes.[54] However, nationally representative research suggests that an estimated 16% of US adults with known diabetes are uninsured.[55] Lack of insurance coverage is associated with under-diagnosis of diabetes and poorer diabetes management.[55]

Methods

Data source and sample

As has been described elsewhere,[8] we used data derived from a large representative data set of the CDC's Behavioral Risk Factor Surveillance System (BRFSS) to test our hypotheses.[56] Computer-assisted telephone interviews were used to collect data over the phone from a large, representative sample of non-institutionalized adults living in households using telephone landlines and cellular phones across all 50 states, the District of Columbia, and three US territories.[56]

Secondary data analysis of the 2012 optional ACE module was used for this study. The module, adapted from the original CDC-Kaiser ACE study,[7] was answered by respondents aged 18 and older in five states (response rates): Iowa (56.8%), Tennessee (45.4%), North Carolina (40.4%), Oklahoma (47.8%), and Wisconsin (50.4%).[56] To focus on adulthood risk for diabetes, data for BRFSS participants aged 40 and older were included. Those with missing data on any of the variables in the analysis were excluded (6.9% missing for men; 6.4% missing for women).

Measures

FMIC exposure. Respondents with a positive history of FMIC before the age of 18 were identified through a response of "once" or "more than once" to the following question: "Did you live with anyone who served time or was sentenced to serve time in a prison, jail, or other correctional facility?" Individuals reporting "never" or "don't know/not sure" to the latter question were categorized as not experiencing FMIC.

Outcome. A history of diabetes was determined by a "yes" response to a question of whether "a doctor, nurse, or other health professional had ever told you had diabetes?" We only counted self-reported diabetes diagnosis. Respondents who reported prediabetes, borderline, or gestational diabetes were coded as "no."

Control variables. Several demographic characteristics were assessed, including age (categorized as 40–64, 65–79, and 80+ years), gender, and race (dichotomized as non-Hispanic White, vs non-White or Hispanic). Education and household income were used to characterize adult SES. Education was assessed based on the following categories: did not graduate high school, graduated high school, attended college or technical school, and graduated from college or technical school. Household income, reported in 2012 dollars, was categorized as less than US$15,000, US$15,000–25,000, US$25,000–50,000, US$50,000–75,000, and above US$75,000.

Childhood risk factors were based on participants' responses to questions regarding experiences before the age of 18, including parental substance abuse (endorsement of "Did you live with anyone who was a problem drinker or alcoholic?" and/or "Did you live with anyone who used illegal street drugs or who abused prescription medications?"), mentally ill family member ("Did you live with anyone who was depressed, mentally ill, or suicidal?"), exposure to domestic violence ("How often did your parents or adults in your home ever slap, hit, kick, punch, or beat each other up?" dichotomized as never vs once or more), physical abuse ("How often did a parent or adult in your home ever hit, beat, kick, or physically hurt you in any way (excluding spanking)?" dichotomized as ever vs never), sexual abuse ("How often did anyone at least 5 years older than you or an adult, ever touch you sexually?" dichotomized as ever vs never), and verbal abuse ("How often did a parent or adult in your home ever swear at you, insult you, or put you down?" dichotomized as one time or less vs two times or more).

The health risk behaviors controlled in this study were BMI, smoking status, and physical activity level. Self-reported weight in kilograms (kg) was divided by self-reported height in squared meters (m^2) to define BMI, which was then categorized into ranges defining normal weight (BMI $<25\,kg/m^2$), overweight (BMI $=25–29.99\,kg/m^2$), and obese (BMI $=30\,kg/m^2$ or higher). Respondents who endorsed smoking at least 100 cigarettes in their entire life were classified as smokers and those who smoked less than 100 were classified as non-smokers.[57] Physical activity was dichotomized as having, in the past month, exercised outside of work or not.

Marital status was categorized as being either married or common-law versus being single, divorced, separated, or never married. Depression history was dichotomized based on participant response to the question of whether one had ever been told by a doctor, nurse, or other health professional that he or she had a depressive disorder, including depression, minor depression, dysthymia, or major depression. Finally, healthcare access was measured based on responses to two items: whether or not the respondent had current healthcare coverage insurance, including prepaid or government plans, and how many persons they think of as their "personal doctor or health care provider" (zero vs one or more).

Statistical analyses

The purpose of the analyses was to determine the odds of diabetes for individuals who reported FMIC. Of particular interest was the degree to which potential confounds might attenuate the relationship between FMIC exposure and diabetes. Logistic regression analyses were conducted separately for men and women, with FMIC as the focal exposure and diabetes as the outcome. We applied a weighting variable that was constructed by the CDC to correct for non-response and likelihood of selection in order for the sample to be representative of community dwellers in each of the five states. This weighting variable was then rescaled to a mean of 1 for the subsample, which is the standardized technique of normalizing weights so as to avoid falsely narrowing the confidence intervals (CIs).

Each model included age and race as well as FMIC. The first model included only age and race. The second model also adjusted for childhood risk factors, the third for health behaviors, the fourth for adult SES, the fifth for depression, the sixth for marital status, the seventh for healthcare access, the eighth for state of residency, and the final model fully adjusted for all the aforementioned variables.

We conducted a sensitivity analysis to determine if the odds of diabetes among those with FMIC varied if we included prediabetes and borderline diabetes, and for women, gestational diabetes in the dependent variable. We found that the estimated odds ratios associated with FMIC were quite comparable. Among men, the odds of the more inclusive diabetes variable were slightly more elevated and remained statistically significant. For example, among men, when prediabetes and borderline diabetes were included in the outcome variable, the odds of diabetes among those with FMIC were 1.70 (95% CI = 1.33, 2.17). When those with prediabetes and borderline diabetes were excluded from the analysis, the odds of diabetes in the fully adjusted model (Model 9) among those with FMIC were 1.64 (95% CI = 1.27, 2.11).

Results

As shown in Table 1, 16.6% of men and 13.8% of women in the sample had diabetes. Among men, those with diabetes were much more likely to have had FMIC exposure than those without diabetes (7.9% vs 4.8%, $p < 0.001$). Among women, FMIC was not significantly associated with diabetes in the bivariate analysis ($p = 0.075$). For both women and men, the prevalence of FMIC was higher among younger respondents, Hispanic or non-White respondents, compared to non-Hispanic White, those with less than a high school education, those with lower income, and single/divorced/separated respondents. Those who had been exposed to adverse childhood events had a much higher prevalence of FMIC exposure as well and this was evident for all six forms of childhood adversities examined (i.e. parental substance abuse, parental mental illness, parental domestic violence, childhood physical abuse, childhood sexual abuse, childhood verbal abuse). Ever smokers, those with depressive disorders, and those who were without healthcare coverage or a personal doctor also had a higher prevalence of FMIC. Of the five states included in this analysis, the prevalence of FMIC was highest in Tennessee. Women who were obese and who did not exercise regularly also reported a higher prevalence of FMIC exposure, but these two factors were not statistically significant for men.

As shown in Figure 1, across nine different models, FMIC exposure was robustly associated with elevated odds of diabetes among men. These odds ranged from a low of 1.59 (for the model adjusting for adult SES) to a high of 2.00 (for the model adjusting for healthcare access). In the fully adjusted model that included all of the variables in the previous eight models, the odds of diabetes were 1.64 for those reporting FMIC ($p < 0.001$).

As shown in Figure 2, for women, the first eight logistic regression models hovered around 1, ranging from 0.99 to 1.27. In the fully adjusted model, which took into account 18 variables, the odds declined to 0.77.

Table 2 provides two logistic regression models for each gender: the first logistic regression adjusts for age and race only (Model 1 in Figures 1 and 2), and the second provides the fully adjusted model (Model 9 in Figures 1 and 2). Table 2 shows a large number of characteristics associated with diabetes in both men and women. These include older age, Hispanic or non-White ethnicity, lower income, lower levels of exercise, obesity, lifetime history of depression, and not having a personal healthcare professional. Once all the lifestyle and socioeconomic characteristics were taken into account concurrently in the fully adjusted logistic regression analyses, neither marital status, smoking history, nor the six childhood adversity variables (i.e. parental substance abuse, parental mental illness, parental domestic violence, childhood physical abuse, childhood sexual abuse, childhood verbal abuse) were statistically significant for men or women.

In comparison to respondents from Iowa, women from Oklahoma had higher odds of diabetes, and women from Wisconsin had lower odds. Among men, only respondents from Tennessee had significantly higher odds of diabetes than men from Iowa. The more detailed information on the association between FMIC and diabetes for each of the nine logistic regression analyses is provided in Figures 1 and 2.

Discussion

The current investigation sought to examine the impact of an increasingly common yet insufficiently examined early adverse experience, family member incarceration during one's childhood (FMIC), on the development of diabetes mellitus, a prevalent, chronic disease in later life that is among the leading causes of mortality and is associated with inflammation and metabolic dysfunction. Based on a large data set with representative data from five states, and consistent with predictions, we found that the age-race adjusted odds of diabetes were higher for men exposed to FMIC compared to those who had not experienced that childhood adversity.

After adjustment for 18 risk factors that included age, ethnicity, childhood risk factors (i.e. physical abuse, sexual abuse, verbal abuse, parental substance abuse, parental mental illness, and parental domestic violence), as well as adult SES (i.e. income and education), health behaviors (i.e. physical activity, smoking, body mass), marital status, depression, and access to healthcare (i.e. health insurance, personal healthcare provider), the odds of diabetes among those exposed to FMIC in comparison to those not exposed to FMIC remained significantly high. This finding is consistent with the view of life-course and biological-embedding models that suggest exposure to early adversities at critical developmental stages disrupts the development of systems involved in stress and inflammation responses,[15,18] including insulin

Table 1. Unweighted sample sizes and weighted percentages of males and females in the adverse childhood experiences module of the 2012 BRFSS.

Sample characteristics	Men (n = 8790)		p-value	Women (n = 14,255)		p-value
	Total %	% who had FMIC		Total %	% who had FMIC	
Diabetes			<0.001			0.075
Yes (not borderline or gestational)	16.6	7.9		13.8	5.4	
No	83.4	4.8		86.2	4.5	
Demographics						
Age			<0.001			<0.001
40–64 years	73.0	6.3		68.0	5.8	
65–79 years	22.2	2.8		24.4	2.5	
80+ years	4.9	1.6		7.5	1.7	
Race			<0.001			<0.001
Non-Hispanic White	81.4	4.5		82.8	4.0	
Hispanic or non-White	18.6	8.8		17.2	8.0	
Education			<0.001			<0.001
Less than high school	15.0	12.8		12.8	8.9	
High school graduate	30.8	4.2		32.0	4.5	
Some college or technical school	28.9	4.9		31.9	4.9	
College or technical school graduate	25.3	2.6		23.3	2.2	
Household income			<0.001			<0.001
<US$15,000	8.5	12.7		9.6	9.0	
US$15,000–24,999	14.4	8.4		16.5	7.8	
US$25,000–49,999	25.3	5.2		23.5	4.6	
US$50,000–74,999	15.8	4.2		13.9	3.7	
⩾US$75,000	26.3	2.2		20.3	2.4	
Do not know/refused/missing	9.7	4.9		16.2	2.7	
Marital status			<0.001			<0.001
Married/common-law	70.1	4.2		60.7	3.5	
Single/divorced/separated	29.9	7.9		39.3	6.5	
Adverse childhood events						
Parent abused drugs or alcohol			<0.001			<0.001
Yes	23.0	15.7		26.6	13.5	
No	77.0	2.2		73.4	1.4	
Lived with mentally ill household member in childhood			<0.001			<0.001
Yes	10.2	14.5		15.0	12.0	
No	89.8	4.2		85.0	3.3	
Parental domestic violence in childhood			<0.001			<0.001
Yes	15.5	14.3		16.2	14.1	
No	84.5	3.6		83.8	2.8	
Physical abuse			<0.001			<0.001
Yes	13.4	14.5		13.5	12.9	
No	86.6	3.9		86.5	3.4	
Verbal abuse			<0.001			<0.001
Yes	22.3	11.4		22.8	10.5	
No	77.7	3.6		77.2	2.9	
Sexual abuse			<0.001			<0.001
Yes	1.9	17.4		5.4	23.5	
No	98.1	5.1		94.6	3.6	
Health						
Smoking status			<0.001			<0.001
Smoked ⩾100 cigarettes	57.7	6.7		43.8	7.1	
Never smoked 100 cigarettes	42.3	3.3		56.2	2.8	
Exercised in the past month			0.467			<0.001
Yes	73.1	5.2		71.0	4.0	
No	26.9	5.6		29.0	6.2	

(Continued)

Table 1. (Continued)

Sample characteristics	Men (n = 8790)		p-value	Women (n = 14,255)		p-value
	Total %	% who had FMIC		Total %	% who had FMIC	
Body mass index category			0.279			<0.001
Not overweight/obese	21.0	4.9		33.2	3.3	
Overweight	43.7	5.0		30.0	4.1	
Obese	34.5	5.9		30.4	7.0	
Do not know/refused/missing	0.8	5.8		6.4	3.3	
Depressive disorder			<0.001			<0.001
Yes	15.0	10.5		22.0	8.0	
No	85.0	4.4		78.0	3.7	
Healthcare coverage			<0.001			<.001
Yes	88.3	4.5		89.4	4.1	
No	11.7	11.2		10.6	8.9	
Has personal doctor			<0.001			<0.001
Yes	84.3	4.7		91.3	4.4	
No	15.7	8.6		8.7	7.8	
State of residency			<0.001			0.001
Iowa	11.2	4.0		11.6	3.7	
North Carolina	37.2	4.7		37.0	4.9	
Oklahoma	7.4	5.1		7.2	4.5	
Tennessee	22.4	7.8		22.5	5.7	
Wisconsin	21.8	4.3		21.6	3.6	

BRFSS: Behavioral Risk Factor Surveillance System; FMIC: family member incarceration during childhood.

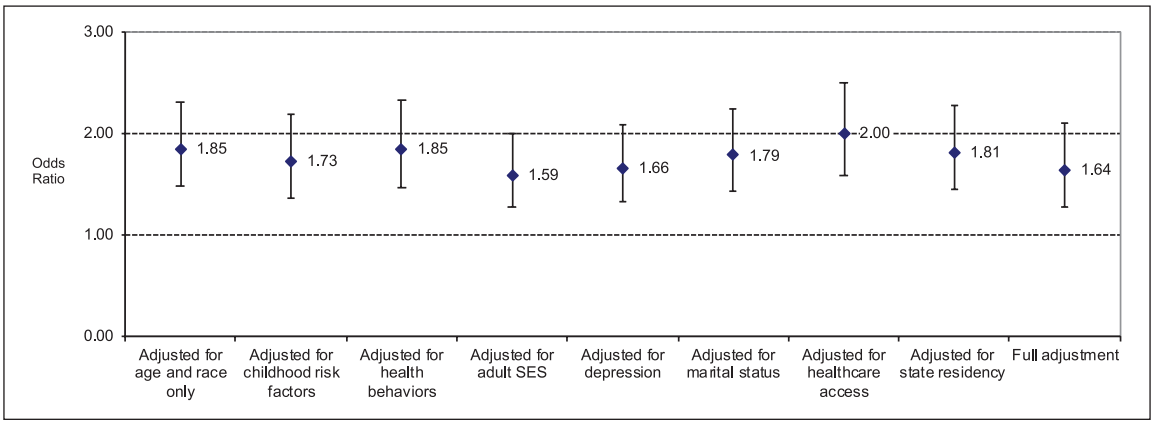

Figure 1. Odds ratio and 95% confidence interval of diabetes among males reporting family member incarceration during childhood. All data are adjusted for age and race. Sample size n = 8790 in all models.

resistance and metabolic dysfunction implicated in the etiology of diabetes.[19,20]

In contrast to men, the odds of diabetes for women hovered around 1.0 for all of the different analyses. An odds ratio of 1.0 indicates that those with FMIC have comparable odds of diabetes to those without. This observed gender difference fits prior evidence suggesting men may be more vulnerable biologically to early adversities than women.[25,28] They may experience stress-related testosterone suppression, which is linked to insulin resistance.[28] Furthermore, incarceration frequently interferes with fathers' contact with children, which may particularly impact their sons' coping with stress,[29,31] and boys and men are less likely than girls and women to seek psychosocial support in response to adverse events.[58]

The findings of this study should be interpreted in light of several limitations. First, data are cross-sectional, thus we are unable to draw causal inferences regarding the relationship between FMIC and diabetes. We are not able to determine what aspects of FMIC-exposed households contribute to boys' negative long-term health. Both our exposure (FMIC) and outcome (diabetes) variables were measured via self-report of exposure and diagnosis, respectively. Notably, prior research

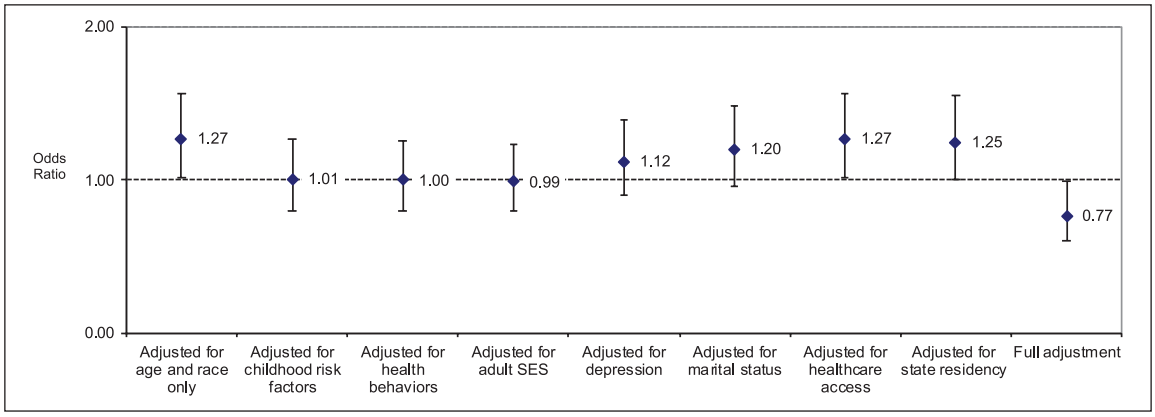

Figure 2. Odds ratio and 95% confidence interval of diabetes among females reporting family member incarceration during childhood. All data are adjusted for age and race. Sample size n = 14,255 in all models.

supports the accuracy of self-report of diabetes, including high agreement with medical records.[59] Although underreporting of FMIC should bias our finding toward the null, external validation of reporting via review of records, including the nature of the crime leading to incarceration, as well as its timing, duration, and frequency would be desirable.[34]

Due to limitations in the BRFSS database, we were unable to control for certain known diabetes risk factors, including diabetic family history, nutritional influences, or serum cholesterol level. With regard to sociodemographic factors, we unfortunately could not control for childhood SES or parental education, which are related to parental incarceration and higher diabetes risk.[37,60] Notable disparities exist among racial and ethnic groups in US incarceration rates,[33] and while we controlled for race, due to power limitations we unfortunately were not able to perform race-specific analyses. A further limitation of the BRFSS data is the absence of information regarding the relationship of the incarcerated family member to the respondent, the age at which the FMIC exposure occurred, as well as the duration of the incarceration. Finally, we did not have information on the gender-specific response rate for each state. It is possible that gendered variation in response rate and/or different response rates by state may have biased the results. Because the response rates may have varied by gender, state, ethnicity, diabetes, and so on, all findings must be interpreted with caution.

As an investigation into how a particular early adversity may impact later development of a serious health condition, this study also has some noteworthy strengths. It is, to our knowledge, the first study to examine the potential impact of FMIC exposure on diabetes with gender-specific analysis using representative data from disparate states. Our findings are consistent with recent evidence for an association between FMIC and myocardial infarction for sons but not for daughters and support the view that, as an ACE, FMIC is linked to important lasting physical health impacts in men.[8] In contrast, among women, FMIC was not a major factor associated with diabetes in adulthood, potentially due to gender differences in psychosocial and biological responses to FMIC, in particular, disruption of contact from fathers, although these proposed mechanisms require further direct investigation.

Conclusion and implications

In this large representative community sample, we found an association between higher odds of diabetes among FMIC-exposed men compared to those without exposure to this form of early adversity. FMIC was not associated with diabetes in women. This research provides a helpful profile of those most susceptible which may be informative for future targeted outreach and intervention.

With regard to criminal justice policy, our findings suggest that the dramatic increase in recent decades of incarceration, particularly in the United States,[11] may have detrimental long-term health effects for individuals exposed to FMIC persisting into later life. These impacts extend beyond previously identified effects on family stability and psychopathology[13] and lend support to consideration of alternatives to current incarceration policies and practices, such as investment in diversion strategies to redirect individuals to community-based rehabilitative programs,[61] facilitating family contact by placing incarcerated individuals in facilities close to their communities,[62,63] and eliminating visitation policies that create excessive burden for family members, such as restrictive visitation hours and prohibitive fees for visitor background checks or for phone calls.[64] Future research should examine the impacts of changing incarceration patterns, such as the growth of the US women's prison population, on children's long-term health.

These findings also have important implications for policies and practices aimed at reducing health inequities in vulnerable populations. With regard to clinical practice, our results suggest that early identification, assessment, and intervention with youth exposed to FMIC, particularly boys, may be beneficial. Given that FMIC appears to confer higher odds

Table 2. Gender-specific logistic regression models of diabetes among respondents reporting versus never reporting family member incarceration during childhood of the BRFSS 2012.

Model	Men (n = 8790)				Women (n = 14,255)			
	Age-race adjusted	p-value	Fully adjusted	p-value	Age-race adjusted	p-value	Fully adjusted	p-value
	OR (95% CI)		OR (95% CI)		OR (95% CI)		OR (95% CI)	
Key variable of interest								
FMIC	1.85 (1.48–2.31)	<0.001	1.64 (1.27–2.11)	<0.001	1.27 (1.02–1.57)	0.032	0.77 (0.61–0.99)	0.039
Control variables								
Age								
40–64	1.00 (Ref.)		1.00 (Ref.)		1.00 (Ref.)		1.00 (Ref.)	
65–79	2.27 (2.00–2.57)	0.001	2.21 (1.91–2.55)	0.001	2.06 (1.85–2.29)	0.001	1.87 (1.66–2.12)	0.001
⩾80	1.88 (1.47–2.40)	<0.001	2.01 (1.53–2.63)	0.001	1.83 (1.54–2.18)	0.001	2.01 (1.65–2.46)	0.001
Race								
Non-Hispanic White	1.00 (Ref.)		1.00 (Ref.)		1.00 (Ref.)		1.00 (Ref.)	
Hispanic or non-White	1.63 (1.42–1.87)	<0.001	1.47 (1.26–1.71)	<0.001	1.89 (1.68–2.12)	<0.001	1.44 (1.26–1.64)	<0.001
Education								
Below high school			1.13 (0.90–1.41)	0.298			1.56 (1.28–1.89)	<0.001
High school graduate			1.04 (0.87–1.25)	0.654			1.23 (1.04–1.45)	0.015
Some college or technical school			1.06 (0.89–1.27)	0.530			1.19 (1.01–1.41)	0.034
College or technical school graduate			1.00 (Ref.)				1.00 (Ref.)	
Household income								
No or <US$15,000			2.14 (1.62–2.81)	<0.001			3.14 (2.46–4.01)	0.001
US$15,000–25,000			2.39 (1.91–2.99)	<0.001			2.53 (2.03–3.15)	0.001
US$25,000–50,000			1.45 (1.19–1.76)	<0.001			2.03 (1.66–2.49)	0.001
US$50,000–75,000			1.41 (1.14–1.74)	0.001			1.23 (0.97–1.55)	0.083
⩾US$75,000			1.00 (Ref.)				1.00 (Ref.)	
Missing data			1.23 (0.95–1.58)	0.118			1.95 (1.57–2.43)	0.001
Childhood adversity								
Physical abuse								
No			1.00 (Ref.)				1.00 (Ref.)	
Yes			0.90 (0.74–1.11)	0.329			1.13 (0.95–1.35)	0.157
Sexual abuse								
No			1.00 (Ref.)				1.00 (Ref.)	
Yes			0.85 (0.54–1.33)	0.476			1.19 (0.96–1.47)	0.117
Verbal abuse								
No			1.00 (Ref.)				1.00 (Ref.)	
Yes			1.14 (0.96–1.35)	0.136			1.09 (0.94–1.27)	0.243
Parental substance abuse								
No			1.00 (Ref.)				1.00 (Ref.)	
Yes			0.96 (0.81–1.13)	0.607			0.90 (0.79–1.03)	0.118
Lived with mentally ill								
No			1.00 (Ref.)				1.00 (Ref.)	
Yes			0.84 (0.68–1.05)	0.126			1.18 (1.01–1.38)	0.038
Domestic violence								
No			1.00 (Ref.)				1.00 (Ref.)	
Yes			1.13 (0.93–1.36)	0.219			0.97 (0.82–1.13)	0.655
Adult health								
Smoker								
Never smoked 100			1.00 (Ref.)				1.00 (Ref.)	
Smoked 100 or more			0.91 (0.80–1.04)	0.170			0.98 (0.88–1.09)	0.737

(Continued)

Table 2. (Continued)

Model	Men (n = 8790)				Women (n = 14,255)			
	Age-race adjusted	p-value	Fully adjusted	p-value	Age-race adjusted	p-value	Fully adjusted	p-value
	OR (95% CI)		OR (95% CI)		OR (95% CI)		OR (95% CI)	
Exercised in past month								
Yes			1.00 (Ref.)				1.00 (Ref.)	
No			1.17 (1.02–1.33)	0.025			1.36 (1.22–1.51)	0.001
Body mass index category								
Not overweight or obese			1.00 (Ref.)				1.00 (Ref.)	
Overweight			1.63 (1.34–1.98)	0.001			2.11 (1.80–2.47)	0.001
Obese			4.53 (3.75–5.48)	0.001			5.17 (4.45–6.01)	0.001
Missing/refused/etc.			1.80 (0.87–3.76)	0.115			3.10 (2.47–3.90)	0.001
Marital status								
Single/divorced/ separated/never married			1.00 (Ref.)				1.00 (Ref.)	
Married			0.90 (0.78–1.03)	0.135			1.00 (0.89–1.13)	0.959
Depressive disorder								
No			1.00 (Ref.)				1.00 (Ref.)	
Yes			1.79 (1.52–2.11)	0.001			1.46 (1.29–1.65)	0.001
Healthcare								
Healthcare coverage								
Yes			1.28 (1.01–1.62)	0.044			1.18 (0.99–1.42)	0.070
No			1.00 (Ref.)				1.00 (Ref.)	
Number of healthcare professionals								
0			1.00 (Ref.)				1.00 (Ref.)	
⩾1			3.06 (2.38–3.93)	0.001			2.35 (1.86–2.98)	0.001
State of residence								
Iowa			1.00 (Ref.)				1.00 (Ref.)	
North Carolina			1.09 (0.88–1.34)	0.446			1.13 (0.94–1.35)	0.196
Oklahoma			1.41 (1.07–1.85)	0.014			1.05 (0.83–1.35)	0.673
Tennessee			1.15 (0.92–1.43)	0.232			1.27 (1.06–1.54)	0.011
Wisconsin			0.76 (0.60–0.96)	0.021			0.94 (0.77–1.14)	0.514
–2 Log-likelihood	7695.1		6925.6		11,176.2		9952.4	
Nagelkerke R^2	0.041		0.178		0.034		0.180	

OR: odds ratio; CI: confidence interval; BRFSS: Behavioral Risk Factor Surveillance System; FMIC: family member incarceration during childhood.

of diabetes and other chronic health conditions, screening for FMIC among adults presenting with diabetes may facilitate early detection and/or prevention of other adverse health outcomes. Furthermore, the development, implementation, and dissemination of empirically supported interventions designed to mitigate the health impacts of FMIC exposure among older adults should be investigated in future research.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

The University of Toronto Research Ethics Board waives the requirement to obtain an ethics approval for secondary analysis of publicly available deidentified data from large governmental agencies and institutions, such as Statistics Canada and the CDC. Because the Behavioral Risk Factor Surveillance System (BRFSS) data are publicly available and deidentified, and informed consent was obtained at the time of the original data collection of the BRFSS by the CDC, no ethical approval or written informed consent is required for this study.

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Informed consent

Informed consent was not sought for this study because the study was based on secondary analysis of publicly available deidentified

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Supplemental material

Supplemental material for this article is available online.

References

1. Cowie CC, Rust KF, Ford ES, et al. Full accounting of diabetes and pre-diabetes in the U.S. population in 1988-1994 and 2005-2006. *Diabetes Care* 2009; 32(2): 287–294.
2. Brutsaert EF. Diabetes mellitus. Merck Manuals Professional Edition, http://www.merckmanuals.com/professional/endocrine-and-metabolic-disorders/diabetes-mellitus-and-disorders-of-carbohydrate-metabolism/diabetes-mellitus-dm (accessed 23 February 2018).
3. Centers for Disease Control and Prevention. *National diabetes statistics report, 2014: Estimates of diabetes and its burden in the United States*. Atlanta, GA: Centers for Disease Control and Prevention, U.S. Dept of Health and Human Services, 2014.
4. Gorina Y, Hoyert D, Lentzner H, et al. Trends in causes of death among older persons in the United States. *Aging Trends* 2005; 6: 1–12.
5. Centers for Disease Control and Prevention. Number of Americans with diabetes projected to double or triple by 2050, https://www.cdc.gov/media/pressrel/2010/r101022.html (accessed 23 February 2018).
6. American Diabetes Association. Economic costs of diabetes in the U.S. in 2012. *Diabetes Care* 2013; 36: 1033–1046.
7. Felitti VJ, Anda RF, Nordenberg D, et al. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: the Adverse Childhood Experiences (ACE) Study. *Am J Prev Med* 1998; 14(4): 245–258.
8. White BA, Cordie-Garcia L and Fuller-Thomson E. Incarceration of a family member during childhood is associated with later heart attack: findings from two large, population-based studies. *J Crim Justice* 2016; 44: 89–98.
9. Fuller-Thomson E, West KJ, Sulman J, et al. Childhood maltreatment is associated with ulcerative colitis but not Crohn's disease: findings from a population-based study. *Inflamm Bowel Dis* 2015; 21(11): 2640–2648.
10. Huang H, Yan P, Shan Z, et al. Adverse childhood experiences and risk of type 2 diabetes: a systematic review and meta-analysis. *Metabolism* 2015; 64(11): 1408–1418.
11. Rich JD, Wakeman SE and Dickman SL. Medicine and the epidemic of incarceration in the United States. *N Engl J Med* 2011; 364(22): 2081–2083.
12. Glaze LE and Maruschak LM. *Parents in prison and their minor children*. Washington, DC: Office of Justice Programs, U.S. Department of Justice, 2008.
13. London AS and Myers NA. Race, incarceration, and health: a life-course approach. *Res Aging* 2006; 28(3): 409–422.
14. Lee RD, Fang X and Luo F. The impact of parental incarceration on the physical and mental health of young adults. *Pediatrics* 2013; 131(4): e1188–e1195.
15. Danese A, Pariante CM, Caspi A, et al. Childhood maltreatment predicts adult inflammation in a life-course study. *Proc Natl Acad Sci U S A* 2007; 104(4): 1319–1324.
16. World Health Organization. The implications for training of embracing: a life course approach to Health, 2000, http://www.who.int/ageing/publications/lifecourse/alc_lifecourse_training_en.pdf
17. Taylor SE, Lehman BJ, Kiefe CI, et al. Relationship of early life stress and psychological functioning to adult C-reactive protein in the coronary artery risk development in young adults study. *Biol Psychiatry* 2006; 60(8): 819–824.
18. Hertzman C. The biological embedding of early experience and its effects on health in adulthood. *Ann N Y Acad Sci* 1999; 896: 85–95.
19. Donath MY and Shoelson SE. Type 2 diabetes as an inflammatory disease. *Nat Rev Immunol* 2011; 11(2): 98–107.
20. Hotamisligil GS. Inflammation and metabolic disorders. *Nature* 2006; 444: 860–867.
21. Schiavone S, Jaquet V, Trabace L, et al. Severe life stress and oxidative stress in the brain: from animal models to human pathology. *Antioxid Redox Signal* 2013; 18(12): 1475–1490.
22. Pitocco D, Tesauro M, Alessandro R, et al. Oxidative stress in diabetes: implications for vascular and other complications. *Int J Mol Sci* 2013; 14(11): 21525–21550.
23. Almuneef M, Qayad M, Aleissa M, et al. Adverse childhood experiences, chronic diseases, and risky health behaviors in Saudi Arabian adults: a pilot study. *Child Abuse Negl* 2014; 38(11): 1787–1793.
24. Fuller-Thomson E, Bejan R, Hunter JT, et al. The link between childhood sexual abuse and myocardial infarction in a population-based study. *Child Abuse Negl* 2012; 36(9): 656–665.
25. Elzinga BM, Roelofs K, Tollenaar MS, et al. Diminished cortisol responses to psychosocial stress associated with lifetime adverse events: a study among healthy young subjects. *Psychoneuroendocrinology* 2008; 33(2): 227–237.
26. Kudielka BM and Kirschbaum C. Sex differences in HPA axis responses to stress: a review. *Biol Psychol* 2005; 69(1): 113–132.
27. Nargund VH. Effects of psychological stress on male fertility. *Nat Rev Urol* 2015; 12(7): 373–382.
28. Smith GD, Ben-Shlomo Y, Beswick A, et al. Cortisol, testosterone, and coronary heart disease. *Circulation* 2005; 112(3): 332–340.
29. Swisher RR and Waller MR. Confining fatherhood: incarceration and paternal involvement among nonresident White, African American, and Latino fathers. *J Fam Issues* 2008; 29(8): 1067–1088.
30. Wildeman C. Paternal incarceration and children's physically aggressive behaviors: evidence from the Fragile Families and Child Wellbeing Study. *Soc Forces* 2010; 89(1): 285–309.
31. Flinn MV, Quinlan RJ, Decker SA, et al. Male-female differences in effects of parental absence on glucocorticoid stress response. *Hum Nat* 1996; 7(2): 125–162.
32. Mackenzie CS, Gekoski WL and Knox VJ. Age, gender, and the underutilization of mental health services: the influence of help-seeking attitudes. *Aging Ment Health* 2006; 10(6): 574–582.

33. Gjelsvik A, Dumont DM and Nunn A. Incarceration of a household member and Hispanic health disparities: childhood exposure and adult chronic disease risk behaviors. *Prev Chronic Dis* 2013; 10: E69.
34. Gjelsvik A, Dumont DM, Nunn A, et al. Adverse childhood events: incarceration of household members and health-related quality of life in adulthood. *J Health Care Poor Underserved* 2014; 25(3): 1169–1182.
35. Bynum L. Adverse childhood experiences reported by adults-five states, 2009. *MMWR Morb Mortal Wkly Rep* 2010; 59(49): 1609–1613.
36. Covey HC, Menard S and Franzese RJ. Effects of adolescent physical abuse, exposure to neighborhood violence, and witnessing parental violence on adult socioeconomic status. *Child Maltreat* 2013; 18(2): 85–97.
37. Connolly V, Unwin N, Sherriff P, et al. Diabetes prevalence and socioeconomic status: a population based study showing increased prevalence of type 2 diabetes mellitus in deprived areas. *J Epidemiol Community Health* 2000; 54(3): 173–177.
38. Sacerdote C, Ricceri F, Rolandsson O, et al. Lower educational level is a predictor of incident type 2 diabetes in European countries: the EPIC-InterAct study. *Int J Epidemiol* 2012; 41(4): 1162–1173.
39. Heard-Garris N, Winkelman TNA, Choi H, et al. Health care use and health behaviors among young adults with history of parental incarceration. *Pediatrics* 2018; 142(3): e20174314.
40. Chang SA. Smoking and type 2 diabetes mellitus. *Diabetes Metab* 2012; 36(6): 399–403.
41. Turney K. Stress proliferation across generations? Examining the relationship between parental incarceration and childhood health. *J Health Soc Behav* 2014; 55(3): 302–319.
42. Centers for Disease Control and Prevention. About diabetes: who's at risk?, https://www.cdc.gov/diabetes/basics/risk-factors.html (accessed 23 February 2018).
43. Hu FB. Sedentary lifestyle and risk of obesity and type 2 diabetes. *Lipids* 2003; 38(2): 103–108.
44. Pan A, Lucas M, Sun Q, et al. Bidirectional association between depression and type 2 diabetes mellitus in women. *Arch Intern Med* 2010; 170(21): 1884–1891.
45. Wildeman C and Western B. Incarceration in fragile families. *Future Child* 2010; 20(2): 157–177.
46. Turney K, Wildeman C and Schnittker J. As fathers and felons: explaining the effects of current and recent incarceration on major depression. *J Health Soc Behav* 2012; 53(4): 465–481.
47. Thomas C, Hypponen E and Power C. Obesity and type 2 diabetes risk in midadult life: the role of childhood adversity. *Pediatrics* 2008; 121(5): e1240–e1249.
48. Felitti VJ. Childhood sexual abuse, depression, and family dysfunction in adult obese patients: a case control study. *South Med J* 1993; 86(7): 732–736.
49. Monnat SM and Chandler RF. Long term physical health consequences of adverse childhood experiences. *Sociol Q* 2015; 56(4): 723–752.
50. Kaplan RM and Kronick RG. Marital status and longevity in the United States population. *J Epidemiol Community Health* 2006; 60(9): 760–765.
51. Cornelis MC, Chiuve SE, Glymour MM, et al. Bachelors, divorcees, and widowers: does marriage protect men from type 2 diabetes. *PLoS ONE* 2014; 9(9): e106720.
52. Martin SA, Haren MT, Taylor AW, et al. Chronic disease prevalence and associations in a cohort of Australian men: the Florey Adelaide Male Ageing Study (FAMAS). *BMC Public Health* 2008; 8: 261.
53. Friedrich N, Schneider HJ, John U, et al. Correlates of adverse outcomes in abdominally obese individuals: findings from the five-year followup of the population-based study of health in Pomerania. *J Obes* 2013; 2013: 762012.
54. Casagrande SS and Cowie CC. Health insurance coverage among people with and without diabetes in the US adult population. *Diabetes Care* 2012; 35(11): 2243–2249.
55. Zhang X, Bullard KM, Gregg EW, et al. Access to health care and control of ABCs of diabetes. *Diabetes Care* 2012; 35(7): 1566–1571.
56. Centers for Disease Control and Prevention. *Behavioral risk factor surveillance system survey questionnaire*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2012.
57. Centers for Disease Control and Prevention. Burden of cigarette use in the U.S. Centers for Disease Control and Prevention. https://www.cdc.gov/tobacco/campaign/tips/resources/data/cigarette-smoking-in-united-states.html (accessed 16 September 2019).
58. Dhaliwal GK, Gauzas L, Antonowicz DH, et al. Adult male survivors of childhood sexual abuse: prevalence, sexual abuse characteristics, and long-term effects. *Clin Psychol Rev* 1996; 16(7): 619–639.
59. Okura Y, Urban LH, Mahoney DW, et al. Agreement between self-report questionnaires and medical record data was substantial for diabetes, hypertension, myocardial infarction and stroke but not for heart failure. *J Clin Epidemiol* 2004; 57(10): 1096–1103.
60. Foster H and Hagan J. The mass incarceration of parents in America: issues of race/ethnicity, collateral damage to children, and prisoner reentry. *Ann Am Acad Polit SS* 2009; 623(1): 179–194.
61. The Center for Health and Justice at TASC. *No entry: a National Survey of Criminal Justice diversion programs and initiatives*. Chicago, IL, 2013, https://csgjusticecenter.org/nrrc/publications/no-entry-a-national-survey-of-criminal-justice-diversion-programs/
62. Washington Lawyers' Committee for Civil Rights & Urban Affairs. *D.C. women in prison: continuing problems and recommendations for change*. Washington, DC, 2016, http://www.washlaw.org/pdf/dc_women_in_prison_report.pdf
63. Sawyer W. The gender divide: tracking women's state prison growth, https://www.prisonpolicy.org/reports/women_overtime.html (accessed 17 September 2019).
64. Rabuy B and Kopf D. Separation by bars and miles: visitation in state prisons—prison policy initiative, https://www.prisonpolicy.org/reports/prisonvisits.html (accessed 17 September 2019).