ORIGINAL RESEARCH

Exposure to Violence and Carotid Artery Intima-Media Thickness in Mexican Women

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***Background*—**Violence against women has become a global public health threat. Data on the potential impact of exposure to violence on cardiovascular disease are scarce.

***Methods and Results*—**We evaluated the association between exposure to violence and subclinical cardiovascular disease in 634 disease-free women from the Mexican Teachers' Cohort who responded to violence-related items from the Life Stressor Checklist and underwent measures of carotid artery intima-media thickness in 2012 and 2013. We defined exposure to violence as having ever been exposed to physical and/or sexual violence. Intima-media thickness was log-transformed, and subclinical carotid atherosclerosis was defined as intima-media thickness ≥0.8 mm or plaque. We used multivariable linear and logistic regression models adjusted for several potential confounders. Mean age was 48.9±4.3 years. Close to 40% of women reported past exposure to violence. The lifetime prevalence of sexual violence was 7.1%, and prevalence of physical violence was 23.5% (7.7% reported both sexual and physical violence). Relative to women with no history of violence, exposure to violence was associated with higher intima-media thickness (adjusted mean percentage difference=2.4%; 95% confidence interval 0.5, 4.3) and subclinical atherosclerosis (adjusted odds ratio=1.60; 95% confidence interval 1.10, 2.32). The association was stronger for exposure to physical violence, especially by mugging or physical assault by a stranger (adjusted mean % difference=4.6%; 95% confidence interval 1.8, 7.5, and odds ratio of subclinical carotid atherosclerosis=2.06; 95% confidence interval 1.22, 3.49).

***Conclusions*—**Exposure to violence, and in particular assault by a stranger, was strongly associated with subclinical cardiovascular disease in Mexican middle-aged women. **(*J Am Heart Assoc*. 2017;6:e006249. DOI: 10.1161/JAHA.117.006249.)**

Key Words: cardiovascular disease • carotid intima-media thickness • stress • violence • women

There has been significant progress in the characterization of risk factors for cardiovascular disease (CVD) in women.[1,2] However, there is a need to expand our understanding of modifiable risk factors. For many years there has been research conducted on the idea that psychological stress is a potential risk factor for CVD.[3–5] In addition, highly stressful or traumatic events, such as violence, have been associated with CVD.[6–10]

As the victimization of women increases globally,[11] understanding the potential consequences to cardiovascular health of exposure to violence is becoming increasingly relevant to public health. In recent years Mexico has undergone a dramatic increase in criminal violence and insecurity.[12] In 2013 one third of Mexican households reported being subjected to crime, and half of the victims were women.[13] The most common crime reported was street robbery or mugging.

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Accompanying Tables S1–S3 are available at http://jaha.ahajournals.org/content/6/8/e006249/DC1/embed/inline-supplementary-material-1.pdf

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Clinical Perspective

What Is New?

- Violence against women is globally on the rise, and the impact of violence on future cardiovascular health remains uncertain.
- In this study among Mexican middle-aged women that relied on centralized measurement of carotid intima-media thickness, exposure to violence was associated with increased risk of cardiovascular disease.
- The association was stronger among women who reported physical violence inflicted by a stranger.

What Are the Clinical Implications?

- Our findings underscore the increasing relevance of violence against women for cardiovascular health and the need to address violence prevention globally.

Previous studies evaluating the impact of violence on subsequent cardiovascular risk have primarily focused on domestic violence[14] or did not directly address violence experiences outside the home.[15] Most of these reports were also limited by their reliance on self-reported CVD.[16]

Understanding the impact of violence on later-in-life cardiovascular health could illuminate additional risk factors for CVD and help garner additional support for violence prevention policies. Thus, we evaluated the association between various lifetime exposures to violence, including violence by a stranger and carotid intima-media thickness (IMT), a measure of subclinical cardiovascular disease, in women living in southern Mexico.

Methods

Study Population

We conducted a cross-sectional analysis on data collected from an ancillary study of the Mexican Teachers' Cohort Study.[17] The Mexican Teachers' Cohort is a prospective investigation of 115 315 female teachers aged ≥25 years that began in 2006 and 2008, during which participants responded to a baseline questionnaire on demographic and reproductive characteristics, lifestyle, and medical conditions. Study participants were public school teachers from 12 geographically and economically diverse states in Mexico. Between September 2012 and November 2013, a random sample of 2230 study participants aged ≥40 years, who lived within 50 km of 5 clinical sites in 2 states in southern Mexico (Chiapas and Yucatan), were invited to participate in a clinical assessment as part of an ancillary study on subclinical cardiovascular disease. A total of 1625 participants (73%) were assessed, and 754 completed the Life Stressor Checklist.[18] The study was approved by the Institutional Review Board at the National Institute of Public Health (INSP; project number 1221).

Assessment of Violence

The Life Stressor Checklist is a self-reported measure used to assess traumatic or stressful life events that is applied in different clinical and research settings[19,20] and has been previously used in studies on Latin American populations.[21,22] This checklist assesses 30 highly stressful life events, including 12 violence-related items (Table S1), and other events such as natural disasters and the death of a relative. Respondents are asked to provide additional information on the age when the event began and ended, depending on the item.

We used Life Stressor Checklist violence-related items and defined exposure to violence as having been exposed to physical and/or sexual violence because these were considered to be more severe and objective events with potentially greater impact on CVD. Thus, women who only reported less severe types of violence (emotional abuse, neglect, and observed violence) were here considered as not exposed. We further explored 2 types of violence separately: sexual and physical violence. For physical violence, we further classified the exposure with respect to offender/perpetrator being either a family member or a stranger. The Life Stressor Checklist did not allow for a similar evaluation of sexual violence. In order to determine age at first exposure, we classified violence by whether exposure first occurred in childhood (<16 years) or in adulthood (≥16 years). For those questions that did not distinguish between childhood and adulthood exposure we used additional questions on age when the event happened first to determine age at first exposure.

Subclinical Cardiovascular Disease

Neurologists used a SonoSite™ MicroMaxx™ ultrasound and Asus™ laptop with M'AthStd Software™ (Intelligence in Medical Technologies, Paris, France) for the semiautomatic measurement of IMT and the presence of plaques. Study neurologists were previously standardized by study investigators and a senior neurologist, C.C.-B., who has ample experience on carotid ultrasonography. Measurements were made on both common carotid arteries[23] with patients in a supine position with their head rotated 0° to 30°. IMT was measured between the lumen-intima and media-adventitia interfaces on the far wall of the common carotid artery, at least 5 mm below its end where the carotid bifurcation was visible. We obtained images of a 10-mm arterial segment and used the mean IMT for each common carotid artery to calculate the overall mean. In the absence of an adequate image, neurologists repeated this procedure on the near wall.

Structures protruding into the arterial lumen by ≥0.5 mm or 50% of the surrounding IMT or IMT >1.5 mm were considered plaques. We assessed the reproducibility of our IMT assessment by repeating measurements in 147 study participants. Reproducibility was high, r=0.89 (95% confidence interval [CI] 0.84, 0.93) for Chiapas and r=0.92 (95% CI 0.86, 0.96) for Yucatan. Carotid IMT is a marker of subclinical arterial injury and is associated with increased risk of cardiovascular events.[24] This noninvasive procedure is one of the best methods for detecting early stages of atherosclerotic disease.[23]

Covariates

Covariate information was based on self-reporting from questionnaires administered in 2008 and 2011[17] as well as measurements taken during the clinical visit in 2012 and 2013. The 2008 questionnaire included information on early life factors: birth weight (below normal <2.5 kg, normal 2.5-4.0, above normal >4.0), whether or not the parents smoked, and the number of siblings. These factors may be associated with exposure to violence and may affect cardiovascular risk in adulthood. The questionnaire also gathered information on current marital status (single/widow, cohabiting/married, and separated/divorced), health insurance (public/private), and whether or not the participants or the participants' parents spoke an indigenous language. We used this same source of information to calculate alcohol intake (drinks/week). In 2011, we asked participants about weekly hours spent doing moderate (ie, riding a bike, dancing, hiking) or vigorous (ie, swimming, running) recreational physical activity, providing 8 time categories to choose (from none to ≥10 hours/week). Smoking and menopausal status were determined using self-reports from the 2008 and 2011 questionnaires. For smoking status, we asked participants whether they were current or past smokers or had never smoked. Menopausal status was determined based on responses to last menstruation, hot flashes, and any history of a hysterectomy, oophorectomy, and/or hormonal treatments.

During the clinical visit we obtained fasting blood samples (≈25 mL) by venipuncture that were processed within 30 minutes. Plasma concentrations of glucose, total cholesterol, and HDL-cholesterol were measured at the clinical site using standard assays. Blood pressure measurements were performed automatically (VaSera VS-1000; Fukuda Denshi, Tokyo, Japan), and standardized personnel performed weight and height measurements with the use of an electronic digital scale (Tanita Corp; Arlington Heights, Illinois, USA) to the nearest 0.1 kg and a wall stadiometer (Seca Corp; Hamburg, Germany) to the nearest millimeter.

Diabetes mellitus status was based on self-reported treated diabetes mellitus or having fasting plasma glucose levels ≥126 mg/dL at the clinical visit. Similarly, hypercholesterolemia was defined as self-reported treated hypercholesterolemia or having fasting plasma total cholesterol ≥240 mg/dL or LDL cholesterol ≥160 mg/dL. Hypertension was defined by self-report of treated hypertension or ≥140 mm Hg systolic blood pressure or ≥90 mm Hg diastolic pressure. We calculated body mass index as weight in kilograms divided by height in meters squared.

Statistical Analysis

Because IMT was positively skewed, we used log-transformation to normalize its distribution.[25] We used age and multivariable-adjusted linear regression models to estimate percentage difference in mean IMT for (1) exposure to violence, (2) types of violence (sexual and physical), (3) physical violence by offender (family member and stranger), and (4) age at first exposure to violence (childhood/adulthood) relative to no exposure to violence (as previously defined). We sought to isolate the impact of sexual and physical violence and violence by a family member and a stranger. For women who reported both sexual and physical violence (n=49) and physical violence by both a family member and a stranger (n=11) we created indicator variables and included them in the models. We defined subclinical carotid atherosclerosis as mean left or right IMT≥0.8 mm or the presence of plaque. We used logistic regression to estimate age- and multivariable-adjusted odds ratios for subclinical carotid atherosclerosis with no violence as the reference. Multivariable models included age (years), study site (Chiapas/Yucatan), indigenous ethnicity (yes/no), parental smoking (yes/no), number of siblings, weight at birth (normal, below normal, above normal), private healthcare insurance—as a proxy for socioeconomic status—(yes/no), marital status (single/widow, cohabiting/married, and separated/divorced), and menopausal status (premenopausal, postmenopausal, and unknown). We conducted additional analyses adjusting for potential mediators: smoking (past, current, never, missing), alcohol intake (drinks/week), recreational physical activity (hours/week), body mass index (kg/m^2), diabetes mellitus, hypertension, and hypercholesterolemia. We explored chronicity of exposure to sexual violence using total number of years exposed to sexual violence (the instrument did not allow for a similar evaluation for physical violence). All statistical tests were 2-sided, and analyses were performed using SAS version 9.4 (SAS Institute, Cary, NC).

Results

We excluded women who opted out of carotid intima-media thickness measurement (n=114) and those who reported a previous diagnosis of myocardial infarction and stroke (n=6). All remaining participants (n=634) provided informed consent.

Table 1. Characteristics of 634 Women in Mexico According to Violence Exposure

Type of violence[†]	No Violence	Lifetime Violence		
		Any*		
			Sexual	Physical
Participants, n	391	243	45	149
Age, y, mean (SD)	48.8 (3.9)	48.9 (4.7)	49.2 (4.4)	48.8 (4.6)
Indigenous	18.4	17.3	24.4	14.1
Marital status				
Single/widowed	16.9	15.6	28.9[§]	13.4
Married	73.9	60.5[§]	57.8[§]	61.1[§]
Separated/divorced	9.2	23.9[§]	13.3	25.5[§]
Private health care	21.0	20.6	24.4	16.8
Menopausal status				
Premenopausal	69.6	58.0[§]	55.6	58.4[§]
Postmenopausal	20.2	29.2[§]	31.1	28.2[§]
Unknown	10.2	12.8	13.3	13.4
Physical activity (hours/week), mean (SD)	1.8 (3.2)	2.2 (3.5)	1.5 (2.4)	2.5 (3.9)
Smoking[‡]				
Never	84.1	76.1[§]	75.6	76.5[§]
Past	8.4	14.8[§]	17.8[§]	15.4[§]
Current	5.9	8.2	6.7	6.7
Alcohol use (drinks/week), mean (SD)	0.5 (1.1)	0.6 (1.0)	0.9 (1.4)	0.5 (0.9)
Diabetes mellitus	10.5	11.5	6.7	10.1
Hypertension	40.7	38.3	31.1	40.9
Hypercholesterolemia	33.5	43.2[§]	37.8	44.3[§]
Body mass index[‡]				
Normal	22.8	19.3	15.6	21.5
Overweight	38.4	39.5	24.4	43.6
Obese	38.3	40.7	57.8[§]	34.9

Values are percentages unless otherwise indicated. Calculated using t test for continuous variables and chi-squared test for categorical variables. SD indicates standard deviation.
*Any includes participants who reported either sexual or physical violence or both.
[†]49 women reported exposure to both sexual and physical violence.
[‡]Less than 5% missing values.
[§]Statistically significant differences ($P<0.05$) between exposed and unexposed groups.

The average age of participants was 48.9 ±4.3 years, and the overall prevalence of subclinical carotid atherosclerosis was 28.9% (n=183). Close to 40% of women reported exposure to violence (38.3%; n=243). The lifetime prevalence of sexual violence was 7.1% (n=45), while prevalence of physical violence was 23.5% (n=149; 49 women or 7.7% reported both sexual and physical violence). Exposure to physical violence occurred most often outside the home committed by a stranger (13.1%, n=83), although close to 9% (n=55) of women reported physical violence at home committed by a family member (11 women [1.7%] reported violent incidents by a stranger and a family member). Eighty-five women (13.4%) reported exposure to violence occurring before age 16. The characteristics of participants according to exposure to violence are shown in Table 1. As compared with women who did not report violence, women who reported violence were more likely to be separated or divorced, to be postmenopausal, and to have a history of smoking. The prevalence of hypercholesterolemia and obesity was higher in women reporting violence when compared with those who did not report violence. Although not found to be statistically significant, women who reported sexual violence tended to be indigenous and had a higher socioeconomic status (as indicated by access to private medical insurance).

The multivariable-adjusted mean percentage difference in IMT in women who reported exposure to violence relative

Table 2. Multivariable-Adjusted Percentage Differences of Mean IMT (95% CI) According to Type of Violence and Age at First Exposure

	Difference, % (95% CI)		
	n	Age-Adjusted	Multivariable
No exposure	391	ref	ref
Any violence*†	243	2.3 (0.4, 4.2)	2.4 (0.5, 4.3)
Sexual	45	3.4 (−0.2, 6.9)	2.9 (−0.7, 6.6)
Physical	149	3.1 (0.9, 5.3)	3.2 (0.9, 5.5)
Physical violence by offender‡			
No violence	391	ref	ref
Family member	55	1.1 (−2.2, 4.4)	1.3 (−2.1, 4.6)
Stranger	83	4.5 (1.7, 7.2)	4.6 (1.8, 7.5)
Violence by age at first exposure			
No violence	391	ref	ref
Childhood (<16 y)	85	1.9 (−0.9, 4.6)	1.6 (−1.1, 4.4)
Adulthood (≥16 y)	158	2.6 (0.4, 4.7)	2.8 (0.6, 5.1)

Multivariable refers to age, state, indigenous, smoking (parents), number of siblings, birth weight, private health care, marital status, and menopausal status. CI indicates confidence interval; IMT, intima-media thickness.
*Any includes participants who reported either sexual or physical violence or both.
†49 women reported exposure to both sexual and physical violence.
‡11 women reported violence by both a family member and a stranger.

Table 3. Multivariable-Adjusted Odds Ratios for Subclinical Carotid Atherosclerosis (95% CI) According to Type of Violence and Age at First Exposure

	Odds Ratios (95% CI)		
	Cases/ Noncases	Age-Adjusted	Multivariable
No violence	99/292	ref	ref
Any violence*†	84/159	1.55 (1.09, 2.21)	1.60 (1.10, 2.32)
Sexual	16/29	1.55 (0.79, 3.01)	1.39 (0.69, 2.78)
Physical	55/94	1.76 (1.16, 2.65)	1.87 (1.22, 2.87)
Physical violence by offender‡			
No violence	99/292	ref	ref
Family member	18/37	1.35 (0.72, 2.51)	1.48 (0.78, 2.83)
Stranger	32/51	1.97 (1.19, 3.28)	2.06 (1.22, 3.49)
Violence by age at first exposure			
No violence	99/292	ref	ref
Childhood (<16 y)	25/60	1.16 (0.68, 1.98)	1.15 (0.66, 1.98)
Adulthood (≥16 y)	59/99	1.79 (1.19, 2.68)	1.91 (1.25, 2.92)

Multivariable refers to age, state, indigenous, smoking (parents), number of siblings, birth weight, private health care, marital status, and menopausal status. CI indicates confidence interval.
*Any includes participants who reported either sexual or physical violence or both.
†49 women reported exposure to both sexual and physical violence.
‡11 women reported violence by both a family member and a stranger.

to women who did not was 2.4% (95% CI 0.5, 4.3; Table 2). The association between types of violence and IMT shows that women who reported exposure to physical violence had a 3.2% (95% CI 0.9, 5.5) higher mean IMT relative to women who had not, after adjusting for early-life factors, sociodemographic characteristics, and menopausal status. Participants who reported having been mugged or physically assaulted by a stranger had a 4.6% (95% CI 1.8, 7.5) higher mean IMT than those who reported no violence. Inclusion of potential behavioral and biological mediators in the models resulted in modest attenuation of the estimates, but they remained statistically significant (Table S2). Percentage difference in IMT after inclusion of mediators was 1.9% (95% CI 0.1, 3.8) for any violence, 3.1% (95% CI 0.9, 5.3) for physical violence, and 3.9% (95% CI 1.3, 6.7) for physical violence by a stranger, relative to women with no history of violence. We did not observe an association between childhood violence and IMT. Mean IMT appeared to be higher among individuals with a history of childhood violence relative to those with no history (0.727 mm versus 0.710 mm); however, the multivariable-adjusted mean percentage difference in IMT between these 2 groups was not statistically significant.

Similar results were observed for analyses on subclinical carotid atherosclerosis. Women who reported any exposure to violence had 60% higher odds of subclinical carotid atherosclerosis compared with those with no history of violence (odds ratio [OR]=1.60; 95% CI 1.10, 2.32; Table 3). The multivariable-adjusted odds for subclinical carotid atherosclerosis was 87% higher in individuals who had reported exposure to physical violence relative to those who reported no violence (OR=1.87; 95% CI 1.22, 2.87). Similar to the results for IMT, exposure to a mugging event or physical assault by a stranger appeared to yield the strongest association (OR=2.06; 95% CI 1.22, 3.49). When potential intermediate variables were included (Table S3), some results were slightly attenuated but remained statistically significant (any violence OR=1.54; 95% CI 1.03, 2.28; physical violence OR=1.90; 95% CI 1.21, 2.99; physical violence by a stranger OR=1.92; 95% CI 1.10, 3.34). We did not observe an association between childhood violence and subclinical carotid atherosclerosis later in life.

We finally explored chronicity of exposure to sexual violence and calculated total number of years exposed to sexual violence in 72 participants who reported their age when sexual violence began and ended and evaluated its relation with IMT and subclinical carotid atherosclerosis. In multivariable models we found that for every year exposed to sexual violence there was an increase of 0.8% on mean IMT

(95% CI 0.1, 1.5), and the corresponding OR was 1.09 (95% CI 0.92, 1.31).

Discussion

In this study with objective measures of subclinical cardiovascular disease, we found exposure to violence, particularly physical assault by a stranger, to be associated with increased IMT and subclinical carotid atherosclerosis in Mexican middle-aged women. The relationship appeared to be tied to violence experienced during adulthood, as we found no evidence of an association between violence in childhood and subclinical CVD later in life.

Exposure to stressful life events may trigger abnormal neuroendocrine, immune, and metabolic response associated with activation of both the sympathetic nervous system, and the hypothalamic-pituitary-adrenal axis leading to an increase in circulating catecholamine, glucocorticoids, and inflammatory cytokines.[26-28] Stress is known to increase heart rate and blood pressure via the autonomic nervous system[29] in addition to intensifying bone-marrow activity leading to increased arterial inflammation.[30] All of these mechanisms can contribute to endothelial dysfunction and promote atherosclerosis and subsequent cardiovascular disease events. CVD risk factors related to these physiological responses—including obesity, diabetes mellitus, hypertension, and dyslipidemia—may represent an intermediate stage in the stress-CVD pathway.[28] Indeed, although we found that some of these intermediate risk factors were more common among women who were exposed to violence, they did not seem to contribute significantly to the reported associations when added to the multivariable models.

Also, psychological stress can lead to adverse cardiovascular health by affecting mental health and modifying health behaviors. Perceived stress and exposure to violence have been associated with a higher prevalence of unhealthy behaviors such as smoking and alcohol use.[31,32] In addition, negative psychological factors related to violence, such as depression and PTSD, have been linked to tobacco consumption, weight gain, physical inactivity, and adverse cardiac outcomes.[33-39] In our study we observed a higher prevalence of unhealthy behaviors (smoking history and obesity) in women exposed to violence compared with those not exposed. Displayed unhealthy behaviors might reveal another potential mechanism that links exposure to violence and cardiovascular health.[40] However, when we adjusted for these factors, results were slightly attenuated but remained statistically significant.

Only a few other cross-sectional studies have evaluated exposure to violence and CVD events.[32,41,42] These analyses suggest an association between exposure to violence and CVD, but most are limited because they depend on self-reported outcomes. In 1 cross-sectional analysis that evaluated subclinical CVD, women who reported abuse had an increased risk of carotid plaque, which is consistent with our results. However, no association was found for IMT.[15]

To our knowledge the current analysis is the first study to report an association between physical violence by a stranger and cardiovascular risk. The only other study to have evaluated assaultive violence did not find an association with self-reported CVD.[43] Unexpectedly, sexual violence was not associated with IMT or subclinical carotid atherosclerosis in our study. However, we found an indication of an association between years of sexual violence and IMT.

The previous literature seems to collectively suggest an association between childhood exposure to violence and CVD in adulthood.[16] Sexual abuse experienced during childhood has been associated with higher IMT. Yet, our findings did not reveal a statistically significant association between exposure to violence during childhood and subclinical CVD later in life. This discrepancy between our findings and the results of previous studies may be because of our small sample size and the relatively low prevalence of childhood violence reported by study participants. A national survey in Mexico on violence against women in 2006[44] showed a prevalence of retrospectively reported childhood violence to be 37.6%, whereas we observed a prevalence of 13.4%. This discrepancy could be explained by differences in data collection methods (eg, interviews versus self-reports) and use of different instruments for assessing violence. Another possibility may be the fact that the states of Chiapas and Yucatan, where our study took place, have the lowest incidence of domestic violence and criminal activity in Mexico.[13,44] Finally, women included in our study may have chosen not to report violent events, especially those occurring during childhood and/or those sexual in nature, because of social norms or fear of potential disclosure of this information. However, our observations related to patterns of violence are consistent with those of national data (eg, a lower prevalence of any violence but higher prevalence of sexual violence in indigenous relative to nonindigenous women).[44]

Our study has important strengths, among them a population-based design, the use of an extensive questionnaire to collect information on types of violence, a standardized high-quality assessment of subclinical CVD, and controlling for multiple risk factors of CVD.

Limitations for the current analysis should also be considered. First, the cross-sectional nature of this study limits causal inference. This being said, it is unlikely that carotid IMT measurements or subclinical carotid atherosclerosis, which were both unrevealed to the participants, would have affected their responses in regard to questions on exposure to violence. Another limitation is potential measurement error that may be attributed to the underreporting of violent events and could provide an explanation for the lack

of association for certain exposures. This could be potentially reflected in our results showing lower than national average results on the prevalence of childhood abuse. This underreporting could lead to underestimation of the reported results since participants were blinded to their IMT and carotid atherosclerosis status. The third limitation to address is the possibility of random error in carotid ultrasound. However, IMT measurements were standardized and carried out by trained neurologists with a high rate of reproducibility; therefore, any error in IMT assessment is probably nondifferential, as neurologists were unaware of responses to the life stressor questionnaire. Fourth, confounding by unmeasured factors or poorly measured factors is possible. For example, we were not able to assess HbA_{1c}, which could fail to include diabetic women who have mostly postprandial hyperglycemia. However, we were able to adjust for early life factors, adult sociodemographic characteristics, and well-known risk factors for CVD that may be associated with violence, and some risk factors (ie, BMI, glucose) were measured at the clinic. Another issue is the relatively small sample size, which may have limited our capacity to detect an association, particularly between sexual and/or childhood violence and subclinical CVD. Another limitation arose in not being able to evaluate the frequency and duration of exposure to physical violence due to the nature of the tool used to gather this information. However, we were able to evaluate total years of exposure to sexual violence and found evidence of an association with subclinical cardiovascular disease. Finally, the generalizability of our results may be limited to Mexican women living in certain areas of Mexico, as the psychological and physiological response to violence may differ across populations. Also, neighborhood conditions, an emerging risk factor for CVD,[45,46] may modify the effect of traumatic experiences on cardiovascular health. Thus, our observations may differ according to neighborhood characteristics. Unfortunately, in our study we were unable to account for neighborhood conditions. Future studies should consider contextual factors when evaluating the impact of violence on health outcomes.

In conclusion, we found strong evidence associating exposure to violence and subclinical CVD, in particular among women with a history of physical violence inflicted by a stranger. The relationship appeared to be powered by exposures that occurred in adulthood in addition to some evidence that sexual violence may also play a role in cardiovascular risk. Our findings emphasize the increasing relevance of criminal activity and violence against women in Mexico and reinforce the need to make it a crucial priority for public health. Violence does not only result in immediate consequences, such as injuries, homicide, and mental illness among victims but may also inflict a long-lasting impact on cardiovascular health. This stresses the need for violence prevention policies and campaigns in order to promote equitable health outcomes across sexes as well as social equality. Our results should be confirmed by evaluating the effect of violence on the incidence of cardiovascular outcomes, and future analyses should seek to further evaluate the different pathways underlying the association of violence and cardiovascular risk.

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SUPPLEMENTAL MATERIAL

Table S1. Life Stressor Checklist violence-related items

Sexual Violence
(1) "Have you ever been bothered or harassed by sexual remarks, jokes, or demands for sexual favors by someone *at work or school* (for example, a co-worker, a boss, a customer, another student, a teacher)?"

(2)"*Before age 16*, were you ever touched or made to touch someone else in a sexual way because they forced you in some way or threatened to harm you if you didn't?"

(3) "*After age 16*, were you ever touched or made to touch someone else in a sexual way because they forced you in some way or threatened to harm you if you didn't?"

(4) "*Before age 16*, did you ever have sex (oral, anal, genital) when you didn't want to because someone forced you in some way or threatened to harm you if you didn't?"

(5) "*After age 16*, did you ever have sex (oral, anal, genital) when you didn't want to because someone forced you in some way or threatened to harm you if you did not?";

Physical violence
(6) "Have you ever been robbed, mugged, or physically attacked (not sexually) by someone you did not know?"

(7) "*Before age 16*, were you ever abused (not sexually) or physically attacked (hit, slapped, choked, burned, or beat up) by someone you knew (for example, a parent, boyfriend, or husband)?"

(8) "*After age 16*, were you ever abused (not sexually) or physically attacked (hit, slapped, choked, burned, or beat up) by someone you knew (for example, a parent, boyfriend, or husband)?"

Emotional abuse or neglect
(9) "Have you ever been emotionally abused or neglected (for example, being frequently shamed, embarrassed, ignored, or repeatedly told that you were "no good")?"

(10) "Have you ever been physically neglected (for example, not fed, not properly clothed, or left to take care of yourself when you were too young or ill)?"

Observed violence
(11) "When you were young (before age 16) did you ever see violence between family members (for example, hitting, kicking, slapping, punching)?"

(12) "Have you ever seen a robbery, mugging, or attack taking place?"

Possible responses for the questions were yes/no. Each item was followed by sub items which included the age when the event first occurred. All but questions 6, 11, and 12 included sub items on age when the event ended.

Table S2. Sensitivity analysis: multivariable-adjusted percent differences of mean IMT (95% CI) according to type of violence and age at first exposure.

	% difference (95% confidence interval)	
	n	Multivariable
No exposure	391	ref
Any violence[*†]	243	1.9 (0.1, 3.8)
Sexual	45	1.6 (-1.9, 5.1)
Physical	149	3.1 (0.9, 5.3)
Physical violence by offender[‡]		
No violence	391	ref
Family member	55	1.6 (-1.6, 4.9)
Stranger	83	3.9 (1.3, 6.7)
Violence by age at first exposure		
No violence	391	ref
Childhood (< 16y)	55	1.1 (-1.6, 3.8)
Adulthood (≥ 16y)	83	2.4 (0.3, 4.5)

Multivariable: age, state, indigenous, smoking (parents), number of siblings, birth weight, private healthcare, marital status, menopausal status, smoking, alcohol intake, recreational physical activity, body mass index, diabetes, hypertension, and hypercholesterolemia. IMT: intima media thickness. [*]Any includes participants who reported either sexual or physical violence, or both. [†]49 women reported exposure to both sexual and physical violence. [‡]11 women reported violence by both a family member and a stranger.

Table S3. Sensitivity analysis: multivariable-adjusted odds ratios for subclinical carotid atherosclerosis (95% CI) according to type of violence and age at first exposure.

	Odds ratios (95% confidence interval)	
	n	Multivariable
No exposure	99/292	ref
Any violence[*†]	84/159	1.54 (1.03, 2.28)
Sexual	16/29	1.24 (0.58, 2.64)
Physical	55/94	1.90 (1.21, 2.99)
Physical violence by offender[‡]		
No violence	99/292	ref
Family member	18/37	1.64 (0.83, 3.23)
Stranger	32/51	1.92 (1.10, 3.34)
Violence by age at first exposure		
No violence	99/292	ref
Childhood (< 16y)	25/60	1.06 (0.59, 1.92)
Adulthood (≥ 16y)	59/99	1.85 (1.18, 2.89)

Multivariable: age, state, indigenous, smoking (parents), number of siblings, birth weight, private healthcare, marital status, menopausal status, smoking, alcohol intake, recreational physical activity, body mass index, diabetes, hypertension, and hypercholesterolemia. IMT: intima media thickness. [*]Any includes participants who reported either sexual or physical violence, or both. [†]49 women reported exposure to both sexual and physical violence. [‡]11 women reported violence by both a family member and a stranger.