



Published in final edited form as:

*Arthritis Care Res (Hoboken)*. 2021 June ; 73(6): 833–840. doi:10.1002/acr.24188.

## Association of Child Abuse with Systemic Lupus Erythematosus in Black Women During Adulthood

Yvette C. Cozier, DSc, MPH<sup>1,\*</sup>, Medha Barbhuiya, MD MPH<sup>2,\*</sup>, Nelsy Castro-Webb, ALM<sup>1</sup>, Carolyn Conte, MPH<sup>1</sup>, Sara Tedeschi, MD, MPH<sup>3</sup>, Cianna Leatherwood, MD<sup>3</sup>, Karen H. Costenbader, MD, MPH<sup>3,\*</sup>, Lynn Rosenberg, ScD<sup>1,\*</sup>

<sup>1</sup>Slone Epidemiology Center at Boston University, Boston, MA;

<sup>2</sup>Rheumatology, Department of Medicine, Hospital for Special Surgery, New York, NY,

<sup>3</sup>Division of Rheumatology, Immunology, and Allergy, Department of Medicine, Brigham and Women's Hospital, Boston, MA

### Abstract

**Objective.**—Exposure to psychosocial stressors may contribute to the onset of systemic lupus erythematosus (SLE) through dysregulation of the adaptive stress response. We assessed the relationship of childhood physical and sexual abuse to SLE risk among Black women.

**Methods.**—Using data from the Black Women's Health Study, we followed 36,152 women from 1995 through 2015 with biennial questionnaires. Women reported on exposure to abuse during childhood (up to age 11) in 2005. Self-reported incident SLE cases were confirmed as meeting American College of Rheumatology SLE classification criteria by medical record review. Cox proportional hazards regression models were used to estimate hazard ratios (HR) and 95% confidence intervals (95% CI) for SLE among women exposed to physical or sexual abuse during childhood, controlling for potential confounders.

**Results.**—We confirmed 101 cases of incident SLE who had completed the child abuse questions, during 670,822 person-years of follow-up. Both physical and sexual abuse during childhood were associated with statistically significant increases in SLE incidence. The HR for SLE associated with 2 episodes of severe sexual abuse compared to no abuse was 2.51 (95% CI 1.29–4.85) after adjustment for alcohol consumption, smoking, body mass index, oral contraceptive use, age at menarche, and parental education. The multivariable-adjusted HR for SLE with 5 episodes of severe physical abuse was 2.37 (1.13–4.99).

**Conclusion.**—Our results suggest that sexual and physical abuse during childhood increase SLE risk during adulthood among Black women. Research is necessary both to confirm this finding and to understand potential mediating mechanisms.

---

**Corresponding author and reprint requests:** Yvette Cozier, DSc, Slone Epidemiology Center at Boston University, 72 East Concord St, Boston, MA 02118; Phone: 617-206-6165; FAX: 617-738-5119; yvettcec@bu.edu.

\*Co-first authors and co-senior authors, contributed equally

The authors have no conflicts to disclose.

Systemic lupus erythematosus (SLE) is an inflammatory autoimmune disease that affects Black individuals more frequently than Whites, often with more severe manifestations and younger onset in Blacks.<sup>1</sup> Environmental factors have been suggested to play an important role in the pathogenesis of SLE in genetically predisposed individuals and are being actively investigated.<sup>2</sup> Exposure to psychosocial stressors, such as depression and PTSD, have been shown to contribute to the onset of SLE and other autoimmune diseases<sup>3,4</sup>, particularly among genetically-predisposed individuals<sup>5</sup>, through the dysregulation of the adaptive stress response<sup>6</sup>. Studies linking trauma to psychiatric disorders in adulthood such as depression, PTSD, psychosis, anxiety and diseases such as obesity, cardiovascular disease, and autoimmune diseases such as rheumatoid arthritis suggest an important role for inflammation<sup>7-9</sup>.

Childhood physical and sexual abuse occur with alarming frequency, affecting an estimated one in four children in their lifetimes and one in seven in the past year<sup>10</sup>. In nationally representative studies, Black women consistently report higher rates of childhood abuse than White women<sup>11,12</sup>, but these differences diminish with adjustment for socioeconomic status<sup>13</sup>. Children who experience victimization show elevated levels of inflammatory biomarkers several decades later<sup>6,14</sup>. Maltreated children in a New Zealand cohort had an elevated risk of clinically relevant C-reactive protein (CRP) and other inflammation biomarkers at age 32<sup>6</sup>, independent of other key risk factors in childhood and adulthood. In an analysis of over 17,000 adult members of the San Diego Kaiser Foundation Health Plan, childhood traumatic stress (including physical, emotional, or sexual abuse) was associated with increased likelihood of hospitalization with an autoimmune condition in adulthood<sup>14</sup>. A recent analysis of 67,500 US female nurses found a significantly increased risk of SLE among those who experienced childhood physical and emotional abuse<sup>15</sup>. Adverse childhood experiences have also been associated with an increased risk of overall poor health<sup>16</sup>, and smoking<sup>17</sup>. Among Black women, studies have found associations with obesity<sup>18</sup>, asthma<sup>19</sup>, uterine fibroids<sup>20</sup>, and breast cancer<sup>21</sup>. Both smoking and obesity have been independently associated with an increased risk of SLE in studies of both White<sup>22,23</sup> and Black women<sup>24-26</sup>.

Using data derived from the Black Women's Health Study (BWHS), a prospective cohort study, we investigated the relationship between physical and sexual abuse as a child and risk of SLE in adulthood in U.S. Black women, a population at high risk of SLE. We hypothesized that early life abuse, in particular increased severity of abuse, would be associated with increased risk of SLE in adulthood.

## Materials and Methods

### The Black Women's Health Study (BWHS).

In 1995, 64,500 Black women ages 21–69 years (median 38 years) from the continental U.S. enrolled in the BWHS by completing 14-page health questionnaires; the 59,000 women whose addresses were considered to be valid a year later comprise the BWHS cohort that has been followed. The questionnaires were mailed largely to subscribers of *Essence* magazine who comprise the vast majority of participants. A small percentage of participants were members of several professional organizations and friends and relatives of early

responders. Only women who self-identified as Black or African American were included. More than 80% of participants lived in California, Georgia, Illinois, Indiana, Louisiana, Maryland, Massachusetts, Michigan, New Jersey, New York, South Carolina, Virginia, and the District of Columbia. The participants provided demographic, medical and lifestyle information at baseline in 1995 and have been followed since then with biennial health questionnaires and yearly linkage with the National Death Index. All but 3% of respondents had completed high school and 44% had completed college; 95% of participants had been born in the U.S. Follow-up of the cohort has been successful for >85% of potential person-years through 2015. The Institutional Review Board of Boston University Medical Center approved the study and participants indicated their consent by filling out the questionnaires and signing consents for obtainment of medical records.

### Data collection.

At baseline, participants provided data on demographics, current weight and height, weight at age 18, medical and reproductive history, vigorous physical activity, cigarette smoking, alcohol use, and other variables. Self-completed biennial follow-up questionnaires have updated various data items.

**Abuse victimization.**—On the 2005 BWHS follow-up questionnaire, participants provided information about abuse victimization as a child (up to age 11), and as an adolescent (ages 12–18). We used a nine-item abuse questionnaire adapted from the Conflict Tactics Scale and the Pregnancy Abuse Assessment Screen<sup>27,28</sup>. Response categories were “never,” “1–3 times,” and “4 times”. We defined childhood physical abuse as a report of a perpetrator having “pushed, grabbed, or shoved me,” “threw something at me that could hurt me,” “kicked, bit, or punched me,” “hit me with something including hand or fist,” “physically attacked me in some other way,” “choked or burned me” or “seriously harmed someone I loved” at a frequency of 4 times during childhood. We defined childhood sexual abuse as a report of a perpetrator having “exposed genitals against my will”, or “been sexual with me against my will” at a frequency of 4 times. To create a childhood physical abuse summary score variable, we assigned 1 point for each report of a physical abuse item that occurred 4 times (severe abuse); to create a childhood sexual abuse summary category, we assigned 1 point for each report of sexual abuse that occurred 4 times<sup>18,21,29–31</sup>. We also employed an alternate method for both physical and sexual abuse by assigning 1 point for each report of 1–3 episodes and 2 points for each report of 4+ and then summing. Previous analyses in the BWHS have utilized these approaches and have found associations between childhood abuse victimization and obesity<sup>18</sup>, asthma<sup>19</sup>, uterine fibroids<sup>20</sup>, and breast cancer<sup>21</sup>.

**Covariates.**—We selected variables related to early childhood and adolescent experiences and which might be associated with SLE. Data on these variables, including age, smoking, body mass index, alcohol consumption, oral contraceptive use, and age at menarche, were obtained in 1995 and updated on subsequent questionnaires. Education of parents was obtained in 2009.

### **SLE cases.**

The 1995 questionnaire asked about a list of diagnoses that included “lupus”. Every biennial questionnaire thereafter asked about “lupus (systemic lupus erythematosus)” and the date of diagnosis. The doctors of women who gave consent were asked for copies of medical records concerning SLE or to fill out a checklist about the presence of American College of Rheumatology criteria for the diagnosis<sup>32,33</sup>. As previously described<sup>24,25</sup>, medical record review by study rheumatologists confirmed cases as the presence of at least 4 ACR SLE classification criteria. An earlier validation in the BWHS found that for the 251 women reporting incident or prevalent SLE for whom a physician checklist or medical chart was obtained, 84% of cases fulfilled ACR criteria for definite or probable SLE or had clinical lupus (SLE diagnosis recorded in a medical chart plus appropriate medication use).<sup>34</sup>

### **Analytic cohort.**

The current analysis utilizes data from the baseline questionnaire and 10 subsequent follow-up cycles (1995–2015). The 2005 questionnaire containing the abuse questions was completed by 43,179 participants. We excluded 483 women who reported SLE prior to 1995 and 6,544 women with missing information on abuse. The remaining 36,152 women comprised the analytic cohort. The women in the analytic cohort were similar to those excluded in terms of the proportion of SLE cases. There were 13 SLE cases among the 6,544 women with missing abuse data (0.20%), while there were 101 SLE cases among the 36,152 women with abuse data (0.28%).

### **Statistical analysis.**

We used Cox proportional hazards regression to estimate hazard ratios (HRs) and 95% confidence intervals (CIs) for the association of physical and sexual abuse, separately and combined, during childhood and adolescence with risk of SLE. Women contributed person-time from baseline (1995) until SLE diagnosis, death, loss to follow-up, or end of follow-up (2015), whichever occurred first. Women who reported SLE but for whom we were unable to obtain medical records to confirm the diagnosis were censored at the year of diagnosis. The Cox models were jointly stratified by age in 1-year intervals and questionnaire cycle (Model 1). Multivariable models for child abuse included age at menarche (<11, 11, 12–14, 15 years), BMI at age 18 (<25, 25–29, 30), age began smoking (<14 years, >14 years/never), age began alcohol consumption (<14 years, >14 years/never), age first used oral contraceptives (<14 years, >14 years/never), and parental education (neither parent attended college, at least one parent attended college, at least one parent was a college graduate).

## **Results**

A total of 101 incident cases of SLE who completed the child abuse questions were confirmed among 670,822 person-years between 1995, the start of follow-up for this analysis, and 2015 the last completed follow-up cycle. Among these confirmed cases of incident SLE, the mean age at diagnosis was 43 years; mean number of ACR criteria for SLE was 5.1 ( $\pm$ 1.4); 66% had a hematological disorder, and 33% had a renal disorder. The majority of all childhood and adolescent abuse exposures were reported to have started during childhood (83% of all participants returning the questionnaire with adolescent abuse

also reported childhood abuse). As only one SLE case reported new-onset abuse during adolescence, we were unable to analyze abuse beginning in adolescence separately.

As shown in table 1, physical abuse was reported more frequently than sexual abuse. Women who reported physical or sexual abuse were younger and heavier during adulthood, had an earlier age at menarche, were more likely to smoke or drink alcohol and to start at an earlier age, to begin oral contraceptive use at an earlier age, and to have a higher level of education than women who reported no abuse. Physical and sexual abuse were unrelated to region of the country and neighborhood socioeconomic status.

Table 2 provides data on childhood physical and sexual abuse in relation to SLE. HRs of physical and sexual abuse associated with SLE that were adjusted for age and questionnaire cycle only were similar to those adjusted for age at menarche, BMI at age 18, age began alcohol consumption, age started smoking, age began oral contraceptive use, and parental education. The multivariable HRs for ever report of sexual abuse only and ever report of both physical and sexual abuse exceeded 2.0, and the estimate for physical and sexual abuse was statistically significant (HR= 2.20, 95% CI 1.14–4.21). The multivariable HR for 2 reports of 4 episodes of sexual abuse was 2.51 (95% CI 1.29–4.85); the HR for 5 or more reports of 4 episodes of physical abuse was 2.37 (95% CI 1.13–4.99). Analyses using an alternate scoring method for both physical and sexual abuse yielded similar estimates.

Table 3 shows HRs for the individual questions that contributed to childhood physical and sexual abuse according to the distribution of questionnaire responses. The HRs exceeded 2.0 and were statistically significant for “choked or burned me”, “attacked me in some other way”, “exposed genitals against my will”, and “been sexual with me against my will”. The number of cases in the highest response category was 3 for “choked or burned me” and 8 or more for the other questions.

We sought to address the possibility of recall bias by conducting an analysis restricted to incident cases occurring after 2005 when the abuse questions were asked. Based on 21 cases, overall, the HR for the highest category of sexual abuse score 2.88 (95% CI: 0.84–9.89) and 1.68 (95% CI: 0.85–3.35) for the highest category of physical abuse score was (data not shown).

## Discussion

In the present study, abuse during childhood was associated with increased incidence of SLE during adulthood. The increase was approximately 2.5-fold for both physical and sexual abuse. Physical abuse was reported more frequently than sexual abuse, and the number of episodes associated with this increased risk was greater for physical abuse (at least 5 reports of physical abuse occurring at least 4 times) than for sexual abuse (2 reports of sexual abuse occurring at least 4 times). Numbers of exposed cases were insufficient to adequately study physical abuse in the absence of sexual abuse, or of sexual abuse in the absence of physical abuse. The actions most strongly associated with increased SLE were “choked or burned me”, “attacked me in some other way”, “exposed genitals against my will”, and “been sexual

with me against my will”, but numbers of exposed cases were small and thus the estimates had wide confidence intervals.

To our knowledge, this is the largest study of abuse victimization in relation to SLE in U.S. Black women. Among 269 prevalent cases of SLE identified in the San Francisco area of California, sexual abuse was reported more frequently by cases than by a comparable sample of people from the Behavioral Risk Factor Surveillance System, of which only 12% were Black<sup>35</sup>. Perhaps the most relevant studies of other exposures are those of PTSD in relation to SLE. A study of Iraq and Afghanistan veterans found a higher absolute prevalence of PTSD (5.4% women, 1.7% men) among those with autoimmune diseases. Veterans of both sexes diagnosed with PTSD were at significantly higher risk of diagnosis with any autoimmune condition –alone or combined – including SLE<sup>36</sup>. In a study of predominantly White, civilian female nurses, PTSD symptoms were associated with a more than 2-fold increased risk of incident SLE among women who experienced any traumatic event compared with those unexposed to trauma<sup>4</sup>. The PTSD exposure studied in the both the veterans and the nurses were mainly adult exposures, whereas we looked at abuse during childhood. Another analysis of NHSII data by Feldman et al.<sup>15</sup>, assessed physical and emotional abuse during childhood controlling for a similar covariates (e.g., parental education, age at menarche) as in our analysis. Similar to us, they found a 2.57 times greater risk of SLE (95% CI 1.30–5.12) related to high levels of childhood exposure relative to low. They additionally found the association to be partially mediated by adult depression and PTSD.

A number of potential mechanisms may explain the observed association between childhood physical and sexual abuse with incident SLE. Animal models demonstrate an important link between PTSD and increased systemic inflammation, via upregulation of micro-RNA in the brain, adrenal glands and blood and higher circulating immunoglobulin-M levels<sup>37,38</sup>. A meta-analysis of 25 studies demonstrated the association between childhood trauma and elevated levels of inflammatory biomarkers such as C-reactive protein, interleukin-6, and tumor necrosis factor-alpha at a mean age of 42 years<sup>39</sup>; in fact, subgroup analyses for specific types of trauma (physical, sexual, or emotional) revealed a differential impact on inflammatory markers by trauma type. While a number of studies have demonstrated that childhood trauma may be associated with high inflammation levels decades after exposure<sup>6</sup>, a recent study demonstrated that childhood victimization predicted elevated CRP levels by age 18 in young women, independent of genetic and socioeconomic risk of inflammation<sup>40</sup>. Additionally, dysregulation of the hypothalamic-pituitary-adrenal axis has been implicated as a modulator of inflammatory activity, potentially leading to activation of the immune system<sup>41</sup>.

The present study has several strengths. The data were collected using a prospective cohort study design, with lengthy follow-up. Validated data collection tools were used to assess childhood physical and sexual abuse<sup>21,28,42</sup>; these instruments have been widely used and demonstrate high reproducibility within the BWHS<sup>29</sup> and in other studies<sup>28,43</sup>. Furthermore, factor analysis of BWHS data indicate that the abuse questions identified the underlying constructs they were intended to measure<sup>29</sup>. Although self-report of child abuse as an adult may lead to underreporting of abuse, and thus potentially underestimating the association

between child abuse and SLE in the present study, self-report measures of child abuse have strong discriminant validity for identifying those with a history of abuse<sup>44</sup>. Potential SLE cases were reviewed and confirmed by study rheumatologists as satisfying accepted classification criteria for SLE. Potential childhood and parental confounding factors were controlled in the analyses. The Conflict Tactics Scale questions have been associated with other outcomes in the BWHS, including age at menarche and obesity<sup>18</sup>—factors also known to be associated with SLE. Additionally, the Black Women’s Health Study has similar prevalence estimates of childhood abuse compared to those found in nationally representative studies<sup>10–12,16,45,46</sup>, suggesting that these findings may be generalizable to a broader population of US Black women.

Study limitations include the cross-sectional nature of data collection concerning abuse. Women were followed for SLE incidence from 1995 to 2015, but experiences of abuse during childhood were ascertained in 2005. Although experiences of physical and sexual abuse victimization in childhood would have preceded the occurrence of SLE in the BWHS, the temporal sequence of reporting abuse experiences did not precede the diagnosis for most cases in our analysis. Thus, recall bias could have occurred if women who had SLE overreported abuse or were more likely to remember childhood abuse compared to women who did not have SLE. Additionally, only those cases of SLE who survived until at least 2005 had the opportunity to report their experiences of abuse. Therefore, the cases analyzed from 1995 to 2005 may underrepresent the most aggressive cases of SLE in the cohort. In addition, since there was only one case of abuse that began in adolescence, it was not possible to assess child and adolescent abuse separately. We conducted multiple testing (e.g., of the individual questions), which increased the possibility of false positives. The positive findings in our study need to be independently confirmed in other data. Although we did account for potentially important childhood and adult confounders, we did not perform mediation analyses to assess whether covariates associated with child abuse and SLE — such as cigarette smoking, alcohol consumption, obesity, reproductive factors, or depression — may actually lie on the causal pathway. Additionally, our study did not control for other childhood stressors which may be associated with childhood victimization<sup>47</sup>. Finally, we were unable to assess “early onset” SLE (in adolescence), which may be particularly related to childhood exposures.

In summary, this study suggests that childhood physical and sexual abuse, in particular severe and frequent abuse, are associated with increased risk of developing SLE among adult Black women. Our study contributes to a growing body of evidence demonstrating an association between psychosocial factors and SLE. However, the study must be considered exploratory as it is the first to assess abuse in childhood and adolescence in relation to SLE and it was based on small numbers of exposed cases. Confirmation in other data are required, and identification of biologic pathways could provide insight into disease etiology.

### Grant Support:

Research reported in this publication was supported by the National Institute of Arthritis and Musculoskeletal and Skin Diseases R01 AR0573727 and K24 AR066109 and the National Cancer Institute R01- CA058420, U01- CA164974; Dr. Barbhuiya is supported by the Rheumatology Research Foundation Investigator Award and Dr. Tedeschi is supported by the Lupus Foundation of America Career Development Award.

## References

1. Feldman CH, Hiraki LT, Liu J, et al. Epidemiology and sociodemographics of systemic lupus erythematosus and lupus nephritis among US adults with Medicaid coverage, 2000–2004. *Arthritis Rheum* 2013;65:753–63. [PubMed: 23203603]
2. Mak A, Tay SH. Environmental factors, toxicants and systemic lupus erythematosus. *Int J Mol Sci* 2014;15:16043–56. [PubMed: 25216337]
3. de Brouwer SJ, Kraaimaat FW, Sweep FC, et al. Experimental stress in inflammatory rheumatic diseases: a review of psychophysiological stress responses. *Arthritis Res Ther* 2010;12:R89. [PubMed: 20478029]
4. Roberts AL, Malspeis S, Kubzansky LD, et al. Association of Trauma and Posttraumatic Stress Disorder With Incident Systemic Lupus Erythematosus in a Longitudinal Cohort of Women. *Arthritis Rheumatol* 2017;69:2162–9. [PubMed: 28929625]
5. Luiz APL, Antico HA, Skare TL, Boldt ABW, Nishihara R. Adverse childhood experience and rheumatic diseases. *Clin Rheumatol* 2018.
6. Danese A, Pariante CM, Caspi A, Taylor A, Poulton R. Childhood maltreatment predicts adult inflammation in a life-course study. *Proc Natl Acad Sci U S A* 2007;104:1319–24. [PubMed: 17229839]
7. Miller G, Chen E, Cole SW. Health psychology: developing biologically plausible models linking the social world and physical health. *Annu Rev Psychol* 2009;60:501–24. [PubMed: 19035829]
8. Danese A, Baldwin JR. Hidden Wounds? Inflammatory Links Between Childhood Trauma and Psychopathology. *Annu Rev Psychol* 2017;68:517–44. [PubMed: 27575032]
9. Danese A, McEwen BS. Adverse childhood experiences, allostasis, allostatic load, and age-related disease. *Physiol Behav* 2012;106:29–39. [PubMed: 21888923]
10. Centers for Disease C. National Center for Injury Prevention and Control. *Child Maltreatment: facts at a glance 2014*. 2016.
11. Finkelhor D. Current information on the scope and nature of child sexual abuse. *Future Child* 1994;4:31–53. [PubMed: 7804768]
12. Barnett OW, Miller-Perrin CL, Perrin RD. Physical Child Abuse. In: Barnett O, CL M-P, Perrin R, eds. *Family Violence Across the Lifespan*. Thousand Oaks, CA: SAGE; 1996.
13. Rennison C, Planty M. Nonlethal intimate partner violence: examining race, gender, and income patterns. *Violence Vict* 2003;18:433–43. [PubMed: 14582864]
14. Dube SR, Fairweather D, Pearson WS, Felitti VJ, Anda RF, Croft JB. Cumulative childhood stress and autoimmune diseases in adults. *Psychosom Med* 2009;71:243–50. [PubMed: 19188532]
15. Feldman CH, Malspeis S, Leatherwood C, Kubzansky L, Costenbader KH, Roberts AL. Association of Childhood Abuse with Incident Systemic Lupus Erythematosus in Adulthood in a Longitudinal Cohort of Women. *J Rheumatol* 2019;46:1589–96. [PubMed: 31092723]
16. 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;14:245–58. [PubMed: 9635069]
17. Nichols HB, Harlow BL. Childhood abuse and risk of smoking onset. *J Epidemiol Community Health* 2004;58:402–6. [PubMed: 15082739]
18. Boynton-Jarrett R, Rosenberg L, Palmer JR, Boggs DA, Wise LA. Child and adolescent abuse in relation to obesity in adulthood: the Black Women’s Health Study. *Pediatrics* 2012;130:245–53. [PubMed: 22753562]
19. Coogan PF, Wise LA, O’Connor GT, Brown TA, Palmer JR, Rosenberg L. Abuse during childhood and adolescence and risk of adult-onset asthma in African American women. *J Allergy Clin Immunol* 2013;131:1058–63. [PubMed: 23219171]
20. Wise LA, Palmer JR, Rosenberg L. Lifetime abuse victimization and risk of uterine leiomyomata in black women. *Am J Obstet Gynecol* 2013;208:272 e1–e13. [PubMed: 23295977]
21. Wise LA, Palmer JR, Boggs DA, Adams-Campbell LL, Rosenberg L. Abuse victimization and risk of breast cancer in the Black Women’s Health Study [corrected]. *Cancer Causes Control* 2011;22:659–69. [PubMed: 21327459]



22. Barbhaiya M, Tedeschi SK, Lu B, et al. Cigarette smoking and the risk of systemic lupus erythematosus, overall and by anti-double stranded DNA antibody subtype, in the Nurses' Health Study cohorts. *Ann Rheum Dis* 2018;77:196–202. [PubMed: 28988206]
23. Costenbader KH, Kim DJ, Peerzada J, et al. Cigarette smoking and the risk of systemic lupus erythematosus: a meta-analysis. *Arthritis Rheum* 2004;50:849–57. [PubMed: 15022327]
24. Cozier YC, Barbhaiya M, Castro-Webb N, et al. Relationship of cigarette smoking and alcohol consumption to incidence of systemic lupus erythematosus in the Black Women's Health Study. *Arthritis Care Res (Hoboken)* 2018.
25. Cozier YC, Barbhaiya M, Castro-Webb N, et al. A prospective study of obesity and risk of systemic lupus erythematosus (SLE) among Black women. *Semin Arthritis Rheum* 2018.
26. Tedeschi SK, Barbhaiya M, Malspeis S, et al. Obesity and the risk of systemic lupus erythematosus among women in the Nurses' Health Studies. *Semin Arthritis Rheum* 2017;47:376–83. [PubMed: 28688713]
27. Straus MA. Measuring intrafamily conflict and violence: the Conflict Tactics (CT) scales. *J Marriage Fam* 1979;41:75–88.
28. McFarlane J, Parker B, Soeken K, Bullock L. Assessing for abuse during pregnancy. Severity and frequency of injuries and associated entry into prenatal care. *JAMA* 1992;267:3176–8. [PubMed: 1593739]
29. Wise LA, Palmer JR, Rothman EF, Rosenberg L. Childhood abuse and early menarche: findings from the black women's health study. *Am J Public Health* 2009;99 Suppl 2:S460–6. [PubMed: 19443822]
30. Wise LA, Zierler S, Krieger N, Harlow BL. Adult onset of major depressive disorder in relation to early life violent victimisation: a case-control study. *Lancet* 2001;358:881–7. [PubMed: 11567704]
31. Rayworth BB, Wise LA, Harlow BL. Childhood abuse and risk of eating disorders in women. *Epidemiology* 2004;15:271–8. [PubMed: 15097006]
32. Hochberg MC. Updating the American College of Rheumatology revised criteria for the classification of systemic lupus erythematosus. *Arthritis Rheum* 1997;40:1725.
33. Tan EM, Cohen AS, Fries JF, et al. The 1982 revised criteria for the classification of systemic lupus erythematosus. *Arthritis Rheum* 1982;25:1271–7. [PubMed: 7138600]
34. McAlindon TE, Formica M, Palmer JR, Lafyatis R, Rosenberg L. Assessment of strategies for identifying diagnosed cases of systemic lupus erythematosus through self-report. *Lupus* 2003;12:754–9. [PubMed: 14596424]
35. De Quattro K, Trupin L, Li J, et al. Relationships between adverse childhood experiences and health status in systemic lupus erythematosus. *Arthritis Care Res* 2019.
36. O'Donovan A, Cohen BE, Seal KH, et al. Elevated risk for autoimmune disorders in Iraq and Afghanistan veterans with posttraumatic stress disorder. *Biol Psychiatry* 2015;77:365–74. [PubMed: 25104173]
37. Wilson CB, McLaughlin LD, Nair A, Ebenezer PJ, Dange R, Francis J. Inflammation and oxidative stress are elevated in the brain, blood, and adrenal glands during the progression of post-traumatic stress disorder in a predator exposure animal model. *PLoS One* 2013;8:e76146. [PubMed: 24130763]
38. Boscarino JA. Posttraumatic stress disorder and physical illness: results from clinical and epidemiologic studies. *Ann N Y Acad Sci* 2004;1032:141–53. [PubMed: 15677401]
39. Baumeister D, Akhtar R, Ciufolini S, Pariante CM, Mondelli V. Childhood trauma and adulthood inflammation: a meta-analysis of peripheral C-reactive protein, interleukin-6 and tumour necrosis factor-alpha. *Mol Psychiatry* 2016;21:642–9. [PubMed: 26033244]
40. Baldwin JR, Arseneault L, Caspi A, et al. Childhood victimization and inflammation in young adulthood: A genetically sensitive cohort study. *Brain Behav Immun* 2018;67:211–7. [PubMed: 28867281]
41. Santa Ana EJ, Saladin ME, Back SE, et al. PTSD and the HPA axis: differences in response to the cold pressor task among individuals with child vs. adult trauma. *Psychoneuroendocrinology* 2006;31:501–9. [PubMed: 16413134]
42. Straus MA. Measuring intrafamily conflict and violence: the Conflict Tactics (CT) scales. *J Marriage Fam* 1979;41:75–88.

43. Straus MA. The Conflict Tactics Scales and its critics: an evaluation and new data on validity and reliability. In: Straus MA, Gelles RJ, eds. *Physical Violence in American Families: Risk Factors and Adaptations to Violence in 8,145 Families*. New Brunswick, NJ: Transaction Publishers; 1990.
44. Widom CS, Shepard RL. Accuracy of adult recollections of childhood victimization: part I. Childhood physical abuse. *Psychol Assess* 1997;8.
45. Kilpatrick DG, Acierno R, Saunders B, Resnick HS, Best CL, Schnurr PP. Risk factors for adolescent substance abuse and dependence: data from a national sample. *J Consult Clin Psychol* 2000;68:19–30. [PubMed: 10710837]
46. Finkelhor D, Ormrod RK, Turner HA. Re-victimization patterns in a national longitudinal sample of children and youth. *Child Abuse Negl* 2007;31:479–502. [PubMed: 17537508]
47. Teegen F. *Childhood sexual abuse and long term sequelae*. Seattle, WA: Hogrefe and Huber Publishers; 1999.

### Significance and Innovations

- Exposure to psychosocial stressors have been shown to contribute to the onset of SLE and other autoimmune diseases decades after exposure.
- To our knowledge, this is the largest study to explore the role of childhood abuse victimization in relation to adult onset SLE in U.S. Black women.
- In this study of U.S. Black women, physical and sexual abuse during childhood, in particular severe and frequent abuse, was associated with increased incidence of SLE during adulthood.
- Our study contributes to a growing body of evidence demonstrating an association between psychosocial factors and SLE, yet it must be considered exploratory as it was based on a relatively small number of confirmed cases.

**Table 1.** Age-standardized baseline characteristics by child abuse type among 36,152 women who reported abuse during childhood in BWHHS.

	Baseline (1995) Factors				
	No childhood abuse (n=8,070)	Physical Abuse only (n=19,274)	Sexual abuse only (n=809)	Sexual & physical abuse (n=7999)	Any abuse (n=28,082)
Age in years, mean(SD)	41.5 ± 11.4	39.0 ± 10.5	37.9 ± 10.3	37.5 ± 9.7	38.6 ± 10.3
BMI kg/m <sup>2</sup> , mean(SD)	27.6 ± 6.4	27.7 ± 6.5	28.2 ± 6.7	28.6 ± 7.1	28.0 ± 6.7
Region of residence					
Northeast, %	28	27	29	29	27
South, %	32	31	29	27	30
Education, years					
12 years, %	21	16	17	15	16
16 years, %	45	51	52	48	50
Neighborhood SES					
Quintile 1 (low), %	19	18	18	19	18
Quintile 5 (high), %	18	19	21	18	19
Oral Contraceptive use, ever %	84	85	84	85	85
Cigarette Smoking, ever %	32	33	33	39	34
Alcohol Intake, ever %	40	43	40	45	43
	Childhood Factors				
Parental Education, HS or less %	45	45	46	46	46
Age at Menarche 11, %	26	28	33	33	29
Oral Contraceptive Use age 14, %	2	2	3	3	2
BMI at age 18	21.3 ± 3.9	21.4 ± 4.0	21.7 ± 4.2	21.7 ± 4.3	21.5 ± 4.1
Passive smoking ages 0–10, %	42	49	45	52	50
Started alcohol intake age 14, %	1	2	1	3	2
Started smoking age 14, %	2	3	3	6	4

Values are standardized to the 1995 age distribution of the study population. Percentages may not add to 100 because of rounding errors or missing values.

**Table 2.**

Hazard ratios for SLE in relation to type and frequency of childhood physical and sexual abuse among 36,152 participants in the Black Women's Health 1995 to 2015.

			Age- and Questionnaire Period- Adjusted			Fully-Adjusted**		
	Cases	Person-years	HR	95% CI		HR	95% CI	
<b>Child abuse type*</b>								
None	58	413173	Ref.			Ref.		
Physical only	28	212301	0.91	0.58	1.43	0.90	0.57	1.42
Sexual only	4	12877	2.11	0.76	5.83	2.04	0.74	5.66
Physical and sexual	11	32469	2.24	1.17	4.27	2.20	1.14	4.21
<b>Sexual abuse score***</b>								
0	86	625475	Ref.			Ref.		
1	5	18956	1.85	0.75	4.56	1.84	0.74	4.54
2	10	26390	2.57	1.33	4.96	2.51	1.29	4.85
<b>Physical Abuse score***</b>								
0	62	426049	Ref.			Ref.		
1–2	20	163969	0.81	0.49	1.35	0.81	0.48	1.34
3–4	11	59963	1.20	0.63	2.27	1.19	0.63	2.27
5+	8	20840	2.44	1.16	5.10	2.37	1.13	4.99

\* A report of 4 instances of each type of abuse.

\*\* Adjusted for age began alcohol consumption <= 14 years, age began smoking <= 14 years, BMI at age 18 years, age first oral contraceptive use <=14 years, parental education level, and age at menarche.

\*\*\* To create a childhood physical abuse summary score variable, we assigned 1 point for each report of a physical abuse item that occurred 4 times; to create a childhood sexual abuse summary category, we assigned 1 point or each report of sexual abuse that occurred 4 times (e.g., 0=zero reports of abuse occurring 4 times, 5=five reports of abuse occurring 4 times).

**Table 3.**

Hazard Ratios for SLE in Relation to Individual Components Childhood Physical and Sexual Abuse among 36,153 Participants in the Black Women's Health Study 1995 – 2005.

	Cases	Person-years	Age- and Questionnaire Period- Adjusted		Fully-Adjusted*	
			HR	95% CI	HR	95% CI
<b>Pushed, grabbed, or shoved me</b>						
Never	43	263447	Ref.		Ref.	
1–3 times	32	259416	0.74	0.47	0.74	0.47
>= 4 times	26	147958	1.03	0.632	1.02	0.62
<b>Threw something at me that could hurt me</b>						
Never	65	445463	Ref.		Ref.	
1–3 times	23	169717	0.90	0.56	0.89	0.55
>= 4 times	13	55640	1.52	0.84	1.49	0.82
<b>Kicked, bit, or punched me</b>						
Never	54	393854	Ref.		Ref.	
1–3 times	30	203082	1.03	0.66	1.02	0.65
>= 4 times	17	73884	1.56	0.90	1.53	0.88
<b>Hit me with something including hand and fist</b>						
Never	41	265398	Ref.		Ref.	
1–3 times	27	228708	0.74	0.45	0.73	0.45
>= 4 times	33	176714	1.13	0.72	1.13	0.71
<b>Choked or burned me</b>						
Never	94	642837	Ref.		Ref.	
1–3 times	4	23042	1.13	0.42	1.10	0.40
>= 4 times	3	4942	3.74	1.18	3.77	1.19
<b>Physically attacked me in some other way</b>						
Never	76	544213	Ref.		Ref.	
1–3 times	12	88082	0.96	0.52	0.95	0.52
>= 4 times	13	38526	2.33	1.29	2.27	1.26
<b>Exposed their genitals against my will</b>						
Never	76	544213	Ref.		Ref.	
1–3 times	12	88082	0.96	0.52	0.95	0.52
>= 4 times	13	38526	2.33	1.29	2.27	1.26

	Person-years		Age- and Questionnaire Period- Adjusted			Fully-Adjusted*	
	Cases	Person-years	HR	95% CI	HR	95% CI	
Never	73	548835	Ref.		Ref.		
1-3 times	17	89646	1.36	0.81	2.32	1.34	0.79 2.28
>= 4 times	11	32339	<b>2.38</b>	<b>1.26</b>	<b>4.51</b>	<b>2.33</b>	<b>1.23 4.41</b>
<b>Was sexual with me against my will</b>							
Never	77	551029	Ref.			Ref.	
1-3 times	10	80396	0.85	0.44	1.65	0.84	0.43 1.62
>= 4 times	14	39396	<b>2.38</b>	<b>1.34</b>	<b>4.23</b>	<b>2.33</b>	<b>1.31 4.15</b>
<b>Seriously harmed someone I loved</b>							
Never	81	569728	Ref.			Ref.	
1-3 times	12	65883	1.25	0.68	2.30	1.23	0.67 2.25
>= 4 times	8	35209	1.53	0.74	3.17	1.50	0.72 3.12

Hazard ratios are presented according to the distribution of responses to the individual components of abuse.

\*\* Adjusting for age, period, age began alcohol consumption <= 14 years, age began smoking <= 14 years, age began oral contraceptive use <=14 years, BMI at age 18 years, age first oral contraceptive use <=14 years, parental education level, and age at menarche.