# Abuse in Childhood and Adolescence As a Predictor of Type 2 Diabetes in Adult Women

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## Abstract

**Background**—Although child abuse is associated with obesity, it is not known whether early abuse increases risk of type 2 diabetes.

**Purpose**—To investigate associations of child and adolescent abuse with adult diabetes

**Methods**—Proportional hazards models were used to examine associations of lifetime abuse reported in 2001 with risk of diabetes from 1989 to 2005 among 67,853 women in the Nurses Health Study II. Data were analyzed in 2009.

**Results**—Child or teen physical abuse was reported by 54% and sexual abuse by 34% of participants. Models were adjusted for age, race, body type at age 5 years, and parental education and history of diabetes. Compared to women who reported no physical abuse, the hazards ratio (HR) was 1.03 (95% CI: 0.91, 1.17) for mild physical abuse, 1.26 (1.14, 1.40) for moderate physical abuse, and 1.54 (1.34, 1.77) for severe physical abuse. Compared with women reporting no sexual abuse in childhood or adolescence, the HR was 1.16 (1.05, 1.29) for unwanted sexual touching, 1.34 (1.13, 1.59) for one episode of forced sexual activity, and 1.69 (1.45, 1.97) for repeated forced sex. Adult BMI accounted for 60% (32%, 87%) of the association of child and adolescent physical abuse and 64% (38%, 91%) of the association of sexual abuse with diabetes.

**Conclusions**—Moderate to severe physical and sexual abuse in childhood and adolescence have dose response associations with risk of type 2 diabetes among adult women. This excess risk is partially explained by the higher BMI of women with a history of early abuse.

# INTRODUCTION

Interpersonal violence is a prevalent and understudied threat to women s health. The 1992 – 1996 survey by the National Institute of Justice and CDC estimated that 52% of U.S. women had been physically assaulted and 15% had been raped in their lifetime. [1] Over half of these assaults first occurred when the women were girls or adolescents.

Despite a sizeable literature regarding the psychological sequelae of childhood abuse, there is little research on the lifelong physical consequences of childhood abuse.[2] The exception to this is a consistently reported association of child abuse with adult obesity, with evidence that child abuse leads to overweight.[3–4] As obesity is one of the strongest risk factors for type 2 diabetes, it follows that early abuse may lead to diabetes through overweight and obesity. Experimental and observational studies also indicate that early trauma may cause lasting dysregulated stress responsivity, which may link child abuse with diabetes through physiologic pathways independent of adiposity.[5–14]

The first study to examine childhood trauma and diabetes was the Adverse Experiences of Childhood (ACE) Study, which reported that adults who had experienced traumas in childhood, including abuse, were at 60% higher risk of diabetes.[15] Two subsequent studies reported associations of child neglect, but not physical or sexual abuse, with diabetes.[16–17] These pioneering studies are variously limited by small samples, cross-sectional assessment, unvalidated or nonspecific metabolic outcomes, or cursory assessments of abuse history.[15–20] Thus, to date, reliable estimates are lacking of the extent to which child physical or sexual abuse is associated with type 2 diabetes.

In 2001, a Violence Questionnaire was added to a large longitudinal cohort study of women, the Nurses Health Study II (NHSII). The authors hypothesized direct associations between physical and sexual abuse and risk of type 2 diabetes, further hypothesizing that the associations would be independent of childhood body type, but that higher BMI among women abused as children would partially mediate the association of early abuse with risk of diabetes.

# METHODS

## Population and follow-up period

Participants in the NHSII, a cohort of 116,430 registered nurses, were aged 25–42 years when the cohort was established in 1989. The cohort has been followed by biennial mailed questionnaires which inquire about risk factors and disease incidence. In 2001, a Violence Questionnaire was mailed to 91,297 NHSII participants, excluding those who had requested short questionnaires or required more than four mailings of the previous questionnaire. Participants returned 68,376 Violence Questionnaires.

Participants contributed person-time from 1989 until their last returned questionnaire, diabetes diagnosis, or the end of follow-up in 2005. The authors examined all 2,074 cases of type 2 diabetes that accrued from 1989 to 2005, as well as 759 incident cases that occurred after the violence questionnaire was administered in 2001. The results for total and incident cases were very similar; to maximize statistical power, total diabetes cases are reported. Data were analyzed in 2009, after diagnoses of diabetes reported on the 2005 questionnaire were reviewed and coded.

## Exclusions

The 523 women who reported a diagnosis of diabetes or use of insulin or an oral hypoglycemic agent at baseline were excluded, leaving 67,853 women in the analysis. The

93 women who reported diabetes secondary to medical treatment (such as steroid medication) or conditions (such as pancreatitis) were censored and were not counted as cases.

## Outcome Assessment

Nurses who reported a diagnosis of diabetes on any biennial questionnaire were mailed a supplemental questionnaire on which they reported details regarding the results of their diagnostic tests, symptoms, and therapy. Information from this form is used to classify cases into categories proposed by the National Diabetes Data Group (NDDG) and American Diabetes Association (ADA),[21–22] as described previously.[23] The validity of this method has been tested by medical record review, with 98% confirmation of type 2 diabetes.[24] In a substudy of undiagnosed diabetes, only 1 of 200 of a random sample (0.5%) of nurse participants who had never reported diabetes had an elevated fasting PG level.[25] Over 97% of NHSII participants visited a physician for a screening examination between 1999 and 2001, and 54% had had a fasting blood glucose test in the past 2 years.

## Exposure Assessment

The Violence Questionnaire covers 3 periods: childhood (up to age 11 years), adolescence (11–17 years), and adulthood.

Childhood and adolescent physical abuse were assessed through an adaptation of the revised Conflict Tactics Scale.[26] The instrument queried whether a parent, step-parent, or adult guardian ever: spanked you for discipline; pushed, grabbed, or shoved you; kicked, bit, or punched you; hit with something that hurt your body; choked or burned you; or physically attacked you in some other way. For each item, respondents indicated the frequency of the event (never, once, a few times, more than a few times). The "spank you for discipline" item was not counted toward the abuse score.

Physical abuse during childhood was categorized into four groups: no physical abuse (none); being "pushed, grabbed, or shoved" at any frequency or being "kicked, bitten, or punched" once or "hit with something" once (mild); being "hit with something" more than once or "physically attacked" once (moderate); being "kicked, bitten, or punched" or "physically attacked" more than once or ever "choked or burned" (severe). Participants were categorized according to the most severe event reported in either childhood or adolescence.

Child and adolescent sexual abuse was measured by questions regarding unwanted sexual touching and forced sexual activity adapted from a national survey conducted in 1995.[27–28] "Were you ever touched in a sexual way by an adult or an older child or were you forced to touch an adult or an older child in a sexual way when you did not want to?" and "Did an adult or older child ever force you or attempt to force you into any sexual activity by threatening you, holding you down, or hurting you in some way when you did not want to?" Participants could respond: "No, this never happened", "Yes, this happened once", or "Yes, this happened more than once". These questions were repeated for childhood and adolescent periods. Exposure was categorized into four groups: no sexual abuse; unwanted sexual touching only; forced sexual activity once; and forced sexual activity more than once.

## Covariates

The authors considered early childhood covariates as potential confounders, including race/ethnicity, birthweight, and maternal and paternal history of diabetes, occupation (ten categories each for mother and father), education, and home ownership when the participant was an infant. A self-reported somatogram score at age 5 years, derived from diagrams of female body figures ranging in adiposity from 1 (very thin) to 9 (extremely obese), was used

to estimate early childhood adiposity. The National Heart Lung and Blood Institute Growth and Health study demonstrated that child somatogram scores are recalled by adults accurately enough for ranking in epidemiologic studies.[29] The authors also considered aspects of high school diet (glycemic load, glycemic index, animal and vegetable fat consumption) from a Food Frequency Questionnaire.[30]

The authors considered as potential mediating factors those diabetes risk factors that occurred after child and adolescent abuse experiences, as these factors may have resulted from abuse. These updated time-varying covariates included adult BMI, cigarette smoking, alcohol use, physical activity, and dietary glycemic load and glycemic index.[31] As depression is a risk factor for diabetes,[5–6] lifetime and current depressive symptoms ("two weeks or longer when nearly every day you felt sad, blue, or depressed for most of the day") with and without clinician diagnosis of depression were included in a subanalysis of follow-up from 2001 to 2005, the period for which depression data were available. Adult experiences of abuse were measured on the 2001 Violence Questionnaire with questions adapted from the McFarlane Abuse Assessment Screen,[7] and used in secondary analysis to identify women whose abuse was isolated to childhood or adolescence.

## Statistical Analysis

Hazard ratios and 95% CIs were estimated using a Cox proportional hazards model, with indicator variables for categories of physical and sexual abuse, including an indicator for missing abuse data.[8]

The authors considered as potential confounders those covariates that preceded childhood abuse and were theoretically or empirically associated with abuse and diabetes risk. The multivariate model included race, maternal and paternal education at the time of the participant s birth, somatotype at age 5 years, and maternal and paternal diabetes. Neither birthweight, high school diet, parental occupation, nor parental education materially altered the abuse risk estimates, and were not considered further.

The authors considered adult covariates as mediators between childhood abuse and adult type 2 diabetes, by examining the extent to which their inclusion in the model diminished the effect estimates for the abuse exposures. Current adult physical activity, smoking, alcohol use, dietary glycemic load, dietary glycemic index, depression, and BMI were tested as potential time-varying mediators. Nurses also recalled their weight at age 18 years.[32] Only adult BMI, smoking and alcohol were retained in the model. The authors parameterized adult BMI updated at every questionnaire in several ways to fully capture its mediating effect on the association of abuse with type 2 diabetes: as a continuous variable, as deciles, and as a restricted cubic spline (21 knots with stepwise selection[33–34]). Continuous BMI was chosen, as this was at least as potent as the other parameterizations in diminishing the risk estimates for the associations of abuse and diabetes. The authors tested multiplicative interactions between abuse types by performing likelihood ratio tests of nested models with and without cross-product interaction terms between physical and sexual abuse categories. To assess additive interaction between physical and sexual abuse, the authors calculated the Relative Excess Risk for Interaction and its variance using the method of Li and Chambless.[9] The authors estimated the proportion of the abuse association explained by current adult BMI[10] using the SAS macro of Spiegelman and colleagues to estimate the mediation proportion, its 95% CI, and a p-value to assess the significance of any mediation.[10, 35] The authors used a multivariable ANOVA to examine associations of physical and sexual abuse with normalized somatotype at age 5 years, BMI at age 18 years, and BMI at the cohort s inception in 1989, adjusted for age, race, parental education and parental diabetes. The partial population-attributable risk percentage and its 95% CI for any abuse in childhood or adolescence were calculated as described previously. [36]

## RESULTS

Fifty-four percent of participants reported physical abuse in childhood or adolescence, including 9% who reported severe physical abuse (Table 1). One third of participants experienced sexual abuse in childhood or adolescence. Twelve percent reported forced sexual activity, half of whom reported that this happened more than once. Few participant characteristics varied by abuse history. Women who had experienced abuse were more likely to smoke cigarettes and to have had parents with diabetes and lower educational attainment. Although somatotype at age 5 years was unassociated with physical abuse (p=0.21), it was 0.11 SDs higher for participants who reported repeated forced sex at ages 5–17 years than for women with no sexual abuse history (p<0.001). As seen in Table 1, by the end of adolescence, abused girls had higher BMI than unabused girls (at age 18 years, severe physical abuse was associated with BMI that is 0.09 SDs higher and repeated forced sex with a BMI that is 0.18 SDs higher than unabused girls; ANOVA p<0.0001). This divergence in BMI trajectories between abused and unabused girls had grown wider by adulthood (at 1989 baseline, BMI was 0.15 SDs higher for severe physical abuse and 0.23 SDs higher for repeated forced sex in childhood or adolescence, p<0.0001).

There was a dose–response association of physical abuse with risk of diabetes (Table 2). Adjustment for race, maternal and paternal education, maternal and paternal diabetes, and somatotype at age 5 years somewhat attenuated these associations. Although mild physical abuse in childhood was not associated with increased risk of diabetes in adulthood, moderate and severe physical abuse were associated with 26% to 54% higher risks of diabetes (Table 2). As expected, physical and sexual abuse history were correlated (Spearman r =0.20, p<0.0001). Moderate and severe physical abuse predicted increased risk of diabetes whether or not women had also experienced sexual abuse, although the risk estimate for severe physical abuse fell short of significance among those without sexual abuse (Table 2).

Women who experienced unwanted sexual touching as children or teens had a 16% increased risk of diabetes, and those who had experienced forced sex once or repeatedly had 34% to 69% higher risks of diabetes than women who were not sexually abused as girls (Table 3). Most girls who experienced sexual abuse also suffered physical abuse (Table 1). Among the minority of sexually abused girls who suffered no physical abuse, there was a 56% higher risk of diabetes associated with forced sex more than once, but no associations of sexual touching or a single episode of forced sex with diabetes (Table 3).

Physical and sexual abuse interacted on an additive scale (RERI=8.71, 95% CI, 1.25, 16.02, p=0.048), but not on a multiplicative scale (p=0.59 for test of interaction), indicating that the absolute, but not the relative, risk of diabetes was higher among women who had experienced both forms of abuse than would be expected from the risk of sexual or physical abuse alone.

To examine abuse isolated to the child and teen years, the authors examined 48,853 women (74% of the cohort) who reported no adult physical or sexual abuse, among whom there were 1,434 diabetes cases. The risk estimates for diabetes associated with isolated child/teen abuse were similar to those for the full cohort, after adjustment for age, race, somatotype at age 5 years, parental education and diabetes. There was a 29% increased risk (14%, 46%) for moderate physical abuse and 49% (23%, 79%) for severe physical abuse isolated to childhood or adolescence. For sexual abuse isolated to childhood or adolescence, there was a 19% (5%, 35%) increased risk for sexual touching; 32% (5%, 65%) for forced sex once; and 86% (52%, 128%) for repeated forced sex.

The authors then considered models adjusted for diabetes risk factors occurring after the abuse, which could be considered intermediate on the pathway from child abuse to adult

diabetes. Adjustment for adult smoking, alcohol use, and BMI weakened, but did not eliminate, the dose–response associations of child and teen abuse with risk of adult diabetes, as can be seen by comparing the relative risks reported in Table 2 to those reported in Table 3. The attenuation was attributable almost entirely to BMI adjustment. The estimated mediation proportion indicated that adult BMI accounted for 60% (32%, 87%) of the associations of physical and 64% (38%, 91%) of sexual abuse with diabetes (p<0.0001 for both). Despite adjustment for these potentially intermediate variables, moderate physical abuse, severe physical abuse, and repeated forced sex remained independently associated with significant increased risks of diabetes of 12%, 21% and 28%, respectively.

In this cohort, 65% of participants reported any degree of physical or sexual abuse in childhood or adolescence, which was associated with a 24% (95% CI=12%, 38%) increased risk of type 2 diabetes in adulthood, after adjustment for age, race/ethnicity, body type at age 5 years, and maternal and paternal education and history of diabetes. The PAR% derived from this model indicates that child/adolescent accounted for 14% (7% to 21%) of type 2 diabetes in this cohort. Applying the hazard ratio from this study to the 43% prevalence of any child or adolescent abuse reported by women in the National Violence Against Women Survey,[1] an estimated 9% of diabetes in U.S. women may be attributed to early abuse.

## DISCUSSION

Physical and sexual abuse in childhood and adolescence were associated with increased risk of type 2 diabetes in adult women in a dose–response fashion. Although mild physical abuse was unassociated with diabetes risk, moderate and severe physical abuse were associated with 26% to 54% higher risks of diabetes in maturity. Unwanted sexual touching was associated with 16% higher risk of diabetes, and forced sexual activity before adulthood carried 34% higher risk when it occurred once and 69% higher risk when it occurred more frequently. Child and teen abuse predicted later diabetes even among women who reported no adult physical or sexual abuse.

Although the minority of physically abused girls reported sexual abuse, most sexually abused girls were also physically abused. The highest risks of diabetes occurred among women who had experienced both types of abuse. Although there was no evidence of a multiplicative, synergistic impact of experiencing both physical and sexual abuse, women who experienced both types of abuse had higher absolute risks of diabetes than expected from physical or sexual abuse alone. Girls who experience both types of abuse may suffer more severe abuse, more emotionally damaging abuse, or more chronic abuse than girls who experienced abuse of one type.

Adult BMI was an important mediator of the associations between early abuse and adult diabetes, accounting for roughly 60% of the increased risk associated with child and adolescent abuse. At age 5 years, there was little difference between the somatotypes of girls who did and did not report later abuse. However, by age 18 years, the BMI trajectories of abused girls had begun to diverge, and by the time they completed the 1989 baseline questionnaire at age 25–42 years, there was a marked trend of increasing BMI with more severe abuse history. This pattern of diverging BMI in the years following abuse is consistent with prospective observations.[3]

After accounting for adult BMI, there remained a 10%–30% increased risk of diabetes among women who had experienced moderate physical abuse or the most severe forms of physical or sexual abuse. Although BMI was updated every 2 years and a variety of parameterizations were tested to fully account for BMI, it is possible that the remaining increased risk of diabetes reflects residual mediation by poorly measured BMI.

Alternatively, early abuse might affect the risk of diabetes through other pathways, such as altered neuroendocrine stress responsivity. Early stress has been shown in preclinical and clinical studies to have profound and lasting effects on the hypothalamic–pituitary–adrenal and noradrenergic stress systems.[11] Conditioned stress responses include heightened glucocorticoid, norepinephrine, and autonomic response to novel stressors,[20–25] which cause insulin resistance in several species.[12–14] These experiments suggest that stressful early experiences lead to central nervous system adaptations that may prove maladaptive in adulthood, especially in an environment in which calorie dense food is ubiquitous.

Few studies have examined the association between childhood abuse and risk of diabetes with more than a few hundred participants.[15–17] The ACE study included 9,508 participants who completed a survey querying a variety of childhood traumas, including abuse.[15] An ACE score ≥3 (of 7) was associated with an OR of 1.6 (1.0, 2.5) for self-reported diabetes prevalence in men and women. This vanguard study did not examine abuse specifically, making direct comparisons with the current study difficult.

In the National Comorbidity Survey (NCS), participants reported "diabetes or high blood sugar" in the past year, and indicated whether they had been "physically abused," "raped and molested," or "seriously neglected" as children.[16] Goodwin found no associations of abuse with diabetes among 4,251 women surveyed, although those who reported serious neglect had a fourfold higher risk. In the National Survey of Midlife Development (MIDUS), Shaw and Krause examined parental physical abuse as a predictor of adult health among 2,788 men and women.[17] As in the current study, they measured physical abuse with the Conflict Tactics Scales; however, they reported no association of physical abuse with self-reported "diabetes or high blood sugar" in the past year. Differences across these studies may stem from variation in the abuse measurements, the validity of diabetes self-reports, or from differing statistical power, as the NCS and MIDUS cohorts each had fewer than 100 cases of diabetes among women, compared with 2,074 cases in this study.

The current study relied on self-reports of abuse, as have most large abuse studies. The authors chose instruments used in national surveys;[26–27] in particular, the Conflict Tactics Scales have good test retest reliability and convergent validity.[26] To reduce bias,[31] instruments were chosen that queried specific acts of physical and sexual violence, rather than ask participants to report abuse or rape. Recall bias is unlikely, as associations were similar in follow-up before (1989–2001) and after (2002–2005) the 2001 Violence Questionnaire administration. The current study lacked data on other household dysfunctions, such as parental mental illness or substance abuse, which cluster with child abuse.[15] Nurses in this cohort are well-educated, predominately white women, who reported more physical (54%) and sexual (12%) abuse in childhood and adolescence than did the random-dial telephone-based National Violence Against Women Survey (NVAWS) (40% physical and 9% sexual).[1] In particular, participants in the current study reported more instances of "push, grab and shove you" and "hit you with something that hurt your body" than had the NVAWS respondents. The questionnaire-based ACE study reported 45% prevalence of physical and 21% prevalence of sexual abuse in a combined male and female sample.[4] These differences in prevalence estimates may stem from the nature of the survey methods and the populations surveyed. It seems unlikely that the biological relationships of abuse with diabetes risk among nurses differ from those of women in general. However, if the educational attainment of nurses buffers their response to abuse, a higher relative risk might be anticipated in a population of lower SES. The differences in estimates of abuse prevalence affect the PAR% estimates. Where abuse prevalence approximates 43% reported by NVAWS, the PAR% estimate is 9%; where abuse prevalence is on the order of 65% reported by participants in this and the ACE study, as much as 14% of diabetes may be attributable to early abuse.

The current study had several strengths compared with smaller, cross-sectional studies using unvalidated self-reports of diabetes. The current study included data on 16 times more women than previous studies and reduced bias by examining validated diabetes endpoints and by testing whether associations were present among prospectively reported, incident cases that followed the 2001 report of abuse history. Another strength of the study was the 16 years of prospectively collected data on lifestyle factors to explore potential confounders and intermediates. The questionnaire collected details on frequency and timing of specific abusive acts, allowing the authors to examine severity and type of abuse in this analysis.

## Conclusion

The current study documented consistent dose–response associations between child and adolescent physical and sexual abuse with risk of adult diabetes, one of the chief threats to women s health. The high prevalence of child abuse suggests that it is an important, if overlooked, contributor to type 2 diabetes. Roughly half of the increased risk associated with abuse was attributable to the higher adult BMI of those who had suffered abuse in childhood or adolescence. A more precise description of the physiologic and psychological mechanisms through which abuse leads to overweight and obesity would focus prevention efforts. Weight control interventions designed specifically for survivors of abuse may help to reduce the risk of diabetes. These data lend further impetus and urgency to abuse prevention programs.

## Acknowledgments

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**Table 1**

Age-adjusted cohort characteristics in 1989 by physical and sexual abuse history, Nurses Health Study II

| | Child and Adolescent Physical Abuse | | | | Child and Adolescent Sexual Abuse | | | |
|---|---|---|---|---|---|---|---|---|
| | None | Mild | Moderate | Severe | None | Touch only | Forced sex once | Forced sex > once |
| | 31396 (46.4%) | 12594 (18.6%) | 17771 (26.3%) | 5880 (8.7%) | 44794 (66.5%) | 14982 (22.2%) | 3931 (5.8%) | 3684 (5.5%) |
| M | | | | | | | | |
| Age (years) | 34.6 | 34.5 | 34.7 | 35.0 | 34.5 | 34.9 | 34.6 | 34.8 |
| Maternal education (years) [a] | 12.5 | 12.4 | 12.2 | 12.1 | 12.4 | 12.2 | 12.2 | 12.1 |
| Paternal education (years) [a] | 12.6 | 12.5 | 12.3 | 12.2 | 12.6 | 12.3 | 12.3 | 12.1 |
| Somatotype at age 5 years [b] | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.6 |
| BMI at age 18 years | 21.2 | 21.2 | 21.3 | 21.5 | 21.1 | 21.4 | 21.3 | 21.8 |
| BMI in 1989 | 23.7 | 23.8 | 24.1 | 24.5 | 23.7 | 24.2 | 24.3 | 24.9 |
| Percentage | | | | | | | | |
| Current smoker | 10.1 | 13.0 | 13.0 | 17.0 | 11.0 | 12.5 | 17.3 | 16.6 |
| Drink no alcohol | 37.6 | 33.0 | 36.9 | 38.5 | 36.1 | 36.9 | 35.6 | 41.8 |
| Drink ≥15g alcohol daily | 2.6 | 3.4 | 3.2 | 3.4 | 2.9 | 3.2 | 3.5 | 2.9 |
| Exercise weekly | 78.2 | 79.1 | 77.7 | 79.0 | 78.5 | 77.2 | 78.6 | 79.6 |
| History of depression [c] | 31.5 | 37.8 | 41.1 | 55.6 | 32.9 | 42.0 | 49.5 | 56.8 |
| Maternal diabetes at age <50 years [c] | 1.7 | 1.7 | 2.3 | 3.2 | 1.7 | 2.1 | 2.9 | 3.4 |
| Paternal diabetes at age <50 years [c] | 2.1 | 2.0 | 2.4 | 2.9 | 2.2 | 2.2 | 2.3 | 3.3 |
| White race | 93.9 | 93.8 | 91.5 | 92.1 | 93.5 | 92.4 | 93.0 | 91.6 |
| Child/teen physical abuse [c] | | | | | 48.0 | 59.5 | 69.4 | 78.7 |
| Child/teen sexual abuse [c] | 25.6 | 34.0 | 38.8 | 57.1 | | | | |
| Adult physical or sexual abuse [c] | 18.7 | 27.8 | 32.5 | 46.3 | 22.6 | 29.8 | 39.9 | 45.3 |

[a] Mean years of education at the time of the participant s birth, reported in 2005

[b] Mean somatogram score at age 5 years; range is 0–9

[c] Reported in 2001

**Table 2**

Hazard ratios (95% CI) for the association of physical abuse in childhood and/or adolescence with risk of incident Type 2 diabetes in adulthood, Nurses Health Study 2

| | Cases[a] Person-Years | Adjusted for age | Adjusted for age, race, somatotype at age 5 years, parental education, and parental diabetes at age <50 years | | | Adjusted for age, race, somatotype at age 5 years, parental education, parental diabetes at age <50 years, and adult BMI, smoking and alcohol use | | |
|---|---|---|---|---|---|---|---|---|
| | | | All women | Without child/teen sexual abuse[b] | With child/teen sexual abuse[c] | All women | Without child/teen sexual abuse[2b] | With child/teen sexual abuse[c] |
| None | 828 484,093 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Mild | 338 194,176 | 1.04 0.91, 1.18 | 1.03 0.91, 1.17 | 0.97 0.82, 1.14 | 1.12 0.91, 1.39 | 1.00 0.88, 1.14 | 0.96 0.81, 1.13 | 1.09 0.88, 1.35 |
| Moderate | 633 273,139 | **1.36 1.22, 1.51** | **1.26 1.14, 1.40** | **1.19 1.04, 1.36** | **1.31 1.10, 1.56** | **1.12 1.01, 1.25** | 1.07 0.93, 1.23 | **1.21 1.01, 1.45** |
| Severe | 272 89,872 | **1.72 1.49, 1.97** | **1.54 1.34, 1.77** | 1.20 0.95, 1.52 | **1.69 1.39, 2.05** | **1.21 1.05, 1.40** | 0.97 0.77, 1.23 | **1.43 1.17, 1.75** |

[a]Data are not presented for 212 women missing data on physical abuse (209 noncases and 3 cases, less than 1% of the cohort).

[b]Among women without sexual abuse, there were 1207 cases of diabetes.

[c]Among women with sexual abuse, there were 856 cases of diabetes.

## Table 3

Hazard ratios (95% CI) for the association of sexual abuse in childhood and/or adolescence with risk of incident Type 2 diabetes in adulthood, Nurses Health Study 2

| Cases[a] Person-Years | Adjusted for age | Adjusted for age, race, somatotype at age 5 years, parental education, and parental diabetes at age <50 years | | | Adjusted for age, race, somatotype at age 5 years, parental education, parental diabetes at age <50 years, and adult BMI, smoking and alcohol use | | |
|---|---|---|---|---|---|---|---|
| | | All women | Without child/teen physical abuse[b] | With child/teen physical abuse[c] | All women | Without child/teen physical abuse[b] | With child/teen physical abuse[c] |
| None | 1207 690,559 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Sexual touching | 507 230,432 | **1.22** **1.10, 1.35** | **1.16** **1.05, 1.29** | 1.08 0.91, 1.28 | **1.19** **1.04, 1.37** | 1.03 0.93, 1.15 | 0.97 0.81, 1.15 | 1.09 0.95, 1.26 |
| Forced sex once | 152 60,318 | **1.45** **1.22, 1.71** | **1.34** **1.13, 1.59** | 0.88 0.60, 1.28 | **1.48** **1.22, 1.80** | 1.10 0.92, 1.31 | 0.77 0.53, 1.13 | 1.22 0.99, 1.49 |
| Forced sex >once | 197 56,114 | **1.96** **1.68, 2.28** | **1.69** **1.45, 1.97** | **1.56** **1.09, 2.22** | **1.69** **1.41, 2.01** | **1.28** **1.09, 1.49** | 0.99 0.68, 1.43 | **1.35** **1.13, 1.62** |

[a] Data are not presented for 462 women missing data on sexual abuse (451 noncases and 11 cases, less than 1% of the cohort).

[b] Among women without physical abuse, there were 828 cases of diabetes

[c] Among women with physical abuse, there were 1243 cases of diabetes.