Military Sexual Trauma Interacts With Combat Exposure to Increase Risk for Posttraumatic Stress Symptomatology in Female Iraq and Afghanistan Veterans

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ABSTRACT

Objective: Sexual trauma during military service is increasingly recognized as a substantial public health problem and is associated with detrimental effects on veteran mental health. In this study, we examined associations between childhood trauma, military sexual trauma (MST), combat exposure, and military-related posttraumatic stress symptomatology (PTSS) in the Women Veterans Cohort Study (WVCS), a community-based sample of veterans who served in the recent conflicts in Iraq and Afghanistan.

Method: From July 2008 to December 2011, 365 female veterans completed a survey that assessed combat exposure, military sexual trauma, military-related PTSS (assessed using the PTSD [posttraumatic stress disorder] Checklist-Military Version), and demographic, life history, and other psychopathology variables.

Results: High rates of childhood trauma (59.7%) and MST (sexual assault = 14.7%; sexual harassment = 34.8%) were observed in this sample. A hierarchical regression revealed that active duty status, childhood trauma, combat exposure, and MST were independently associated with increased severity of military-related PTSS (*P*s < .05). Moreover, a significant interaction emerged between MST and combat exposure in predicting military-related PTSS (*P* = .030), suggesting that the relationship between combat exposure and PTSS was altered by MST status. Specifically, under conditions of high combat exposure, female veterans with MST had significantly higher PTSS compared to female veterans without MST.

Conclusions: Taken together, results suggest that exposure to multiple traumas during military service may have synergistic effects on posttraumatic stress symptoms in female veterans. Moreover, our findings highlight the importance of prevention efforts to protect female veterans from the detrimental effects of MST, particularly those who are exposed to high levels of combat.

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The role of women in war zone military operations has changed significantly in recent conflicts. With the increased use of guerilla warfare tactics in Operations Enduring Freedom and Iraqi Freedom (OEF/OIF), female military personnel are being exposed to increasing levels of combat compared to prior conflicts,[1–3] such as Operation Desert Storm.[4] With greater numbers of women in the military[5] and the recent lifting of the ban on female soldiers in direct ground combat roles,[6] exposure to combat among female military personnel is likely to increase further in future operations.

Living in a war zone increases risk of exposure to an array of traumatic events, including stressful combat experiences (eg, threat of death, being injured, witnessing injury or death to others). It has been shown that the severity of a trauma is strongly associated with risk for posttraumatic stress disorder (PTSD),[7] and the accumulation of multiple traumatic experiences exerts a cumulative effect on mental health outcomes.[8–10] A number of studies, though, also point to the complex nature of these relationships. For example, in male veterans, precombat trauma history (eg, childhood trauma) has been associated with PTSD symptoms, but primarily for those individuals with higher levels of combat exposure.[11,12] To date, however, the interactive effects between traumatic experiences on PTSD outcomes have been relatively unexplored in Iraq and Afghanistan veterans.

Specific to the military context, between 10% and 30% of female veterans and approximately 1% of male veterans report military sexual trauma (MST) during their military service.[2,13–15] MST has been conceptualized to include both sexual assault and threatening sexual harassment[16,17] and has been shown to increase the risk of a range of mental disorders in OEF/OIF veterans and to have particularly strong relationships with PTSD, especially in female veterans.[13,18–21] Although sexual assault and rape also account for a high conditional risk of developing PTSD in population-based studies of men and women,[22] some studies have found that MST is even more detrimental for mental health outcomes than civilian sexual trauma.[23,24] While the reasons for these differences are still unresolved, a number of contextual and trauma-related factors have been proposed, including the often close relationship between MST victim and perpetrator (ie, often a fellow service member), the limited social support available after MST, and the disruptions to unit cohesion and trust related to MST (see Allard et al[16] for a more thorough review).

Female veterans may also experience MST in the context of other deployment-related stressors, including combat exposure. High severity of combat exposure is a well-known risk factor for military-related posttraumatic stress symptomatology (PTSS) and other adverse mental health outcomes in veterans.[25–28] Women's exposure to multiple types of trauma across the lifespan, including childhood- and adult-onset traumas, has also been shown to increase risk for PTSS.[29–31] Childhood trauma, including physical and sexual abuse, is particularly deleterious to

mental health outcomes and risk for PTSD with subsequent trauma.[9,32–34] However, little is known about the potentially interactive relationships among childhood trauma, MST, and combat exposure on military-related PTSS in female OEF/OIF veterans, despite recent calls for further study of these relationships.[3,16] Increased understanding of the interactive effects of trauma prior to military service, combat trauma, and MST could help identify determinants of military-related PTSS in female service members and inform primary prevention and treatment efforts in this population.

In this study, we evaluated the direct and interactive relationships between childhood trauma, combat trauma, and MST in relation to combat-related PTSD symptomatology in a sample of female OEF/OIF veterans enrolled for Veterans Administration (VA) care who participated in the Women Veterans Cohort Study (WVCS).[35,36] On the basis of prior work,[11,32,37,38] we hypothesized that childhood trauma, combat trauma, and MST would be independently associated with greater combat-related PTSS. Moreover, we hypothesized that childhood trauma and MST would interact with combat exposure to increase the severity of military-related PTSD symptomatology for women with high combat exposure.

Clinical Points

- Female veterans of Iraq and Afghanistan may have experienced multiple traumas over their lifetime, and clinicians would benefit from taking a lifetime perspective in assessing and treating sequelae of these traumas.
- Childhood trauma, military sexual trauma, and high levels of combat exposure could all be independently associated with increased posttraumatic stress symptoms in female veterans.
- Female veterans who experienced both military sexual trauma and high levels of combat exposure may have an elevated risk of increased posttraumatic stress symptoms.

METHOD

Participants were 365 female veterans who participated in the WVCS, an ongoing prospective cohort study of OEF/OIF veterans.[35,36] The sampling frame for the overall WVCS study is the OEF/OIF roster, a list of veterans who separated from OEF/OIF military service and enrolled in VA health care between October 1, 2001, and April 30, 2008 (N = 406,802). The current study reports data collected during the prospective survey component (July 2008–December 2011) of WVCS. Letters inviting veterans to participate in the study were sent to all female veterans and an equivalent number of male veterans on the OEF/OIF roster who lived within 300 miles of the VA New England and VA Indiana regions. Of the 3,199 eligible participants, 366 (11.44%) completed the survey; 695 were not eligible or could not be reached because of incorrect/changed addresses. In the New England sample, compared to nonresponders, responders were slightly older (32.7 vs 29.1 years) and more likely to be white (82.9% vs 73.4%), while other demographic and military service variables did not differ. Data regarding nonresponders were not systematically collected at the Indiana site. Veterans who expressed interest in the study contacted the research coordinator, who provided a detailed description of the study and screened for eligibility. Participants provided signed informed consent, and institutional review boards of Yale University and VA Connecticut Healthcare System approved the study.

Measures

The main dependent variable was severity of military-related PTSS, assessed using the PTSD Checklist-Military Version (PCL-M).[39] The PCL-M is a 17-item screening measure based on *DSM-IV* diagnostic criteria for PTSD that specifically references military-related PTSD symptoms. Total scores range from 17 to 85, with higher scores indicating greater severity of symptoms. We chose to use a continuous dependent variable for both theoretical and statistical reasons. First, dichotomization of a continuous variable results in a loss of statistical power and may result in weakening of relations between constructs of interest.[40,41] Second, there are few studies validating cutoff scores with PTSD screening measures against diagnostic criteria in female OEF/OIF veterans, and prior studies in female OEF/OIF veterans have used continuous measures of PTSD symptomatology.[2,42] Thus, using continuous scores will facilitate direct comparison and integration of our results with prior research. However, for descriptive purposes, we classified individuals as screening positive for PTSD if they had a total PCL-M score ≥ 50 and endorsed each of 3 *DSM-IV* criteria for PTSD (ie, endorsement of being at least "moderately" bothered by symptoms that comprise *DSM-IV* Criteria B, C, and D), which provides a conservative estimate of the prevalence of PTSD.[43] Cronbach α for the PCL-M items was 0.96.

The Combat Exposure Scale (CES)[44] was used to assess frequency of exposure to each of 7 types of combat experiences (eg, number of times under enemy fire, going on combat patrols or other dangerous duty). The CES total score ranges from 0 to 41 and is calculated by computing a sum of weighted scores, with higher scores indicating greater combat exposure. Cronbach α for these items was 0.79.

Military sexual trauma was assessed using 2 questions: (1) "While you were in the military, did you receive uninvited and unwanted sexual attention, such as touching, cornering, pressure for sexual favors, or sexual remarks?" and (2) "Did someone ever use force or threat of force to have sexual contact with you against your will?" A positive response to either question, scored dichotomously, was indicative of MST. These questions are identical to the Veterans Health Affairs MST screen, which has displayed adequate sensitivity and specificity and has been validated against clinical interview.[17]

Childhood trauma was assessed using items from the Traumatic Life Events Questionnaire (TLEQ),[45,46] which assesses 22 potentially traumatic events ranging from learning of a friend or close friend being assaulted to being raped or attacked yourself. Childhood trauma was coded

Table 1. Demographic and Military Characteristics of Study Participants (N = 365)

Variable	Value[a]
Age, mean (SD), y	32.2 (10.5)
Race/ethnicity	
White	299 (83.1)
Hispanic	29 (8.1)
Black	26 (7.2)
Asian/Pacific Islander	6 (1.7)
Marital status	
Married	147 (40.8)
Never married	127 (35.3)
Divorced/separated/widowed	86 (23.9)
Education	
High school diploma or GED certificate	92 (25.6)
Associate's/junior college degree	77 (21.4)
Bachelor's degree	139 (38.6)
Graduate/professional degree	52 (14.4)
Branch of service	
Army	247 (68.2)
Air Force	67 (18.5)
Navy	33 (9.1)
Marine Corps	14 (3.9)
Coast Guard	1 (0.3)
Unit type	
National Guard	139 (38.4)
Active duty	118 (32.6)
Reserves	105 (29.0)
Combat Exposure Scale total score, mean (SD)	10.4 (9.0)
Childhood trauma	212 (59.7)
Military sexual trauma	175 (49.4)
Sexual harassment	123 (34.8)
Sexual assault	52 (14.7)

[a]Data are presented n (%) unless otherwise noted. Totals vary in some cases because of missing data.
Abbreviation: GED = General Equivalency Development.

dichotomously based on endorsement of 1 or more of 5 TLEQ questions that assessed childhood physical abuse, sexual abuse, and witnessing of family violence.

Data Analysis

All variables were initially screened for significant outliers; missing data patterns were explored; and variables were tested for multicollinearity through inspection of the variance inflation factor and tolerance. Seventeen PCL-M scores were missing, including 9 with minimal item-level data missing (1–2 items each) and 8 without any response to PCL-M questions. Correlations between missingness on each variable used in the analyses and other variables in the analyses, including demographic data, were examined, but all correlations were < .12.

Bivariate correlations between sociodemographic variables (eg, age), military history (eg, combat exposure), psychosocial factors (eg, trauma exposure), and PCL-M scores were first examined. Hierarchical regression analyses were conducted to examine predictors of posttraumatic stress symptom severity. All female respondents, including those with and without PTSD, were included in these analyses. Variables hypothesized to be related to PTSD symptoms were entered as independent variables. Step 1 included demographic variables (age, ethnicity, education, marital status, duty type: active vs national guard/reserve), Step 2 included the main effects of trauma risk factors, and Step 3 included interactive effects of exposure to multiple traumas (ie, MST × combat exposure and child trauma × combat exposure interaction terms). CES Total Score was centered prior to creating the interaction term, and MST was converted into a dichotomous variable for the purposes of the interaction, with sexual harassment and sexual assault combined into one level. Regression diagnostics revealed heteroscedasticity in residuals, and minor deviations from normality were detected in the regressions. A series of transformations of the PCL-M Total were attempted to reduce heteroscedasticity, but none were satisfactory. Therefore, regressions with Huber/White/Sandwich robust standard error estimators were used to take into account issues concerning the heteroscedasticity of residuals.[47]

RESULTS

As shown in Table 1, 212 female veterans (59.7%) in this sample reported childhood trauma, and 175 (49.4%) reported MST. Female veterans on average reported a light to moderate level of combat exposure according to the original criteria of Keane et al.[44] Table 2 shows bivariate analyses by PTSD screening status. Bivariate analyses showed that female veterans who screened positive for PTSD were significantly more likely to be nonwhite (ie, Hispanic, black, or Asian/Pacific Islander), to report MST and childhood trauma, and to score higher on a measure of combat exposure ($P < .05$).

The interaction between childhood trauma and combat exposure was not significant in predicting PCL-M total scores ($\beta = .01$, $t = 0.20$, $P = .845$), and thus models were rerun with this interaction excluded from further analyses. Table 3 shows the results of a hierarchical regression analysis that examined predictors of military-related PTSS. Childhood trauma, military sexual trauma, and combat exposure were positively associated with military-related PTSS, while active duty status displayed a trend-level association. Moreover, a significant interaction ($\beta = .14$, $t = 2.18$, $P = .030$) emerged between combat exposure and military sexual trauma in predicting PTSS. Figure 1 displays this interaction, showing that female veterans with a history of MST had greater military-related PTSS as a function of increasing combat exposure compared to female veterans with no MST history.

DISCUSSION

Consistent with prior research,[2,13,38] results of the current study indicated that MST and combat exposure were both strongly associated with severity of military-related PTSS in a sample of female OEF/OIF veterans. These associations persisted even after accounting for other stressors (eg, child trauma) that have been linked to PTSD in prior work. In addition to these main effects, MST and combat exposure severity interacted to predict military-related PTSS in female OEF/OIF veterans, even after accounting for other risk factors for PTSD, including demographic, prior trauma, and deployment-related variables. Under conditions of high combat exposure, female veterans who experienced military sexual trauma had higher military-related PTSS compared to female veterans with no MST history. This interaction

Table 2. Bivariate Analyses of Demographic and Psychosocial Variables by PTSD Status

Variable	No Positive Screen for PTSD (n = 278)[a]	Positive Screen for PTSD (n = 70)[a]	t/χ^2	*P*	OR (95% CI)[b]
Demographic and military					
Age, mean (SD), y	32.4 (10.5)	30.5 (10.3)	1.36	.17	…
Education			1.61	.11	…
Some/completed high school	64 (23.1)	25 (35.7)			
Associate's/junior college degree	60 (21.7)	12 (17.1)			
Bachelor's degree	111 (40.1)	24 (34.3)			
Graduate degree	42 (15.2)	9 (12.9)			
Ethnicity[c]			2.07	.04	…
White	238 (85.9)	53 (75.7)			
Hispanic	19 (6.9)	7 (10.0)			
Black	17 (6.1)	7 (10.0)			
Asian/Pacific Islander	3 (1.1)	3 (4.3)			
Married	118 (42.6)	25 (35.7)	1.04	.30	…
Active duty	90 (32.5)	24 (34.3)	0.29	.78	…
Branch of service			1.24	.21	…
Army	187 (67.5)	49 (70.0)			
Air Force	55 (19.9)	10 (14.3)			
Navy	26 (9.4)	5 (7.1)			
Marine Corps/other	9 (3.3)	6 (8.6)			
Traumatic exposures					
Combat exposure (CES total score), mean (SD)	9.0 (8.3)	16.3 (9.6)	6.40	< .001	*d* = 0.81
MST			5.18	< .001	3.63 (2.02–6.55)
Sexual harassment	92 (33.2)	28 (41.2)	4.30	< .001	3.42 (1.92–6.12)
Sexual assault	28 (10.1)	22 (32.4)	4.68	< .001	4.27 (2.25–8.11)
Childhood trauma	19 (13.7)	51 (24.6)	2.46	.01	2.06 (1.16–3.68)

[a]Data presented as n (%) unless otherwise noted. Totals vary in some cases because of missing data.
[b]Values shown as OR (95% CI) unless otherwise noted.
[c]χ^2 analysis compared white versus all other ethnic groups.
Abbreviations: CES = Combat Exposure Scale, MST = Military Sexual Trauma, PTSD = posttraumatic stress disorder.
Symbol: … = not applicable.

Table 3. Predictors of Posttraumatic Stress Disorder Checklist-Military Version (PCL-M) Scores in the Women Veterans Cohort Study

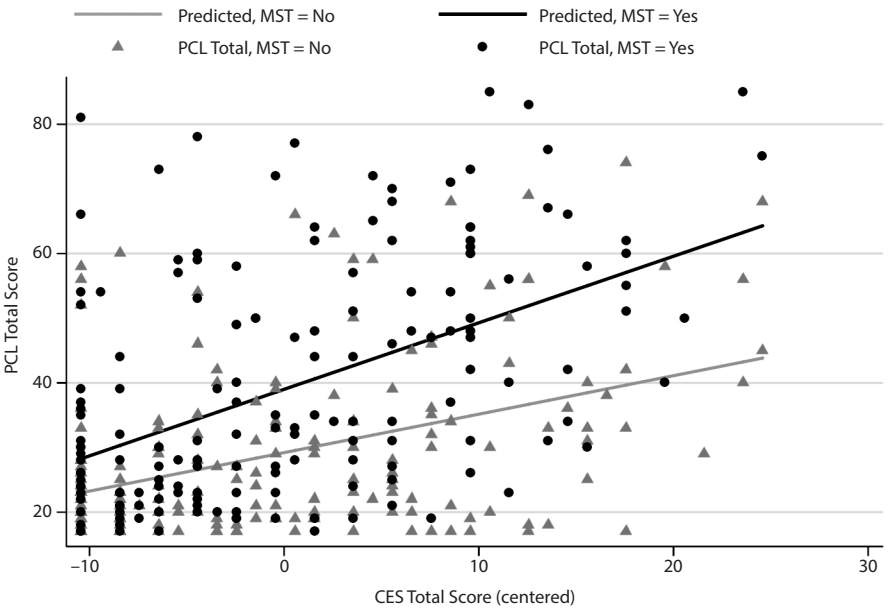
Variable	*F*, *P*	R^2	R^2 Change, *P*	β	*t*	*P*
Step 1	1.77, .09	.04	…			
Age				.02	0.52	.601
Associate's/junior college degree[a]				–.09	1.55	.123
Bachelor's degree[a]				–.08	0.83	.174
Graduate degree[a]				–.08	0.96	.146
Ethnicity				.07	1.53	.150
Marital status				.01	1.53	.851
Active duty (vs National Guard/reservist)				.09	2.19	.050
Step 2	16.04, < .001	.29	.248, < .001			
Childhood trauma				.10	2.19	.029
MST				.27	5.89	< .001
CES				.34	5.37	< .001
Step 3	15.54, < .001	.32	.031, .021			
MST × CES (centered)				.14	2.18	.030

[a]Reference group is Some/completed high school.
Abbreviations: CES = Combat Exposure Scale, MST = military sexual trauma.
Symbol: … = not applicable.

effect extends literature showing the cumulative risk of experiencing multiple traumas for PTSD outcomes in civilian samples.[48,49] However, ours is one of the first studies to show increased synergistic risk associated with experiencing multiple traumatic events during military service in female OEF/OIF veterans and suggests a dual burden of combat exposure and sexual trauma in this population.

While the precise mechanisms are unclear, MST occurring during military service may increase the vulnerability of female soldiers to PTSD symptoms by decreasing feelings of safety and unit support/cohesion. Thus, female veterans who are already sensitized to threat and lack of safety as a result of MST may be more susceptible to the traumatizing experience of combat. Previous studies have shown that perceived threat may modify or partially mediate the relationship between combat exposure and PTSD,[50,51] which suggests its importance in the manifestation of combat-related PTSD. Further, studies have suggested that women may perceive

Figure 1. Interaction of Combat Exposure and Military Sexual Trauma (MST) in Predicting Posttraumatic Stress Symptoms in Female OEF/OIF Veterans



Abbreviations: CES = Combat Exposure Scale, MST = military sexual trauma, OEF/OIF=Operations Enduring Freedom and Iraqi Freedom, PCL = PTSD Checklist-Military Version, PTSD = posttraumatic stress disorder.

threat at a lower threshold than men,[52,53] which may contribute to a heightened vulnerability. Moreover, given that unit cohesion is critical to perceptions of combat readiness,[54] lower rates of PTSD and other mental health disorders,[55] and resilience following exposure to traumatic stressors,[56] the reduced unit cohesion or support often provoked by MST[16] may consequently increase vulnerability to military-related PTSS and other adverse mental health outcomes. Women have been shown to report low levels of social support during deployment and stronger associations between lack of social support and mental health outcomes compared to male veterans.[57] Thus, due to the relational nature of MST, future studies should examine whether interpersonal trauma that occurs in the context of familial or intimate partner relationships may also increase risk of PTSS.

Due to the cross-sectional design of this study, the results do not allow us to ascertain the temporal relationship between MST and combat exposure. Military sexual trauma may thus have occurred prior to, concurrent with, or subsequent to combat exposure. In light of these possibilities, an alternative explanation for our findings is that female veterans with higher combat exposure or more traumatic combat experiences such as killing[58] may have more severe reactions to military-related sexual harassment or assault, thereby resulting in elevated military-related PTSS. Longitudinal studies or studies that employ more detailed interviews to assess the temporal relations between combat exposure and MST will be useful in replicating the findings reported herein and also in teasing apart the temporal associations between combat exposure, MST, and military-related PTSS. Studies that elucidate the chronology of these relationships might also inform intervention efforts to mitigate the cumulative effects of MST and combat exposure. For example, if the majority of female veterans with elevated military-related PTSS experience MST prior to combat exposure, it may be beneficial to evaluate the effectiveness of interventions before exposure to additional stressors during deployment.

Interestingly, although there was a main effect of childhood trauma on military-related PTSS, we did not find significant interactions between childhood trauma and combat exposure. It may be that, while childhood trauma increases the risk for PTSD symptoms after exposure to subsequent trauma, it does not magnify the strength of the relationship between combat exposure and posttraumatic stress symptoms, perhaps due to the length of time elapsed between childhood trauma and combat exposure. On the other hand, a recent study showed that prior trauma exposure itself did not increase the risk of future PTSD after a subsequent trauma; this risk was increased only for those individuals who developed PTSD to the prior trauma.[59] Thus, it would have been helpful to know whether participants in this study developed PTSD to prior childhood trauma, although this was not possible with our design.

Our study had a number of notable strengths, including its use of instruments with established validity and reliability and a moderately large sample of female OEF/OIF veterans. However, it is not without limitations. First, self-report measures are subject to recall bias, and clinical interviews are considered the "gold standard" psychiatric assessment techniques and should be a focus of future research addressing this topic. Second, our measure of childhood trauma did not assess the wide range of childhood

experiences that could potentially be traumatic, and other more focused instruments, such as the Childhood Trauma Questionnaire,[60] which assess specific types of traumas (eg, sexual trauma) that may interact with MST and increase risk of military-related PTSS, might have provided more precise measurements of this construct. Third, our sample reflected a relatively low survey response rate, and thus the generalizability of our results may be limited. Moreover, our sample consisted of female veterans enrolled in VA care, with most in the Army, Reserves, and National Guard, although all were deployed to OEF or OIF and 50.4% experienced at least light-to-moderate combat exposure. Results may be most generalizable to female veterans enrolled in VA from similar cohort groups. Additional research is needed to see whether results are replicable in samples of female veterans from other countries, eras, and branches of the military. Finally, the WVCS sample had low reported MST rates in male OEF/OIF veterans, precluding our ability to examine similar research questions as the current study in that population. Future studies should examine these questions in a larger sample of men, especially given research showing greater vulnerability to mental health problems following MST in men compared to women.[61,62]

Despite these limitations, this study extends the literature on risk factors for military-related PTSD in female OEF/OIF veterans by focusing on potential interactive relationships between traumatic stressors, which may help to inform prevention, treatment, and policy efforts. One direction for future studies would be to examine whether multiple co-occurring traumas, such as childhood trauma, MST, and combat exposure, increase risk for PTSD symptom complexity (eg, aggressive behaviors) in female veterans, as prior studies have shown that cumulative trauma from childhood and adulthood showed an additive effect on both the severity and pattern of PTSD symptoms.[63,64] Such a symptom profile could have implications for the treatment of PTSD in this population, as these symptoms have been shown to impact affective and interpersonal self-regulatory abilities (eg, dissociative symptoms).[64] Importantly, although the military and VA systems have developed efforts to raise awareness of MST and provide outreach and services to victims of MST, our results and those of other investigators show that prevalence estimates of MST remain precariously high, and evidence for the significant toll that MST exerts on adverse mental health outcomes continues to mount. Thus, efforts to establish primary prevention of MST and research addressing the effectiveness of such programs are critically needed to protect women (and men) from the adverse health consequences of military sexual assault and harassment.

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