IMPORTANCE  Racial/ethnic and sex disparities in suicide ideation and attempts are well established, with higher risk of suicide ideation and attempt among US racial/ethnic minority school-aged youths (than their White peers) and girls (than boys and men). The suicide-related risk of racial/ethnic minority young adults, especially young women, may be strongly influenced by adverse childhood experiences, known early determinants of suicide ideation and attempts.

OBJECTIVES  To assess lifetime and past-year prevalence estimates of suicide ideation and attempt and to examine sex differences in the role of adverse childhood experiences as a prospective risk factor for Puerto Rican young adults from 2 sociocultural contexts.

DESIGN, SETTING, AND PARTICIPANTS  Data in this longitudinal cohort study are from 4 waves of the Boricua Youth Study, a population-based cohort study of Puerto Rican children from San Juan and Caguas, Puerto Rico, and the South Bronx, New York, 5 to 17 years of age (N = 2491; waves 1-3: 2000-2004) and 15 to 29 years of age (wave 4: 2013-2017). Data analysis was performed from February 26, 2019, to October 16, 2020.

EXPOSURES  Adverse childhood experiences were assessed by interview in childhood and early adolescence (waves 1-3) and included child maltreatment (physical, sexual, and emotional abuse and neglect), exposure to violence, parental loss (separation, divorce, and death), and parental maladjustment (mental health problems, substance or alcohol abuse, intimate partner violence, and incarceration).

MAIN OUTCOMES AND MEASURES  Lifetime and past-year suicide ideation and attempt were assessed in young adulthood (wave 4) using the World Health Organization Composite International Diagnostic Interview.

RESULTS  Among 2004 Puerto Rican young adults (80.4% of the original cohort; mean [SD] age, 22.9 [2.8] years; 1019 [50.8%] male), young women compared with young men had a higher prevalence of lifetime suicide attempt (9.5% vs 3.6%) and lifetime suicide ideation (16.4% vs 11.5%), whereas past-year suicide ideation (4.4% vs 2.4%) was not statistically different. Logistic regression models, adjusting for demographics and lifetime psychiatric disorders, found that young women but not young men with more adverse childhood experiences had higher odds of suicide ideation (lifetime; odds ratio [OR], 2.44; 95% CI, 1.54-3.87; past year; OR, 2.56; 95% CI, 1.18-5.55). More adverse childhood experiences were also prospectively associated with lifetime suicide attempt (OR, 1.16; 95% CI, 1.04-1.29), irrespective of sex.

CONCLUSIONS AND RELEVANCE  The findings of this cohort study suggest that, among Puerto Rican young adults from 2 different sociocultural contexts, adverse childhood experiences were relevant to understanding suicide attempt and suicide ideation, the latter specifically among young women. The prevention of cumulative adverse childhood experiences could reduce later risk of suicide attempts and, among young women, for suicide ideation.
are associated with significant mental health problems. Adverse childhood experiences (ACEs), which include child maltreatment, parental loss, and parental maladjustment, are linked to SI and SA in adulthood and disproportionately burden Latinx youths, especially those of Puerto Rican background. The unique sociopolitical relationship between the mainland US and Puerto Rico may influence how exposure to ACEs influences SI and SA in Puerto Rican youths on the island and mainland US.

Adolescent girls are at greater risk for SI and SA compared with boys. The elevated rates of SI, although not of SA, in girls persist into adulthood. It is unknown whether the pattern of sex differences in SI and SA in young adulthood is the same as the pattern observed in adolescence or more similar to what is seen later in adulthood. Young women, particularly those of Puerto Rican background, are at elevated risk for SI and SA compared with young women from other Latinx and non-Latinx White subgroups. One factor that may explain patterns of sex differences in youth suicide-related risk are ACEs. Understanding the association of ACEs with suicide-related risk in Puerto Rican young adults could provide important insight into racial/ethnic and sex differences in youth suicide-related risk.

Longitudinal studies link ACEs to SI and SA in adulthood, but are limited by their assessment of ACEs retrospectively during adulthood, which has poor concordance with assessment of ACEs in childhood. High exposure to different types of ACEs is especially harmful because different ACEs often co-occur, particularly in high-risk populations, in whom unique ACEs, such as exposure to violence, have been identified. This information is important because, for example, 4 or more ACEs are associated with significant mental health problems. Studies have also found a graded association between cumulative ACEs and severity (ie, frequency and lethality) of SI and SA, independently of psychiatric disorders. However, sex differences in the association between cumulative ACEs and suicide-related risk remains poorly understood, given the paucity of prospective studies, the nearly exclusive focus on 1 type of ACE, particularly sexual or physical abuse, methodologic limitations (ie, isolated types of ACEs examined and timing of assessment of ACEs), and convenience sampling. The association between cumulative ACEs (assessed in childhood) and suicide-related risk later in life in a highly exposed population could determine whether there are potential differential long-term influences of cumulative ACEs on suicide-related risk in young women and men. This information would improve identification of boys and girls at greatest risk for SI and SA, providing earlier and more targeted opportunities to implement preventive strategies.

Sex differences in the type of ACE exposure may be related to the differential impact of cumulative ACEs in young women compared with young men. For instance, a study on Puerto Rican youths found that boys were more likely than girls to experience neglect, physical abuse, and exposure to community violence, although sex differences in cumulative ACEs were not detected. Nevertheless, cumulative ACEs were associated with early alcohol use in girls but not boys. Similarly, other studies found cumulative ACEs were associated with smoking problems and nonsuicidal self-injury in girls but not boys. Thus, differences in how ACEs influence each sex, rather than merely frequency or type of ACEs, may be relevant to understanding the risk of SI and SA in youths.

The current study aimed to better define the role of ACEs in explaining the risk of SI and SA in a US ethnic minority group at high risk for suicide-related outcomes. Specifically, whether the prevalence of SI and SA is higher in Puerto Rican young women compared with young men and whether the prospective association between cumulative ACEs in childhood and early adolescence and SI and SA is stronger among young women than young men, independently of psychiatric disorders.

Methods

Sample
Participants are from the Boricua Youth Study, a longitudinal, probability-based, cohort study of samples representative of 2 sociocultural contexts: San Juan and Caguas, Puerto Rico, and the South Bronx, New York. Three waves of data were collected annually from Puerto Rican children and early adolescents ranging in age from 5 to 13 years at baseline and from their primary caretaker. A fourth wave of data was collected a mean of 11 years after the third wave. Youth age range was 15 to 29 years at wave 4. The retention rate was greater than 80% across the 4 waves. Participants were interviewed in their homes or over the telephone in English or Spanish. Informed consent was obtained in writing or voice recorded on the telephone. All data were deidentified. Study procedures were approved by the institutional review boards at the New York State Psychiatric Institute, University of Puerto Rico Medical School, Cambridge Health Alliance, and Massachusetts General Hospital. The study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline.

Measures
Lifetime and past-year SI and SA were assessed in young adulthood at wave 4 using questions from the World Health Organization Composite International Diagnostic Interview (CIDI).
These questions were asked as part of the major depressive disorder module as well as independently. A total of 476 participants (23.8%) were not asked questions related to SI or SA at wave 4. This happened either because of an unplanned skip of suicide-related questions, with more missing values in the South Bronx site (n = 275 [13.7%]), or because of the ethical concerns over asking suicide-related questions during the interviews conducted over the telephone while assessing minors (n = 201 [10.0%]). Imputation methods (described below) were used so that these participants were not excluded from analyses.

Exposure to ACEs was assessed in childhood and early adolescence through parent and/or youth report (eTable in the Supplement) across waves 1 to 3; ACEs assessed were child maltreatment (ie, physical abuse, sexual abuse, emotional abuse, or neglect), exposure to violence, parental maladjustment (ie, intimate partner violence, incarceration, mental health problems, and substance abuse problems), and parental loss (ie, divorce or separation or death). An endorsement of these items via parent or youth report at any of the 3 waves was determined as ACE positive. Participants who refused to respond, responded “do not know,” or did not respond at waves 2 and 3 were considered as having missing cumulative ACEs (n = 133 [6.6%]). Cumulative ACEs were examined as a continuous variable using a count of different types of ACEs endorsed and as a categorical variable divided into 3 groups: 0 or 1 ACE as low exposure (1044 [57.9%] reported parental divorce or separation, making 1 exposure normative in the sample), 2 to 3 ACEs as moderate exposure, and 4 or more ACEs as high exposure (in a recent meta-analytic review, 15 ≥4 ACEs was associated with negative health outcomes). Domains of cumulative ACEs were defined based on a confirmatory factor analysis that yielded a 2-factor model (root mean square of approximation, 0.033; 90% CI, 0.027-0.038; comparative fit index, 0.938; Tucker-Lewis index, 0.921). The first factor represents the youth domain: child maltreatment (as described above) plus exposure to violence. The second factor represents the parent domain: parental maladjustment (as described above) and parental divorce or separation. Parental death did not load onto either of the 2 factors but was included in the cumulative ACEs count and categorical variables.

Psychiatric disorders included lifetime history of major depressive disorder, generalized anxiety disorder, alcohol use disorder, and substance use disorder reported during young adulthood (ie, wave 4) ascertained by the CIDI.23 Age at wave 4, sex, site, and socioeconomic status at wave 1 (use of public assistance served as a proxy for poverty) were also included in the analyses as covariates. Details on the specific measures used are available in eTable in the Supplement and elsewhere.21,22

Statistical Analysis

The prevalence of lifetime and past-year SI and SA were estimated using population-based weights to reflect the Boricua Youth Study reference population for each site adjusted for nonresponse at wave 4 (or Boricua Youth Study site-specific weights).21 Unadjusted logistic regression models were used to examine sex differences in lifetime and past-year SI and SA at wave 4. Further analyses did not include past-year SA because of low prevalence.

Three sets of logistic regression models were constructed to estimate the odds ratio (OR) and 95% CI for each outcome at wave 4: (1) lifetime SI, (2) lifetime SA, and (3) past-year SI. Each set contained cumulative ACEs at waves 1 to 3 as (1) a count of different types of ACEs, (2) categories characterized by degree of exposure (with 0-1 indicating low; 2-3, moderate; and ≥4, high) and dummy coded with low (0-1 ACEs) as the reference group, and (3) type of ACEs as factor scores: youth-domain ACEs or parental-domain ACEs. Interactive effects between ACEs and sex associated with lifetime SI or SA and past-year SI were examined in each model. Covariates included sex, age, site, socioeconomic status, and psychiatric disorders.

Data were analyzed from January 1, 2019, to December 31, 2020, using SAS software, version 9.4 (SAS Institute Inc). The missing SI and SA data were addressed using the fully efficient fractional imputation (FEFI) method with demographic variables and responses to depression items used for creating so-called donor units for the imputations. The FEFI method is useful for population-based surveys with missing data that are not at random because it can incorporate sampling and nonresponse weights. The FEFI method was implemented in SAS SURVEYIMPUTE.

Results

This cohort study included 2004 Puerto Rican young adults (80.4% of the original cohort; mean [SD] age, 22.9 [2.8] years; 1019 [50.8%] male). The weighted prevalences of lifetime and past-year SI and SA in Puerto Rican young women and young men are presented in Table 1. Sex differences were detected because women had statistically significant higher rates of lifetime SA (9.5% vs 3.6%; P = .001) and lifetime SI (16.4% vs 11.5%; P = .01) than men, with differences in past-year SA (1.7% vs 0.3%; P = .07) and past-year SI (4.4% vs 2.4%; P = .06). No sex by site differences were detected in lifetime SA, lifetime SI, or past-year SI.

The distribution by sex of different types of and cumulative ACEs in childhood and early adolescence are presented in Table 1. Imputed and Weighted Prevalence of Lifetime and Past-Year SI and SA in Young Women and Men

<table>
<thead>
<tr>
<th>SI or SA</th>
<th>Total No. (%) (N = 2004)</th>
<th>OR (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lifetime SA</td>
<td>Young women (n = 985)</td>
<td>93 (9.5)</td>
<td>36 (3.6)</td>
</tr>
<tr>
<td>Lifetime SI</td>
<td>Young men (n = 1019)</td>
<td>161 (16.4)</td>
<td>117 (11.5)</td>
</tr>
<tr>
<td>Past-year SA</td>
<td>Young women (n = 985)</td>
<td>16 (1.7)</td>
<td>3 (0.3)</td>
</tr>
<tr>
<td>Past-year SI</td>
<td>Young men (n = 1019)</td>
<td>43 (4.4)</td>
<td>24 (2.4)</td>
</tr>
</tbody>
</table>

| Abbreviations: OR, odds ratio; SI, suicide attempt; SA, suicide ideation. * Young men as the reference group. |
the Figure. Compared with young men, young women were at lower risk of experiencing cumulative ACEs in childhood and early adolescence (OR, 0.73; 95% CI, 0.61-0.87). Specifically, women had a lower risk of experiencing physical abuse (OR, 0.63; 95% CI, 0.50-0.79), neglect (OR, 0.69; 95% CI, 0.53-0.89), and exposure to violence (OR, 0.46; 95% CI, 0.37-0.56) in childhood and early adolescence.

Table 2 and Table 3 detail the associations among sociodemographic factors, psychiatric disorders, and ACEs with each outcome: lifetime SA, lifetime SI, and past-year SI. Sex differences were detected in certain associations, including between ACE count and past-year SI ($F_{2} = 3.59; P = .03$). In stratified analyses (Table 4), young women but not young men with 4 or more ACEs, although not 2 to 3 ACEs, had higher odds of past-year SI (OR, 2.56; 95% CI, 1.18-5.55) compared with those with 0 to 1 ACE. Sex differences were also detected in the association between cumulative ACEs and lifetime SI among young adults with 2 to 3 ACEs ($b = 0.77, P = .03$) and 4 or more ACEs ($b = 0.77, P = .03$). Specifically, young women but not young men with 2 to 3 ACEs (OR, 1.55; 95% CI, 1.00-2.40) and 4 or more ACEs (OR, 2.44; 95% CI, 1.54-3.87) had higher odds of lifetime SI compared with women with 0 to 1 ACE. Lastly, no sex differences were detected in the association between cumulative ACEs and lifetime SA. Young adults overall with 4 or more, although not 2 to 3, ACEs had higher odds of lifetime SA (OR, 1.92; 95% CI, 1.15-3.18) compared with those with 0 to 1 ACE.

Young adults with high factor scores in the youth domain (OR, 1.28; 95% CI, 1.10-1.49) or parental domain (OR, 1.21; 95% CI, 1.07-1.36) had higher odds of lifetime SI. Young adults with higher factor scores in the parental but not youth domain ACEs had higher odds of lifetime SA (OR, 1.31; 95% CI, 1.10-1.57). No sex differences were detected when ACEs were examined by youth or parental domain. No association was found between ACEs in the youth or parental domains with past-year SI among young women or men.

To test whether associations of interest would differ among participants more difficult to engage longitudinally compared with those retained, a sensitivity analysis included young adults with missing ACE information at waves 2 or 3 (weighted $n = 101$ [5.0% of the total wave 4 sample]; excluded from the main analysis) as a distinct ACE category (in addition to children with low to high ACEs). Similar to the findings among children with high ($\geq 4$) ACEs, those with missing ACEs at waves 2 and 3 were at greater risk for lifetime SA (OR, 2.32; 95% CI, 1.13-4.75) and SI (OR, 1.74; 95% CI, 1.02-2.97), although not past-year SI (OR, 1.62; 95% CI, 0.51-5.17). Thus, when accounting for participants who were not engaged longitudinally, cumulative ACEs still conferred subsequent risk for SA and for SI (lifetime and past year) in young women.

To improve testing of the temporal sequence between ACEs and SI or SA, we performed another sensitivity analysis that excluded young adults (weighted $n = 142$ [7.1% of total wave 4 sample]) who reported any SI or SA in childhood or early adolescence. This method further probed the temporal association between cumulative ACEs in childhood and early adolescence and SI and SA in young adulthood. After adjustment for covariates, findings were consistent with the main results because those with 4 or more ACEs had higher odds of lifetime SA (OR, 1.92; 95% CI, 1.12-3.30) and lifetime SI (OR, 1.74; 95% CI, 1.18-2.58), although not past-year SI (OR, 1.42; 95% CI, 0.68-2.96), independently of SI or SA in childhood or early adolescence. No significant interactive associations between ACEs and sex were detected in any of the outcomes in this selected sample.

### Discussion

Puerto Rican youth is the US Latinx subgroup with the highest levels of psychopathology. In this cohort study of Puerto Rican young women and young men, the lifetime prevalences of SA ($9.5\%$ in young women and $3.5\%$ in young men) and SI ($16.4\%$ in young women and $11.5\%$ in young men) were higher than previously reported cross-sectional estimates for adolescents in the US. The past-year prevalences of SI in young women ($4.4\%$) and young men ($2.4\%$) in this study were lower than national estimates of past-year SI in young women ($9.4\%$) and young men ($7.2\%$) 18 to 25 years of age and lower than the rates of past-year SI in Hispanic young adults overall ($7.4\%$). Methodologic differences could account for the discrepancies, including sample composition and assessments of SI and SA. Cultural differences in disclosure of SI and SA or protective factors, such as strong family values (ie, familism), particularly relevant for the island Puerto Rican sample, may also explain the differences observed.
Young women were 2.8 times more likely to ever think about and 1.5 times more likely to ever attempt suicide compared with young men. Sex differences were not detected in past-year SI in young adulthood. These patterns parallel the sex differences in the prevalence of SI and SA observed in adolescents. Cumulative ACEs in childhood and early adolescence were associated with elevated risk of SI among young women, although not among young men. Specifically, higher ACEs, irrespective of degree (2-3 or ≥4) or domain (youth or parental) of exposure, were associated with lifetime SI, with only the highest level of ACEs (≥4) associated with past-year SI in young men. This finding suggests the relevance of sex in the etiology of SI risk. Gender socialization of girls, particularly in societies with more restrictive gender norms for girls, may put more emphasis on social goals rather than autonomy, which may, in light of negative events such as ACEs, result in high SI risk for young women. The interpersonal nature of many of the ACEs examined may be more relevant to SI risk in young women because interpersonal difficulties may be one pathway through which ACEs may confer suicide-related risk. Meanwhile, other factors, such as poverty and basic neurocognitive processes (eg, episodic memory), may be more relevant for SI risk in young men. In addition, rumination, a cognitive response style characterized by perseveration on a negative mood, is more frequently used by women than men and is linked to suicide-related risk. Young women may be more vulnerable to the developmental consequences of cumulative ACEs in childhood and early adolescence that specifically confer risk for SI.
terized by variations in stress responsivity and SI patterns,\textsuperscript{35} which may be associated with the sex differences in SI risk identified in this study. Further research is warranted on suicidal subtypes in young women and young men.

Cumulative ACEs may have long-lasting effects on SI risk that may persist through young adulthood in women because 4 or more ACEs were associated with lifetime and past-year SI in young women, but 2 to 3 ACEs were associated with lifetime, although not past-year, SI. This finding may reflect an effect of timing, with exposure to fewer ACEs being enough to confer risk for SI shortly after the exposure; however, unlike what is seen with exposure to increased ACEs, SI risk would not persist into young adulthood as is observed when inquiring about past-year SI. Cumulative ACEs also seem to be more relevant for SI risk than specific domains of ACEs.

Young women and young men with cumulative ACEs were at elevated risk of SA, and sex differences were not detected. Should future studies with larger samples support these findings, perhaps mechanisms underlying SA risk may be less susceptible to sex influences than mechanisms underlying SI risk. The developmental consequences of cumulative ACEs may similarly influence pathways for SA risk in both young women and men. Such mechanisms may involve neurocognitive problems that involve impulsivity (ie, inhibitory control and decision-making) that may be unique to the etiology of SA,\textsuperscript{36} although not directly related to SI, to promote transition from SI to SA. Overall, the current findings are consistent with the increasing evidence that suggests sex differences in SI, although not SA, in adolescence.\textsuperscript{37,38} Future research should further examine developmental influences in the prospective association between ACEs and SI or SA risk, such as age at ACE exposure.

**Limitations**

This study has limitations. First, there was an 11-year gap in data collection. Some participants were still children or early adolescents when data were last collected, which could have resulted in lower levels of cumulative ACEs. Second, adversities that may be more relevant to suicide-related risk in men than women, such as neighborhood-level indexes of poverty,\textsuperscript{31} were not examined. Third, because of limitations related to measurement of racial/ethnic discrimination in children as young as 5 years, this important stressor relevant to ethnic minority individuals was not directly examined. However, several of the ACEs addressed (eg, parental incarceration and exposure to violence) may reflect the effects of structural racism and experiences of racial/ethnic discrimination.\textsuperscript{39} Fourth, findings may not generalize to a wider youth population, although they may provide critical information about an understudied group, which may be of relevance to other young adults at risk for suicidal behaviors. Fifth, assessments are based exclusively on youth and/or parental report, which is a potential source of bias. Sixth, low cases in past-year outcomes may have compromised power.

**Conclusions**

Clarifying the prospective association between cumulative ACEs and SI and SA in Puerto Rican young women and men could help explain racial/ethnic and sex differences in youth suicide-related risk. The current findings indicate that greater exposure to ACEs, irrespective of the domain of ACEs (youth or parental), in childhood and early adolescence may increase the risk of SI in young women and may increase the risk of SA in both young women and men. This information may improve identification of children at greatest risk for SI and SA to inform early preventive strategies. If these findings are replicated, practitioners working with ethnic minority youths from disadvantaged backgrounds who present with 4 or more ACEs should screen for SI and SA risk. The prevention of cumulative ACEs in childhood and early adolescence could reduce risk later in life for SA and SI, particularly among young women of ethnic minority groups living in underserved contexts.
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