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Suicidality and Self-Harm Behavior of Adolescents During the Early Phase of the War in Ukraine

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Objective: War profoundly impacts people's lives, causing death, displacement, and psychological trauma, but research investigating suicidality of adolescents in this context has been limited. We compared suicidality or self-harm behavior among adolescents in regions that were, and were not, affected by Russia's initial invasion of Ukraine in 2014.

Method: This cross-sectional study comprised 2,752 school students aged 11 to 17 years from the war-affected Donetsk region and non-war Kirovograd region. Data collection occurred in 2016 and 2017 using self-report tools to assess suicidality or self-harm behavior; psychopathology including posttraumatic stress disorder (PTSD), depression, and anxiety; and war trauma exposure.

Results: Adolescent girls in the war-affected region reported more suicide attempts (9.5% vs 5.1%; adjusted odds ratio [aOR] 1.8, 95% CI 1.2-2.8), suicidal ideation (39.3% vs 19.6%; aOR 2.6, 95% CI 2.01-3.3), or self-harm behavior (19.6% vs 13.1%; aOR 1.6, 95% CI 1.2-2.1), and boys reported more suicidal ideation (17.0% vs 9.8%; aOR 1.7, 95% CI 1.2-2.4). Boys and girls with PTSD, depression, or anxiety showed increased risks for any suicidality or self-harm. A dose-effect relation was observed between war trauma exposure and suicidality or self-harm. The association was strongest for adolescents who had experienced 5 or more different war trauma exposures (aOR 3.2, 95% CI 2.2-4.8).

Conclusion: War trauma exposure and psychopathology were strongly associated with suicidality or self-harm behavior, with a greater impact in girls than boys. The high prevalence of suicidality found in this study emphasizes the need for intervention on a large scale for adolescents living in war situations.

Plain language summary: In a cross-sectional study of two thousand seven hundred fifty-two 11- to 17-year-olds, adolescents who were exposed to the early phase of war in Ukraine showed increased risk for suicide attempts, suicidal ideation, or self-harm behavior among girls living in war-affected region compared to those in non-war region while boys reported increased risk for suicidal ideation only.

Key words: self-harm; war; suicidal ideation; suicide attempts

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War has a profound impact on people's lives, causing death, injuries, psychological traumas, and displacement.[1] The Russian invasion of Ukraine, which started in the eastern region in 2014, is the largest European ground offensive since World War II. Children and adolescents are among the most vulnerable groups during war due to their dependency and their need for family care and support from institutions such as schools.[2,3]

The French sociologist Émile Durkheim, in his book *Le Suicide* in 1897, first proposed sociological theories of suicide.[4] He argued that during war, suicide rates decrease as a result of social integration, but the rates increase once the war ceases due to social isolation and hopelessness. Hopelessness and losses in war may lead to despair and suicidal thinking, which may be acted on. In empirical research, exposure to war trauma has been linked strongly to mental health problems in adolescents, including posttraumatic stress disorder (PTSD), depression, and anxiety in adolescents.[5] War-related stressors such as exposure to violence, loss of parents or loved ones, and subsequent forced displacement might cause extra stressors for children and adolescents.[6,7] Suicidal behaviors may be conceptualized to occur along a continuum, ranging from suicidal ideation to attempts and to completed suicide.[8] Individuals with a previous history of self-harm or suicidal ideation are at increased risk for suicide attempts.[8-11] It is important to carry out empirical studies about how war is associated with a continuum of suicidal behavior.

The prevalence of suicidal behavior and self-harm among adolescents varies widely,[12,13] with notably higher rates observed among adolescents exposed to war or armed conflict.[6,14-17] This research included 3 studies with sample sizes of more than 1,000 adolescents from Kosovo,[14] Lebanon,[15] and Northern Ireland.[16] Only 1 study,

comprising 1,005 university students aged 17 to 24 years, has examined suicidal behavior in Ukrainian youth.[18] The study found that the prevalence of lifetime suicidal ideation was 26.1% and prevalence of suicide attempts was 5.5%. The existing literature has several limitations because it is difficult to conduct population-based studies about suicidality during war. First, there were no studies that compared suicidality or self-harm behavior between 2 regions within a single country when only one area has been affected by the war. Second, most studies focused only on suicidal ideations,[6,15,19-21] and no population-based study reported suicide attempts, suicidal ideation, and self-harm as a continuum. Third, most of the studies were based on small samples,[6,20,22] or data were collected from refugee centers or clinics and were not representative of the whole population.[6,19,23,24] Of note, the previous study from Ukraine measured only depression and did not directly compare suicidal behaviors in war and non-war regions, and self-harm behavior was not investigated.[18]

In February 2022, Russia launched a full scale-invasion of Ukraine; however, the Russian-Ukrainian war had started in April 2014, with the invasion and occupation of part of eastern Ukraine and Crimea by Russian forces. The present study is the first large epidemiological study that measures suicidality as a continuum, from self-harm behavior to suicide attempts, among adolescents during the early phase of the war in Ukraine. It compares suicidality or self-harm in war-affected and non-war regions and measures war trauma and a wide range of psychopathology. In our previous report, we showed that Ukrainian adolescents living in the war-affected region had high levels of war trauma and elevated risks of PTSD, depression, and anxiety.[25] The aim of this study was to compare suicidality or self-harm behavior among adolescents in the war-affected Donetsk region and in the Kirovograd region, which was not affected by the war at the time of the study. The second aim was to examine the associations between suicidality or self-harm and different levels of psychopathology and war trauma exposure. Our main hypothesis was that adolescents living in the war-affected region would have higher levels of suicidality and/or self-harm. Furthermore, we hypothesized that the severity of psychopathology and war trauma exposure would be associated with suicidality or self-harm.

METHOD

Context

The first stage of the Russian-Ukrainian war started in April 2014, when Russian forces invaded and occupied the Donbass region of eastern Ukraine. This happened just after Russia annexed Crimea in February 2014. Russia contributed to the formation of quasi-states in eastern Ukraine, namely, the so-called Donetsk and Lugansk people's republics.[26,27] These were recognized by Russia as independent states on the eve of the full-scale invasion in February 2022.

Participants

This was a cross-sectional study carried out 2 years after Russia invaded areas of eastern Ukraine in 2014. The participants were adolescents attending government-funded schools in 2 regions: Donetsk, which had experienced war since 2014, and Kirovograd in central Ukraine, which was a peaceful region at the time of the study (Figure 1). The full recruitment procedure has previously been published.[25] From September 2016 to January 2017, convenience sampling was used to select 15 public schools in the 2 regions. Nine schools were chosen from 3 cities in the Donetsk region: Kramatorsk, Sloviansk, and Druzhkovka. In the Kirovograd region, 6 schools from Kropyvnytskyi and Alexandria cities were selected. The principals of each school were contacted and asked if they were willing to participate in the study. The aim of the research and nature of participation were explained in detail, and the teachers distributed study details and informed consent forms to the parents. Only adolescents with informed consent from a parent were allowed to participate in the study. On the day of the data collection, adolescents completed a paper version of the Ukrainian or Russian questionnaire in their classroom. They submitted filled questionnaires in sealed envelopes to their teachers or researchers. Participants were briefed on the voluntary nature of their involvement, confidentiality of their responses, and their rights to withdraw without any explanation. It took the participants about 45 minutes to complete the questionnaire under the supervision of the researchers and their teachers.

The target population comprised 2,803 adolescents aged 11 to 17 years. Only 42 adolescents were excluded from the study, including 37 who were absent from school on the day of the data collection: 11 in the Donetsk region and 26 in the Kirovograd region. Five parents or guardians refused to give their consents: 2 in the Donetsk region and 3 in the Kirovograd region. The response rates were 98.5% in the Donetsk region and 97.2% in the Kirovograd region. The assessment was conducted in the classroom under the supervision of the researchers and their teachers. The analysis comprised 2,752 participants (98.1%), as there were 14 participants with missing or incorrect coding in the suicidal questions: 1,449 from the war-torn Donetsk region and 1,303 from the unoccupied Kirovograd region.

FIGURE 1 Data Collection in the War-Affected Donetsk Region and Non-War Kirovograd Region

Measures

The outcome measure was suicidality or self-harm. Suicide attempts, suicidal ideation, and self-harm behavior were assessed using 3 questions with "yes" or "no" responses. Adolescents were asked if they had intentionally hurt themselves by cutting or burning their skin during the past 6 months, if they had seriously thought about taking their own life, and whether they had tried to commit suicide. We merged responses of suicide attempts, suicidal ideation, and self-harm behavior into a single group, calculating any occurrence of any suicidality or self-harm behavior in adolescents. Further, to assess individual-level suicidality or self-harm behavior and because adolescents could simultaneously experience self-harm, suicidal ideation, and suicide attempts, we stratified the participants into 4 different groups pooling available information about self-harm, suicidal ideation, and attempts. We stratified the participants' responses into a hierarchy of severity. The most severe group comprised participants who had attempted suicide. The second group comprised participants with suicidal ideation and participants who had inflicted self-harm. The third group comprised participants with suicidal ideation only. Finally, the fourth group comprised participants with self-harm only. Each adolescent could belong to only 1 group. This scale was used in a previous study.[28] We reported both item and individual levels of suicidality or self-harm behavior.

Demographic Information. The questionnaire included information about sex (boy or girl), age, region of residence (Donetsk region or Kirovograd region), parental employment status, and family structure. Age was divided into <13 and ≥ 13 years. Parental occupation was categorized as employed or unemployed. The family structure included living with 2 biological parents or other family structures, including living with 1 parent, foster family, grandparents, or adopted family.

War Trauma Exposure. War trauma exposure was assessed using questions that were developed by Ukrainian child and

adolescent psychiatrists and psychologists working with adolescents exposed to war events. The questionnaire comprised 12 items about different types of war events, with "yes" or "no" responses. The war trauma exposures were summed with scores ranging from 0 to 12. We were interested in studying the associations between levels of war trauma exposure and suicidality or self-harm; thus, we categorized the number of war trauma exposures into 4 groups: no war trauma exposure, 1 to 2 exposures, 3 to 4 exposures, or 5 or more different types of war trauma exposures.

Posttraumatic Stress Disorder. PTSD was assessed with the Harvard Trauma Questionnaire (HTQ), which has been widely used with traumatized civilians, war veterans, torture victims, and refugees, including adolescents.[29,30] This is a self-report instrument in which the first 16 items are based on the PTSD criteria in *DSM-IV*. The respondent rates the frequency of symptoms experienced during the last week on a scale that ranges from zero for "not at all" to 4 for "extremely." PTSD symptom severity is computed by averaging responses of 16 items with scores ranging from 1 to 4. The HTQ recommends a clinical cutoff score of 2.5 to be considered symptomatic for PTSD. This instrument has reported good validity and reliability for detecting PTSD among adolescent populations,[30,31] with 88% concordance reported between interview- and HTQ self-report–based diagnosis of PTSD.[29]

Depression. Depression symptoms were assessed using the 9-item Patient Health Questionnaire (PHQ-9), a self-administered tool that has been widely used with adults and adolescents.[32,33] The respondent rates how frequently they had experienced symptoms over the last 2 weeks on a 4-point Likert scale, ranging from zero to 3. The total score ranged from 0 to 27. The scores were categorized into 3: none (0-4), mild/moderate depression (5-14), and severe depression (15-27). The PHQ-9 have reported high sensitivity (89.5%) and good specificity (78.8%) for detecting depression in adolescents.[34]

Anxiety. Anxiety symptoms were assessed with the 7-item Generalized Anxiety Disorder (GAD-7) questionnaire.[35] This self-report instrument contains 7 items based on the *DSM-IV* diagnostic criteria for generalized anxiety disorder. The respondent rates symptoms experienced in the last 2 weeks on a 4-point Likert scale: zero for "not at all," 1 for "several days," 2 for "half of the days," and 3 for "nearly every day." The total scores ranged from 0 to 21. The scores were divided into 3 categories: none (0-4), mild/moderate (5-14), and severe (15-21). The GAD-7 has reported good reliability in adolescent populations.[36] The translation was carried out using standard procedures. All the psychopathology measures were translated from English into Ukrainian and Russian language and then back-translated to English to assess their accuracy.

Ethical approval was obtained for this study from the ethical committee for the medical research ethics of Donetsk National Medical University. Informed consent was obtained from the parents and adolescents. The participants were told their participation was voluntary; their responses were anonymous, and psychological consultations were available if needed. They were also told they could leave the classroom without explanation when the questionnaires were filled in.

Statistical Analysis

A descriptive analysis was performed to describe the demographic characteristics of participants and the prevalence of suicidality and self-harm. Means and standard deviations were calculated for continuous variables, and frequencies and associated percentages were calculated for categorical variables. Binary and multinomial logistic regressions were conducted to examine the associations between any suicidality or self-harm and their subcategories and psychopathology or war trauma exposure. Odds ratios (OR) were used to estimate the strength of the associations and 95% CIs were calculated. The level of statistical significance was a 2-sided p value of $< .05$. Logistic regression was used to test for interactions between any suicidality or self-harm and demographic variables and psychopathology. Due to the exploratory nature of the study, no adjustment to p values due to multiple testing was done. All statistical analyses were analyzed using IBM SPSS statistical software version 27.0 (IBM Corp, Armonk, NY).

RESULTS

Table 1 shows the demographic characteristics of the sample. There were no significant differences in most demographic variables between the war-affected Donetsk region and non-war Kirovograd region, including sex, age, mother's employment status, and family structure, except for father's employment status. In the war-affected region, more fathers were unemployed than in the non-war region ($p < .001$).

Table 2 shows the prevalence of suicidality or self-harm behavior by region and sex. There was a significant sex-by-region interaction ($p < .001$) only with suicidality and self-harm. Therefore, the analyses of the 2 regions were carried out separately for boys and girls. The overall prevalence of any suicidality or self-harm in the total sample was 31.7%

TABLE 1 Demographic Characteristics in War-Affected Donetsk Region and Non-War Kirovograd Region

	Total (N = 2,752)		Donetsk region (n = 1,449)		Kirovograd region (n = 1,303)		
	n	(%)	n	(%)	n	(%)	p
Sex							.112
Female	1,402	(50.9)	759	(52.4)	643	(49.3)	
Male	1,350	(49.1)	690	(47.6)	660	(50.7)	
Age, y							.568
<13	1,007	(36.6)	523	(36.1)	484	(37.1)	
≥13	1,745	(63.4)	926	(63.9)	819	(62.9)	
Mother's employment status							.905
Employed	2,141	(77.8)	1,126	(77.7)	1,015	(77.9)	
Unemployed	611	(22.2)	323	(22.3)	288	(22.1)	
Father's employment status[a]							<.001
Employed	2,444	(88.8)	1,206	(83.3)	1,238	(95.01)	
Unemployed	307	(11.2)	242	(16.7)	65	(4.9)	
Family structure							.592
Biological parents	1,726	(62.7)	902	(62.2)	824	(63.2)	
Others[b]	1,026	(37.3)	547	(37.8)	479	(36.8)	

Note: [a]*Missing: 1.*
[b]*Living with 1 parent, foster family, grandparents, or adopted family.*

in the war-affected region and 18.6% in the non-war region (adjusted OR [aOR] 1.9, 95% CI 1.6-2.4). Adolescent girls in the war-affected region reported more suicidality or self-harm behavior than girls in the non-war region (42.9% vs 23.8%; aOR 2.3, 95% CI 1.8-2.9). Similar results were reported in boys, with a higher prevalence in the war-affected region than the non-war region (19.4% vs 13.5%; aOR 1.4, 95% CI 1.1-1.9). Girls living in the war-affected region reported significantly higher suicide attempts (9.5% vs 5.1%; aOR 1.9, 95% CI 1.2-2.8), suicidal ideation (39.3% vs 19.6%; aOR 2.6, 95% CI 2.01-3.3), and self-harm behavior (19.6% vs 13.1%; aOR 1.6, 95% CI 1.2-2.1) than girls in the non-war region. Adolescent boys in the war-affected region reported more suicidal ideation (16.9% vs 9.8%; aOR 1.7, 95% CI 1.2-2.4) than their peers in the non-war region. These associations were adjusted for demographic variables (age and father employment). There were significant sex differences in suicide attempt, ideation, or self-harm behavior in both war-affected and non-war regions, with girls more likely to experience suicide attempt, ideation, or self-harm compared with boys.

Because one participant could have different types of combinations of self-harm, suicidal ideation, and suicide attempts, we stratified the sample into 5 groups: no suicidality or self-harm, self-harm only, suicidal ideation only, combined suicidal ideation and self-harm, and suicide attempts, including participants who had comorbid suicidal ideation or self-harm. As shown in Table 2, after adjustment, girls in the war-affected region had higher prevalence of suicide attempts (9.5% vs 5.1%; aOR 2.4, 95% CI 1.5-3.7), combined suicidal ideation and self-harm (9.4% vs 5.9%; aOR 2.1, 95% CI 1.4-3.2), and suicidal ideation only (20.6% vs 8.6%; aOR 3.1, 95% CI 2.2-4.4). In boys in the war-affected region, the only group that was more prevalent was suicidal ideation only (10.4% vs 4.4%; aOR 2.4, 95% CI 1.5-3.8). There was no significant difference in the self-harm behavior only group in girls or boys (girls: 3.6% vs 4.2%; aOR 1.1, 95% CI 0.6-1.9; boys: 2.2% vs 3.5%; aOR 0.6, 95% CI 0.3-1.3). However, significant sex differences were observed, with girls more likely to report suicide attempts, combined suicidal ideation and self-harm, and suicidal ideation only compared with boys, in both war-affected and non-war regions. Self-harm only was more prevalent in girls compared with boys in the war-affected region.

Table 3 shows the association between overall suicidality or self-harm and psychopathology, namely, PTSD, depression, and anxiety, in the 2 regions separately for girls and boys. The analyses were adjusted for age and father employment in model I, and psychopathology was added in model II. In girls, PTSD and depression were associated with any suicidality or self-harm in the war-affected region (aOR 1.3, 95% CI 1.1-1.7, and aOR 2.5, 95% CI 2.02-3.2, respectively) and non-war region (aOR 1.5, 95% CI

TABLE 2 Comparison of Suicidality or Self-Harm Behavior in Both Regions and Sex

Suicidality or self -harm behavior	Total (N = 2,752)		Donetsk region (war-affected) (n = 1,449)						Kirovograd region (non-war) (n = 1,303)						Girls in war-affected region vs girls in non-war region		Boys in war-affected region vs boys in non-war region	
			Girls		Boys				Girls		Boys							
	n	(%)	n	(%)	n	(%)	OR	(95% CI)[a]	n	(%)	n	(%)	OR	(95% CI)[a]	OR	(95% CI)[a]	OR	(95% CI)[a]
Item level approach																		
Suicide attempts	148	(5.4)	72	(9.5)	26	(3.8)	2.6	(1.7-4.2)***	33	(5.1)	17	(2.6)	2.1	(1.1-3.8)*	1.9	(1.2-2.8)**	1.6	(0.8-2.9)
Suicidal ideation	606	(21.9)	298	(39.3)	117	(16.9)	3.2	(2.5-4.1)***	126	(19.6)	65	(9.8)	2.2	(1.6-3.1)***	2.6	(2.01-3.3)***	1.7	(1.3-2.4)*
Self-harm behavior	339	(12.3)	149	(19.6)	48	(6.9)	3.3	(2.3-4.6)***	84	(13.1)	58	(8.8)	1.5	(1.1-2.2)*	1.6	(1.2-2.1)*	0.7	(0.5-1.1)
Individual level approach																		
Any suicidality or self-harm	702	(25.5)	326	(42.9)	134	(19.4)	3.1	(2.5-3.9)***	153	(23.8)	89	(13.5)	1.9	(1.5-2.7)***	2.3	(1.8-2.9)***	1.4	(1.1-1.9)*
Suicide attempts	148	(5.4)	72	(9.5)	26	(3.8)	3.5	(2.2-5.6)***	33	(5.1)	17	(2.6)	2.3	(1.3-4.2)**	2.4	(1.5-3.7)***	1.6	(0.9-3.1)
Both suicidal ideation and self-harm	150	(5.5)	71	(9.4)	21	(3.04)	4.3	(2.6-7.1)***	38	(5.9)	20	(3.03)	2.3	(1.3-3.9)**	2.1	(1.4-3.2)***	0.8	(0.4-1.6)
Suicidal ideation only	312	(11.3)	156	(20.6)	72	(10.4)	2.7	(2.03-3.8)***	55	(8.6)	29	(4.4)	2.3	(1.4-3.6)***	3.1	(2.2-4.4)***	2.4	(1.5-3.8)***
Self-harm only	92	(3.3)	27	(3.6)	15	(2.2)	2.3	(1.2-4.4)*	27	(4.2)	23	(3.5)	1.4	(0.8-2.4)	1.1	(0.6-1.9)	0.6	(0.3-1.3)

Note: *OR = odds ratio.*
*p < .05; **p < .01; ***p < .001.
[a]*Adjusted for age and father's employment status.*

TABLE 3 Association Between Posttraumatic Stress Disorder (PTSD), Depression, Anxiety, and Any Suicidality or Self-Harm Among Girls in War-Affected Donetsk Region and Non-War Kirovograd Region

	Girls								Boys							
	Donetsk region				Kirovograd region				Donetsk region				Kirovograd region			
	Model I		Model II		Model I		Model II		Model I		Model II		Model I		Model II	
	Mean (SD)	OR (95% CI)[a]	OR	(95% CI)[b]	Mean (SD)	OR (95% CI)[a]	OR	(95% CI)[b]	Mean (SD)	OR (95% CI)[a]	OR	(95% CI)[b]	Mean (SD)	OR (95% CI)[a]	OR	(95% CI)[b]
PTSD (HTQ) scores	0.8 (1.2)	2.4 (2.01-2.8)***	1.3	(1.1-1.7)*	0.4 (0.9)	2.01 (1.7-2.6)***	1.5	(1.2-1.9)***	0.8 (1.5)	2.5 (2.1-3.1)***	1.7	(1.3-2.2)***	0.3 (1.2)	2.3 (1.8-2.9)***	1.3	(0.9-1.8)
Depression (PHQ-9) scores	1.1 (1.4)	3.3 (2.7-3.9)***	2.5	(2.02-3.2)***	0.8 (1.0)	2.9 (2.4-3.7)***	2.3	(1.8-2.9)***	0.5 (1.3)	3.1 (2.4-3.9)***	1.9	(1.4-2.5)***	0.8 (1.2)	3.9 (2.9-5.4)***	2.5	(1.8-3.4)***
Anxiety (GAD-7) scores	0.9 (1.2)	2.4 (2.1-2.9)***	1.2	(0.9-1.5)	0.5 (1.0)	2.2 (1.8-2.7)***	1.4	(1.1-1.7)*	0.6 (1.2)	2.5 (2.04-3.1)***	1.3	(0.9-1.7)	0.6 (1.2)	4.1 (2.9-5.7)***	2.2	(1.5-3.1)***

Note: OR was calculated for 1 SD change.GAD-7 = 7-item generalized anxiety disorder; HTQ = Harvard Trauma Questionnaire; OR = odds ratio; PHQ-9 = 9-item Patient Health Questionnaire.

*p < .05; ***p < .001.

[a]*Model I: Adjusted for age and father's employment status.*

[b]*Model II: Adjusted for age, father's employment status, and psychopathology (PTSD, depression and anxiety).*

TABLE 4 Association Between War Trauma Exposure and Any Suicidality or Self-Harm in War-Affected Donetsk Region

War trauma exposure	n	(%)	OR	(95% CI)[a]
No exposure	41	(18.6)	1.0	
1-2	113	(25.4)	1.4	(0.9-2.1)
3-4	101	(29.9)	1.6	(1.01-2.4)*
≥5	205	(46.1)	3.2	(2.2-4.8)***

Note: n (%) refers to participants with suicidality or self-harm. OR = odds ratio.

[a]*Adjusted for sex, age, and father's employment status.*

*p < .05; ***p < .001.

1.2-1.9, and aOR 2.3, 95% CI 1.8-2.9, respectively), while anxiety was associated with any suicidality or self-harm only in the non-war region (aOR 1.4, 95% CI 1.1-1.7). In boys, PTSD and depression were associated with any suicidality or self-harm in the war-affected region (aOR 1.7, 95% CI 1.3-2.2, and aOR 1.9, 95% CI 1.4-2.5, respectively), and there were significant associations between suicidality or self-harm and depression and anxiety in the non-war region (aOR 2.5, 95% CI 1.8-3.4, and aOR 2.2, 95% CI 1.5-3.1, respectively). Similar results were observed when psychopathology was analyzed as categories (Tables S1 and S2, available online). Severe depression was more strongly associated with suicidality or self-harm than moderate depression, as shown in Tables S1 and S2 (available online).

The associations between psychopathology and suicidality or self-harm outcome stratified into sub-categories (suicide attempts, combined suicidal ideation and self-harm, suicidal ideation only, and self-harm only) are shown in Tables S3 and S4 (available online). Suicidal attempts were associated with all psychopathologies among boys and girls in both regions except PTSD among girls and anxiety among boys in the war-affected region. Most of the psychopathology was associated with suicidal ideation and self-harm or suicidal ideation only in groups in both regions and for both sexes. The only association between self-harm only and psychopathology was found for depression among girls in the war-affected region.

In Table 4, we examined the association between war trauma exposures and suicidality or self-harm when the number of different war trauma exposures were categorized into 4 groups: no exposure, 1 to 2 exposures, 3 to 4 exposures, and 5 or more different types of war trauma exposures. The analyses included only war trauma exposures in the war-affected region because of the low prevalence in the non-war region and the interest in studying the role of trauma exposure in the war-affected region. There was no interaction between sex and war trauma exposure; therefore,

the estimates were presented for the total sample. As shown in Table 4, there was a dose-effect relation between suicidality or self-harm outcome and the level of war trauma exposure. The association with outcome was not significant if adolescents had experienced 1 or 2 different trauma exposures (aOR 1.4, 95% CI 0.9-2.1) and was relatively low for adolescents who had experienced 3 or 4 exposures (aOR 1.6, 95% CI 1.01-2.4). However, the association was strong in participants who had been exposed to 5 or more different trauma exposures (aOR 3.2, 95% CI 2.2-4.8). As war trauma exposure and psychopathology were highly correlated (Spearman rank correlation coefficients varied between 0.14 and 0.21; $p < .001$), the association between war trauma exposure and suicidality or self-harm was not adjusted for psychopathology.

When the associations between specific war trauma exposures and any suicidality or self-harm outcome were studied, 10 of 12 specific direct violent or nonviolent war trauma exposures were associated with the outcome (Table S5, available online). The highest odds were observed for being a victim of violence or being used as a human shield (aOR 3.4, 95% CI 2.4-4.6), finding it difficult to adapt to a new location (aOR 2.6, 95% CI 1.9-3.4), and experiencing forced separation from parents or family members (aOR 2.5, 95% CI 1.8-3.6).

Finally, we studied associations between war trauma exposure and suicidality or self-harm outcomes in the war-affected region when stratified into subcategories: suicide attempts, suicidal ideation and self-harm, suicidal ideation only, and self-harm only (Table S6, available online). The association was significant for suicide attempts, combined suicidal ideation and self-harm, and suicidal ideation only groups if adolescents had been exposed to at least 5 or more different war traumas. No significant association was found between war trauma exposures and the self-harm only group.

DISCUSSION

The findings of this study provide unique insights into the impact of the early phase of the Ukraine war on suicidality or self-harm among adolescents in war-affected and non-war regions. First, suicidality or self-harm behavior and suicidal ideation were associated with both boys and girls living in the war-affected region. Second, PTSD, depression, and anxiety were associated with increased risks for suicidality or self-harm behavior. Third, a dose-effect relation was observed in the association between war trauma exposure and suicidality. Fourth, suicide attempts and suicidal ideations (with or without self-harm behavior) were associated with the high level of war trauma exposure, while self-harm behavior not comorbid with suicidal attempts or ideations was not.

We found higher prevalence rates of suicidality or self-harm behavior in both sexes in the war-affected region than in the non-war region after the invasion. The prevalence rates were higher than in previous studies of adolescents after wars or armed conflicts.[14,16,20,22] High rates of suicidality or self-harm behavior are likely to result from psychological distress due to prolonged exposure to war atrocities, facing displacement, and economic hardship.[37] This study showed that war trauma exposures were associated with suicidality or self-harm behavior. Relative cognitive maturity of adolescents will influence their understanding of losses or threats resulting from the war. However, they may face further risks due to their exposure to suicidal ideation or behavior among family members, as this has been associated with an increased risk of adolescent suicidality.[38,39]

We found sex differences, with girls in war-affected regions experiencing more suicide attempts, suicidal ideation, and self-harm behavior, while boys showed an increased risk for suicidal ideation. Previous studies in war or conflict settings have shown that girls reported more suicide attempts and suicide ideation than boys.[14,15,20] Similarly, in epidemiological studies in non-war situations, in most countries, adolescent girls have more suicide attempts[40] or more suicidal ideations,[41] while boys have more complete suicides.[42,43] The risk of depression has been shown to increase more substantially for girls than boys after the onset of puberty,[44] and this has been shown to be linked with suicidality.[42]

The study showed that PTSD, depression, and anxiety were associated with suicidality or self-harm in both sexes in both regions. It is worth noting that the level of psychopathology was higher in the war-affected region. Suicidality or self-harm behavior was more strongly associated with severe depression among adolescents in the war-affected region. This finding is consistent with a cumulative risk factor model in which risk may have additive effects. Our data indicate that war has heterogeneous effects, which result in an accumulation of stressors over time. Exposure to war or armed conflicts has been shown to contribute to the development of PTSD, depression, and anxiety, which precede suicidal behaviors.[45] The association between war exposure, losses, and displacement and suicidality may be mediated by the sense of hopelessness and fear of and pessimism about the future, reflected in depressive symptoms. These experiences of negative affect may then increase the risk for suicidal behaviors as a way to cope with the symptoms.[46]

Exposure to higher levels of different types of war trauma was associated with any suicidality or self-harm. We showed a dose-effect relation indicating that higher level of war trauma exposure was associated with suicidality or self-harm, which has not been reported previously in adolescents in war situations. The cumulative exposure to traumatic events may exacerbate the effect of trauma on mental health of adolescents[47] and may overwhelm coping skills of children. When specific war trauma exposures were studied, both violent and nonviolent war trauma exposures were associated with any suicidality or self-harm. Experiencing violence has been associated with mental health problems and suicidal ideation,[7] and being separated from parents has been shown to have adverse effects on social and emotional development, well-being, and mental health.[48] Adolescents might experience stress related to resettlement in a new area, and this could result in social exclusion, which has been shown to increase the risk for suicidal behavior.[49] These findings emphasize the importance connectedness and feeling settled to adolescents, such as among refugees, in detention centers, and in unsupportive living situations.

The main strengths of this study were the large and representative sample of Ukrainian adolescents. Another strength is the use of 2 geographical regions with different exposures to war to compare suicidality and self-harm behavior. However, some limitations should be considered. First, this was a cross-sectional study, and so causal inference could not be demonstrated. In view of this design, information on prewar events or psychopathology was not available. Second, the study relied on self-reports. However, adolescents disclose more about their mood, anxiety, and suicidality than parents and teachers, who underreport in these areas.[50] Third, psychometric properties of instruments for psychopathology were unavailable for the Ukrainian population; however, the measures were translated from English into Ukrainian and Russian language and then back-translated to English language. The war trauma questionnaire was specifically developed for this study, and psychometrics had not been previously established, but the findings that the war trauma measure had predictive validity indicate its strengths. We need to acknowledge that the measure of depression included 1 question about suicidal ideation and self-harm, and we could not make analyses after removing this item in view of the absence of item-level information. Finally, due to the exploratory nature of the study, no adjustment to p values due to multiple testing was done. Although this was a large study, bigger samples are required to confirm the results.

In conclusion, our study reveals high risk of suicidality among both adolescent girls and boys in a war-affected region. Additionally, war trauma exposure and psychopathology were strongly associated with suicidality. The high prevalence of suicidality found in this study emphasizes the need for intervention on a large scale for adolescents living in war situations. However, this cross-sectional study does not address the question of which or what type of intervention would be appropriate. We would expect the psychiatric difficulties and needs of adolescents following the full-scale invasion by Russia of Ukraine in February 2022 will have increased significantly.

CRediT authorship contribution statement

Andre Sourander: Writing – review & editing, Writing – original draft, Conceptualization, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision. **Sanju Silwal:** Methodology, Investigation, Formal analysis, Data curation, Conceptualization, Writing – original draft, Writing – review & editing. **Olga Osokina:** Conceptualization, Data curation, Investigation, Methodology, Project administration, Resources, Supervision, Writing – review & editing. **Susanna Hinkka-Yli-Salomäki:** Conceptualization, Formal analysis, Investigation, Methodology, Supervision, Writing – review & editing. **Matthew Hodes:** Writing – review & editing, Conceptualization, Investigation, Methodology, Supervision. **Norbert Skokauskas:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization.

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The research was performed with permission from the Ethical Committee for the Medical Research Ethics of Donetsk region National Medical University.

Informed consent from parents and adolescents was obtained before data collection. The informed consents were distributed in Ukrainian or Russian language. The informed consents will be provided upon request.

Dr. Silwal and Ms. Hinkka-Yli-Salomäki served as the statistical experts for this research.

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