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War, Torture and Trauma in Preadolescents from Gaza Strip. Two Different Modalities of PTSD

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ABSTRACT

The aim of the present study was to assess the impact of past traumatic war experiences on preadolescents in the Gaza Strip, which could be useful for psychological intervention with current and future child victims. Participants were 521 preadolescents from United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA) schools, aged 11 and 13 years old. Sections I to IV from Iraqi Version-Arabic of Harvard Trauma Questionnaire was used to assess trauma experiences and Post-Traumatic Stress Disorder (PTSD). The results show that the preadolescents in the Gaza Strip witnessed the destruction of their homes and the murder of family members and friends. A quarter of the individuals assessed either suffered torture or witnessed others undergoing it, including sexual assaults. Almost half of them experienced a lack of food and clean water. The traumatic and torture experiences seriously affected preadolescents' mental health as 26.29% met criteria for the diagnosis of PTSD. The data analysis revealed two PTSD modalities, with the severity of impact depending on whether social implications were involved. Further research is required to check whether these two modalities fit to PTSD and complex PTSD. Understanding the effects of past wars on preadolescents in Gaza and distinguishing between different PTSD types could enhance comprehension of the impacts of current attacks on child victims. It can also aid in determining the type of intervention needed to minimize the impact on the mental health of Palestinian youth, enhancing their resilience through psychological and social support.

Guerra, tortura y trauma en preadolescentes de la Franja de Gaza: Dos modalidades diferentes de TEPT

RESUMEN

El objetivo del presente estudio fue evaluar el efecto de pasadas experiencias traumáticas de guerra en preadolescentes de la Franja de Gaza, lo que pudiera ser útil para la intervención psicológica con presentes y futuras víctimas infantiles. Participaron 521 preadolescentes de escuelas de la Agencia de las Naciones Unidas para los Refugiados de Palestina en el Cercano Oriente (UNRWA), con edades comprendidas entre los 11 y 13 años. Se utilizó la sección I a la IV de la versión en árabe del Cuestionario de Trauma de Harvard para evaluar las experiencias traumáticas y el Trastorno de Estrés Postraumático (TEPT). Los resultados muestran que los preadolescentes de la Franja de Gaza fueron testigos de la destrucción de sus hogares y del asesinato de familiares y amigos. Un cuarto de las personas evaluadas sufrió torturas o fue testigo de cómo otros las sufrían, incluidas agresiones sexuales. Casi la mitad de ellos experimentó la falta de alimentos y agua potable. Las experiencias traumáticas y de tortura afectaron seriamente la salud mental de los preadolescentes, ya que el 26.29% cumplía con los criterios para el diagnóstico del TEPT. El análisis de datos reveló dos modalidades de TEPT, donde la gravedad del impacto dependía de si tenían implicaciones sociales. Se necesita más investigación para comprobar si estas dos modalidades se ajustan al TEPT y al TEPT Complejo. Conocer los efectos de las guerras pasadas en los preadolescentes de Gaza y distinguir entre los diferentes tipos de TEPT podría mejorar la comprensión de los impactos de los ataques actuales en las víctimas infantiles actuales. También puede ayudar a determinar el tipo de intervención necesario para minimizar el impacto en la salud mental de la juventud palestina, mejorando su resiliencia a través del apoyo psicológico y social.

In the last decade, armed conflicts and human rights violations have increased worldwide. Of particular severity are situations of ethnic cleansing that result in the forced displacement and extermination of thousands of people. Minors are the most vulnerable victims in these conflicts. Since October 2023, following an attack by Hamas, the State of Israel launched an assault on the Gaza Strip and the West Bank, resulting in over 26,000 deaths by January 2024, with approximately half being children. Thousands of children have been injured, witnessed the murder of their relatives, had to leave their homes, and lacked basic supplies to survive. These events are currently under investigation by the International Court of Justice in The Hague as potential genocide. Understanding the psychological impact that previous attacks had on surviving children could aid in future psychological interventions for the new victims.

Preadolescents in war zones may face severe developmental impacts due to traumatic experiences, particularly related to torture, with limited specific studies in this age group (Dimitry, 2012). Existing research focuses on younger and older populations, revealing that children and adolescents are significantly affected by war situations (Barber, 2008). Mental health studies indicate that minors from war zones often exhibit pathologies such as posttraumatic stress disorder (PTSD), anxiety, and depression (Bronstein & Montgomery, 2011; Dimitry, 2012; Slone & Mann, 2016).

Determining factors influencing the effects include exposure level, age, gender, family factors, socio-economic adversity, coping strategies, belief systems, social support, and religiosity (Dimitry, 2012; Lustig et al., 2004; Richardson et al., 2021; Slone & Mann, 2016). Low social support is recognized as a PTSD risk factor (Bryant, 2019), and parental responses to trauma play a crucial role (Hiller et al., 2018). The relationship between social support and PTSD is intricate, with social support potentially buffering the effects of adverse childhood experiences (ACE), while ACE may negatively impact social support (Jones et al., 2018; Wang et al., 2021).

A meta-analysis focused on social support as a PTSD predictor found complex relations, varying based on types of traumatic events (Zalta et al., 2021). PTSD, associated with traumatic experiences, has faced criticism for diagnostic criteria (Manzanero et al., 2021; McNally et al., 2014). Some argue that PTSD is a cognitive pathology related to memory processes, where perceptions of traumatic memories predict posttraumatic stress symptoms (Brewin, 2001; Brewin et al., 1996; Manzanero et al., 2020; Manzanero & Morales-Valiente, 2024; McGuire et al., 2021).

Adolescents experiencing forced displacement due to combat, with traumatic events, may meet PTSD criteria (Panter-Brick et al., 2009). The association between PTSD and the number of traumatic experiences suggests a link between intensity, coping strategies, resilience, and the manifestation of traumatic pathology. Repeated exposure to traumatic events may erode resistance, leading to symptoms and psychological disorders.

Traumatic experiences' effects extend beyond PTSD, encompassing psychosocial elements impacting the well-being and quality of life of child victims in war zones (Thabet & Thabet, 2016; Veronese et al., 2017).

The Case of the Gaza Strip

The whole Palestine region, and the Gaza Strip in particular, have undergone a persistent conflict for decades that has implied repetitive exposure to violence and war, and that have clearly eroded the psychological well-being, health, and quality of life of children population (D'Andrea et al., 2023; Manzanero et al., 2021; Massad et al., 2009; Shank et al., 2023; Shehadeh et al., 2015; Thabet et al., 2014, 2009; Thabet & Thabet, 2016; Thabet & Vostanis, 1999, 2000), adding urgency to the need to understand and address the implications of war-related trauma in this population.

In general, the severity of psychological disorders in minors exposed to war-related violence depends on the quantity of the traumatic events suffered (Thabet & Vostanis, 1999). In any case, there are important individual differences (Kolltveit et al., 2012; Punamaki, 2002) and resilient strategies (Betancourt et al., 2013; Tol et al., 2013). Several studies have found that girls in Gaza would be more vulnerable to war-related stressors than boys (Kolltveit et al., 2012; Panter-Brick et al., 2009; Thabet et al., 2014).

Also, there are many stressors that affect minors in war situations (Lustig et al., 2004). Most of the studies (Kadir et al., 2019) point out, among the most frequent, the lack of medical attention and diseases related to unsanitary conditions and lack of food, exposure to toxins (which increase the medium and long-term prevalence of cancer), environmental and meteorological factors, exposure to violence and extreme trauma (primary or secondary), social and geographical changes, and sexual assaults. APA (2000) defined extreme trauma as directly experiencing, witnessing, or learning about events that involve actual or threatened death or serious injury, or other threat to physical integrity.

Sometimes traumatic experiences in war situations correspond to what has been defined as torture (Kadir et al., 2019; Quiroga, 2009). According to Article 1 of the Convention against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment (UNCAT), adopted by the United Nations's General Assembly in its 39/46 resolution of December 10th, 1984, "torture" shall be understood as any act by which severe pain or suffering, whether physical or mental, is intentionally inflicted on a person in order to obtain information or a confession from him or a third party, to punish him for an act he has committed, or is suspected of having committed, or to intimidate or coerce that person or others, or for any reason based on any type of discrimination, when said pain or suffering is inflicted by a public official or another person in the exercise of public functions, at his instigation, or with his consent or acquiescence. Article 2 specifies that in no case may exceptional circumstances, such as a state of war or threat of war, internal political instability or any other public emergency, be invoked as a justification for torture.

In addition, sexual assaults have been reported in war situations against minors on numerous occasions (Kadir et al., 2019). In the case of Palestine, the Public Committee Against Torture in Israel (PCATI) documented, during 2005-2012, 60 cases of sexual abuse (4% of all files in this period), 36 reports of verbal sexual harassment, either directed toward Palestinian men and boys or toward family members, and 35 reports of forced nudity; 15% of the attacks were against minors (Weishut, 2015).

Context and Objectives of Current Study

On July 8th, 2014, the Israeli Army launched an attack against the population of Gaza Strip that lasted 51 days, causing the death of 2,251 people, 551 of them children, 299 women and 64 unidentified. During the conflict, 11,231 Palestinians were injured, including 3,436 children. This attack caused the destruction of infrastructures, particularly water supplies and sewerage, while the destruction of dwellings left more than 500,000 people homeless. During this time, 118 UNRWA (United Nations Relief and Works Agency for Palestine Refugees in the Near East) installations were damaged, including 83 schools and 10 health centers. In total, over 12,600 housing units were totally destroyed and almost 6,500 sustained severe damage. Almost 150,000 additional housing units sustained various degrees of damage and remained inhabitable. The conflict led to a massive displacement crisis in Gaza, with almost 500,000 persons internally displaced at its peak. Approximately 50,000 of them took refuge in UNRWA schools. Other people found

refuge with family or friends, in overcrowded conditions and lack of essential resources (UNRWA, 2014).

Consequently, this study assessed exposure to traumatic events and posttraumatic symptoms in preadolescents from the Gaza Strip between December 30th, 2014, and May 17th, 2015. The study's objectives were: (1) to determine the prevalence of exposure to traumatic events among male and female children aged 11 to 13 living in the Gaza Strip, and (2) to examine the symptoms of traumatic stress in these children.

Method

Participants

A total of 521 preadolescents (11-13 years old) from the Gaza Strip (Palestine) with a mean age of 11.62 years (*SD* = 0.73), 225 girls (43.2%) and 296 boys (56.8%), participated in the study. They resided in five areas of the Gaza Strip: Rafah, Khan Yunis, Wustah, Gaza City, and North Gaza. All of them attended UNRWA elementary schools.

Material

The assessment is based on the application of the Harvard Trauma Questionnaire (HTQ[1]) developed by the Harvard Program in Refugee Trauma (Mollica et al., 1992). The sections I to IV from Iraqi Version-Arabic of Harvard Trauma Questionnaire (HTQ; Shoeb et al., 2007) allows to obtain information about the effects of war in the participants:

- First section enumerates 39 traumatic events in a yes/no question.
- Second section include 35 yes/no questions about torture experiences.
- Third section measures physical effects of war (injury and starvation), composed by three items with several types of responses depending on the information requested.
- Fourth section measures psychological symptoms of trauma and is composed of 44 items that evaluate the severity or intensity of the symptoms on a 4-point Likert scale (1 = *not at all*, 2 = *a little,* 3 = *quite a bit*, and 4 = *extremely*). The first 16 items aim to measure PTSD symptoms according to DSM-IV criteria, with a threshold of 2.5 or higher. The other 28 items quantify what the authors name "refugee specific", which evaluates the impact that the traumatic events could have had on their perception of their own daily life. The overall scale of section 4 also considers a threshold value of 2.5 or higher.

Procedure

For the purpose of this study, the UNRWA schools in the Gaza Strip were asked in writing by the Department of Psychology of the Al-Azhar University-Gaza for their collaboration in the application of the HTQ trauma questionnaire. When approval was obtained, psychologists who work with the families went to the schools to meet the children and their parents. The purpose of the study was explained, and the children's parents were asked for their consent to apply the test. The instruments were applied in individualized interviews by psychologists from UNRWA schools between December 2014 and May 2015, several months after the Israeli army carried out attacks on the Gaza Strip from July until august 2014.

Data Analysis Techniques

The first perspective of data analysis explored variables one by one or relationships of couples of variables. To do that, data exploration and analysis used several tools, based on the research questions to answer. Cronbach's alpha was calculated to get scale reliability measured. Analysis of variance (ANOVA) and chi-squared (χ^2) were used to test statistically significant differences, and eta-squared (η^2) to assess effect size.

The second perspective of data analysis explored large or complete set of assessed variables. For that, multidimensional scaling (MDS) was used to permit 3D dimensionality reduction (Nguyen & Holmes, 2019) and data visualization (Walny et al., 2019) of complex data. Specifically, classic metric MDS was used. Those graphs reflect data distribution, so it is possible to see, for example, if people with and without PTSD are somehow grouped. Interesting visual groupings are analyze using machine learning (ML), also called data science (DS), tools to check group arrangements beyond apparent visual arrangement. That way, evidence (or a lack of it) is obtained to support those groupings. Support vector classifier (Vapnik, 1998) (SVC), multivariate logistic regression (MLR), and *k*-means (Yadav & Sharma, 2013) nearest centroid classifier (Levner, 2005) (KM-NCC) are used to get global support. Additionally, one-way ANOVA (group comparison) and η^2 are used to detect the most relevant variables, differentiating identified groupings.

Additional data analysis ML techniques are used, providing additional insights through its different data analysis perspective. "(…) machine learning enables more rigorous exploration, and holds the potential to advance theory formation in developmental psychology and other fields. Machine learning is an umbrella term for methods that learn patterns from data through automated model build" (Van Lissa, 2023, p. 2). Although ML methods are still a novelty in psychological research, its use is growing fast in all areas of psychological research (Orrù et al., 2020), as educational psychology (Levy et al., 2020; Luan and Tsai, 2021), clinical psychology (Dwyer et al., 2018), and social psychology (Kumar et al., 2019). Because these techniques used here are still not very widely known, they are shortly described in a foot note[2].

Samples with missing data were removed for DS analysis, implying a reduction of 8.6% of data samples. Data imputation using average values decreases data variability (Hastie et al., 2009), making groupings identification difficult. To prevent higher values bias being favored in algorithm training, Likert type items were rescaled from [1, 2, 3, 4] values to [-1.5, -0.5, 0.5, 1.5][3].

Ethical Information

Children's participation in the study was voluntary and approved by their family members or caregivers. All the children and their families who participated in the study had the necessary psychological support. This study was part of the research project about the assessment of psychological trauma in vulnerable refugees and asylum seekers (children and women), and was approved by Ethic Committee from [masked institution]. It was endorsed by UNHCR-Spain and declared of interest to the European Union, and it was possible thanks to the collaboration of the UNRWA schools. After the attacks of the summer of 2014 the UNRWA's Community Mental Health Programme assisted refugees in the Gaza Strip, asserted that children who could present physical and psychological needs were adequately cared for. They collectively support children and families, not only through individual and group counselling, but targeted interventions aimed at enhancing psychosocial resiliency and well-being. Along the armed conflict, UNRWA provided humanitarian assistance (including non-food-items, food, water, psycho-social support) to internally displaced persons in 90 of 156 UNRWA school buildings, with the remaining school buildings either unsafe or damaged. On 23rd August, 2014, a record-high of 292 959 internally displaced persons were counted in 85 UNRWA school buildings (UNRWA, 2014).

Results

The results are reported by grouping the responses of the participants to the four sections of the questionnaire applied in

Table 1. Children Who Experienced Different Types of Traumatic War Events, Ordered by Frequencies from Highest to Lowest

Traumatic War Events	n	%
Witnessed shelling, burning, or razing of residential areas	440	84.45
Witnessed mosques desecration or destruction	378	72.69
Confined to home because of outside shelling and violence	364	69.87
Exposed to combat situation (explosions, artillery fire, shelling)	331	63.53
Witnessed corpses	329	63.15
Forced to flee from his/her home	279	53.76
Witnessed chemical attacks on residential areas	262	50.48
Serious physical injury of family member or friend from combat situation or shelling	225	43.19
Forced to leave his/her hometown and settle in a different part of the country with minimal services	211	40.58
Witnessed someone being physically harmed	210	40.31
Witnessed murder	192	36.85
Witnessed mass execution of civilians	162	31.09
Lacked shelter	153	29.42
Murder or violent of friend's death	107	20.54
Property looted or destroyed	102	19.73
Disappearance of a friend	71	13.65
Was he/she present while someone searched his/her home for people or things	60	11.54
Murder or violent death of family member (brother, sister, parents, etc.)	56	10.75
Disappearance of a family member (brother, sister, parents, etc.)	43	8.27
Someone informed on you placing you and your family at risk of injury or death	43	8.27
Searched	27	5.18

"traumatic war events", "torture experiences", "physical effects", and "mental health". Also, two more sections were added, "sexual abuse" and "posttraumatic stress disorder".

Traumatic War Events

The results of the participants are reported separately on the questions raised about the experience of events related to the war, and in a different section of those situations that go beyond combat situations and can be considered torture according to the UNCAT (1984). The Cronbach's alpha of the section in this sample was .844.

Table 1 shows the traumatic situations to which the preadolescents were exposed in order from highest to lowest frequency. As can be seen, the majority witnessed the destruction of residential areas and religious sites and were confined to try to protect themselves from bombings and violence. A large number of preadolescents were exposed to fighting and witnessed the presence of corpses. About half of the children studied had to leave their homes and witness chemical attacks. Around 40 % of their friends or family were injured as a result of the fighting and shelling, were forced to internally displace in the Gaza Strip to underserved areas, and witnessed some people being injured. Around a third of the minors witnessed deaths, executions of civilians, and lacked shelter to protect themselves from the war. About 20 percent lost friends in violent deaths and their property was destroyed. Around 10 percent or less witnessed their homes being searched, suffered the disappearance of friends and the violent death of a relative, were victims of complaints that put them at risk of death, and were searched on occasion.

The evaluated preadolescents suffered an average of 10.77 traumatic events throughout the 51 days of the war. No statistically significant differences were found in the number of traumatic experiences according to gender, $F(1, 519) = 1.559$, $p = .212$, $\eta^2 = .003$; age, $F(2, 518) = 1.690$, $p = .186$, $\eta^2 = .006$; or the place of residence, $F(4, 516) = 1.261$, $p = .284$, $\eta^2 = .010$.

Torture Experiences

This section collects the data found from the responses of the evaluated preadolescents to the questions related to experiences that could be considered torture, cruel, inhuman or degrading treatment or punishment (see Table 2).

Table 2. Children Who Experienced Different Type of Torture and Cruel, Inhuman, or Degrading Treatment, Ordered by Frequencies from Highest to Lowest

Torture	n	%
Witnessed torture	147	28.21
Witnessed the arrest, torture, or execution of important family members	98	18.81
Forced to destroy someone's property	50	9.60
Forced to inform on someone placing them at risk of injury or death	42	8.06
Tortured (i.e., while in captivity you received deliberate and systematic infliction of physical and/or mental suffering)	40	7.68
Forced to harm someone physically	35	6.74
Imprisoned	35	6.73
Used as a human shield	30	5.76
Witnessed sexual abuse or rape	29	5.57
Family member (brother, sister, parents, etc.) kidnapped or taken as a hostage	24	4.61
Friend kidnapped or taken as a hostage	22	4.23
Sexually abused or raped (i.e., forced sexual activity)	16	3.07
Kidnapped or taken as a hostage	13	2.50

Table 3. Scores of Mental Health Symptoms, Ordered by Frequencies from Highest to Lowest

	Not at all		A little		Quite a bit		Extremely		N
	n	%	n	%	n	%	n	%	
Recurrent thoughts or memories of the most hurtful or terrifying events	73	14.0	198	38.0	143	27.4	107	20.5	521
Irritability, nervousness, lack of patience, and anger outbursts	112	21.5	155	29.8	130	25.0	124	23.8	521
Feeling irritable or having outbursts of anger	119	22.8	161	30.9	128	24.6	111	21.3	519
Feeling that child has no one to rely upon but god	191	36.7	105	20.2	102	19.6	121	23.2	519
Feeling as though the event is happening again	132	25.3	189	36.3	130	25.0	70	13.4	521
Feeling a need for revenge	201	38.6	111	21.3	84	16.1	124	23.8	520
Tired soul	163	31.3	172	33.0	86	16.5	98	18.8	519
Avoiding activities that remind child of the hurtful event	147	28.2	186	35.7	112	21.5	73	14.0	518
Feeling that child has less skills than child did before	153	29.4	180	34.5	110	21.1	77	14.8	520
Recurrent nightmares	139	26.7	204	39.2	114	21.9	64	12.3	521
Difficulty concentrating	152	29.2	181	34.7	123	23.6	65	12.5	521
Ruminations, poor concentration, lack of initiative, boredom, sleep problems, tiredness, and somatic complaints	172	33.0	164	31.5	102	19.6	83	15.9	521
Sudden emotional or physical reaction when reminded of the most hurtful events	156	30.0	176	33.8	134	25.8	54	10.4	520
Difficulty paying attention	161	30.9	180	34.5	118	22.6	62	11.9	521
Feeling jumpy, easily startled	170	32.8	178	34.4	97	18.7	73	14.1	518
Avoiding thoughts or feelings associated with the hurtful vents	169	32.4	175	33.6	115	22.1	62	11.9	521
Feeling unable to make daily plans	157	30.2	205	39.3	114	21.9	44	8.4	520
Having difficulty dealing with new situations	157	30.2	197	37.9	130	25.0	36	6.9	520
Feeling exhausted	175	33.6	197	37.8	82	15.7	67	12.9	521
Sensation of the heart being squeezed	191	36.9	165	31.9	100	19.3	62	12.0	518
Less interest in daily activities	170	32.7	194	37.2	115	22.1	41	7.9	520
Trouble sleeping	172	33.0	204	39.2	97	18.6	48	9.2	521
Feeling on guard	181	34.9	192	37.0	91	17.5	55	10.6	519
Spending time thinking why God is making child goes through such events	218	41.8	145	27.8	89	17.1	69	13.2	521
Poor memory	221	42.5	153	29.4	88	16.9	58	11.2	520
Feeling of tightness in the chest and a choking sensation	234	44.9	153	29.4	71	13.6	63	12.1	521
Feeling as if child don't have a future	239	46.0	143	27.5	83	16.0	55	10.6	520
Troubled by bodily pain or physical problems	255	49.1	146	28.1	71	13.7	47	9.1	519
Feeling no trust in others	234	45.2	183	35.3	66	12.7	35	6.8	518
Inability to remember parts of the most hurtful events	226	43.6	201	38.8	62	12.0	29	5.6	518
Feeling that others don't understand what happened to him/her	262	50.4	150	28.8	76	14.6	32	6.2	520
Feeling others are hostile to child	261	50.1	158	30.3	69	13.2	33	6.3	521
Unable to feel emotions	261	50.3	163	31.4	68	13.1	27	5.2	519
Feeling powerless to help others	256	49.2	179	34.4	63	12.1	22	4.2	520
Hopelessness	295	56.7	146	28.1	48	9.2	31	6.0	520
Feeling detached or withdrawn from people	300	57.6	138	26.5	53	10.2	30	5.8	521
Feeling humiliated by their experience	319	61.3	108	20.8	64	12.3	29	5.6	520
Feeling that child is the only one who suffered these events	311	60.0	121	23.4	58	11.2	28	5.4	518
Finding out or being told by other people that child has done something that child can't remember	297	57.0	154	29.6	50	9.6	20	3.8	521
Feeling guilty for having survived	351	67.5	103	19.8	50	9.6	16	3.1	520
Feeling as though child is split into two people and one of him is watching what the other is doing	366	70.2	88	16.9	49	9.4	18	3.5	521
Blaming himself/herself for things that have happened	367	70.4	97	18.6	41	7.9	16	3.1	521
Feeling ashamed of the hurtful or traumatic events that have happened to child	372	71.4	89	17.1	45	8.6	15	2.9	521
Feeling that child is a jinx to himself/herself and his/her family	391	75.0	72	13.8	41	7.9	17	3.3	521

Forty preadolescents (7.68%) reported having been tortured while being held. Around a quarter of the preadolescents evaluated reported that they witnessed torture and a fifth that such torture, arrests, or executions were against relatives. Between 8 and 9 percent were forced to destroy their property or to expose someone, putting their lives at risk. Some 30 teenagers were used as human shields, forced to cause physical harm to other people, taken prisoner, or witnessed sexual assaults and rapes. Around 25 children had suffered the kidnapping of relatives or friends, and 13 were themselves kidnapped or taken hostage.

As can be seen in Table 2, 16 minors (3.07%), 10 girls and 6 boys, were sexually assaulted. Most of the sexual assaults occurred against younger children; 10 children were 11 years old, 4 were 12 years old, and 2 were 13 years old. Even more minors witnessed sexual abuse and rape, this event being reported by 29 minors (5.57%), 14 girls and 15 boys.

Physical Effects

Seventy-seven preadolescents (14.8%) were physically harmed, 35 (6.7%) informed about physical injuries due to nearby explosions, and 47 (9.03%) about serious physical injury from combat situation. No statistically significant differences were found based on gender or age.

Nor were statistically significant differences found for "serious physical injury from combat situation" based on gender, age or residence.

Due to the confinement and food shortages, and due to supply problems during the 51 days of attacks on the Gaza Strip, 233 children (44.72%) suffered from "food and drinking water shortages", and 36 (6.9%) reported having suffered "starvation" that resulted in a weight loss of between 0 to 15 kg. ($M = 4.50$, $SD = 3.31$). Statistically significant differences were found for "lack of water and food" as a function of age, $\chi^2(2, N = 521) = 6.737$, $p < .05$, and gender, $\chi^2(4, N = 521) = 4.275$, $p < .05$, with boys and younger ones being the most affected. No statistically significant differences were found in starvation based on gender or age.

Asked about medical care, 196 preadolescents (37.69%) informed that they suffered from diseases without being able to access to medical care or medicine because of war.

Mental Health Effects

Table 3 shows the data collected regarding some aspects related to the mental health of the preadolescents evaluated, ordered from highest to lowest frequency. The Cronbach's alpha of the section in this sample was .96. Considering the symptoms that the evaluated preadolescents present, we found that 137 (26.29%) would have PTSD. No statistically significant differences were found according to age, $\chi^2(2, N = 521) = 2.933$, $p = .231$; gender, $\chi^2(1, N = 521) = 0.028$, $p = .867$; or the place of residence, $\chi^2(4, N = 521) = 2.715$, $p = .607$.

DS techniques were used to analyze data distribution and variable relationships. MDS were used to reduce dimensionality from 44 dimensions data points (psychological variables) to its equivalent 3 dimensions (3D) data points. The 3D points obtained were plotted as a 3D scatterplot graph (Figure 1). PTSD diagnose presence or absence is shown through color.

In this case, two aspects are especially useful for a better understanding of symptoms: data distinguishability and data distribution. Data distinguishability tells us if we can distinguish, separate, psychological data considering PTSD diagnoses. This graph visualizes the war effects in psychological variables and PTSD. Data distribution in each group shows individual differences both on participants meeting and not meeting PTSD DSM criteria.

Data can be visually distinguished based on PTSD diagnoses. Data distribution is also different based on PTSD condition. So, the effect of war, torture, and the rest of traumatic experiences, show among participants how psychological state move away (towards the upper area) from psychological well-being. It can be seen, as per Figure 1 shows, how red data points (PTSD) have displaced from what can be considered a preserved psychological health as shown by green data points (no PTSD).

To get beyond what graphically appears to be the case and get classification quality measured, SCV and LR were used, scoring its correct classification degree from psychological data to PTSD diagnoses. Both models used all 44 psychological variables as predictor variables, and PTSD diagnoses (absence or presence) as target variable. In both cases 60% of data were used to train the model and 40% was used to test it. A 50 folds cross validation process was done to calculate average accuracy.
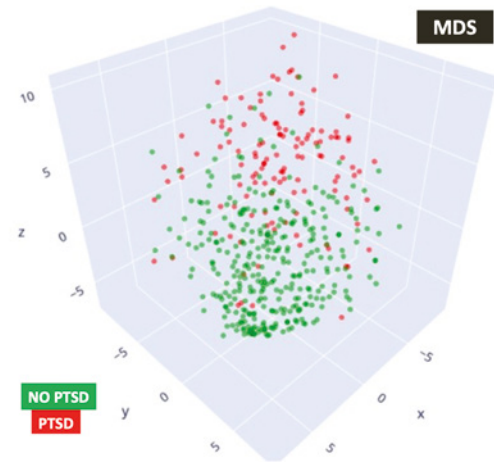

Figure 1. Data Distribution per PTSD Diagnosis[4].
Note. The fit measure for the data transformation was $R^2 = .90$, with $p < .05$, indicating a fit good enough to get insight from this figure.

SVC models shown an average accuracy of .84. LR models shown a similar average accuracy of .83. Both models were able to classify well, so adolescents with and without PTSD can be correctly classified to that level of accuracy. The effect of mental health state as per PTSD disease is clearly recognizable at the detailed level of psychological variables.

Data distribution shows greater variability among PTSD (red points) compared to no PTSD (green points). In this analysis, PTSD points have an average distance to its centroid a 6.4% higher than no PTSD points. Figure 1 shows how individual differences increase in PTSD condition. These individual differences show different ways of traumatic experience. These reaction differences could be linked to traumatic experiences and show difference among protection/risk factors, as social support.
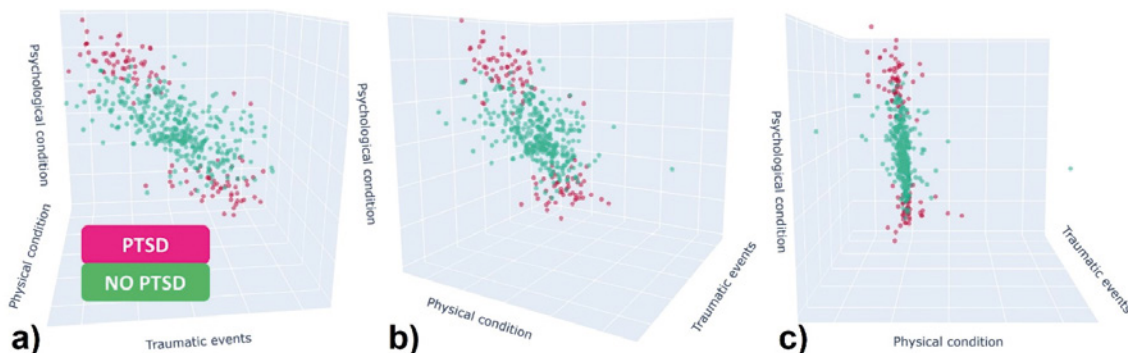

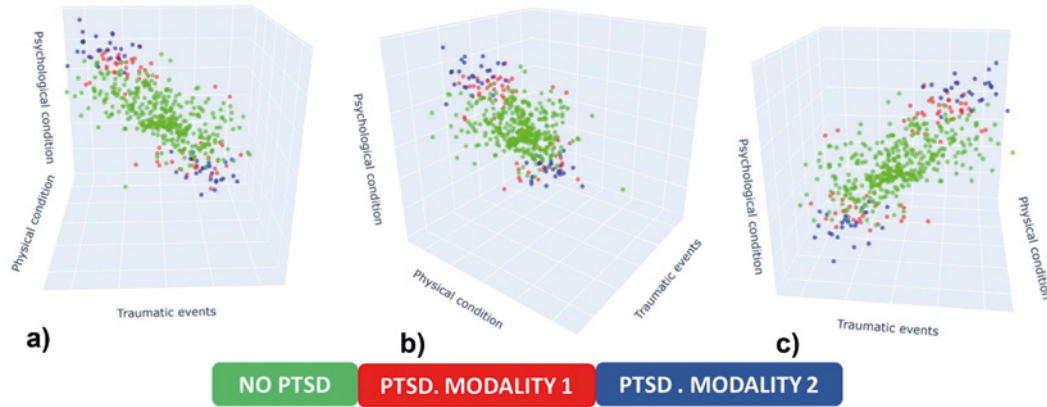**Figure 2.** Data distribution per Variable Group, and PTSD Diagnosis[5].

Figure 3. Data Distribution per Variable Group, and PTSD Diagnosis. PTSD Modalities Highlighted[6].

To dig deeper on PTSD data variability, we reduced all variables linked to trauma to one value. The same was done with physical condition and psychological variables. Each participant dataset was, then, reduced to a three-dimensional (3D) point, each value corresponding to each variable group (trauma, physical condition, and psychological variables). This 3D points are graphically represented in Figure 2.

This transformation showed a fit of R^2 = .68, with p < .01. This fit is not very high, so the graphic can suggest insights, but they are in clearly need, at the end, of hypothesis testing and effect size analysis to get back to a high level of confidence.

Figure 2 suggests two modalities of PTSD. In order to check how these two distinguishable modalities are distributed for PTSD diagnosed participants, a k-means clustering model with all 44 psychological variables to get two categories was trained and used to classify all PTSD participants in one of the two categories. That information was added, producing Figure 3.

Figure 3 suggests two modalities linked to PTSD severity. Non PTSD cases are located at a central area, having PTSD cases at two sides. It looks like the closer cases (red points) have less severe PTSD, while the more distant cases (blue points) have a more severe PTSD. This hypothesis was tested, and its results corroborated it: F (0.999, 1, 115) = 14.193, p < .05/44 (Bonferroni adjusted), η^2 = .110, corresponding to a medium size effect. PTSD severity was calculated as the average over the 16 items linked to PTSD DSM diagnosis.

It was not observed any relation of PTSD modalities to sex, F(0.999, 1, 115) = .260, p = .611, or age, F(0.999, 1, 115) = .252, p = .617.

Once the two PTSD modalities can be distinguished, it is relevant to know what variables, beyond those used to diagnose PTSD, best distinguish both modalities. Table 4 shows the six variables having statistically significant differences and showing largest effect sizes.

With the exception of the first one, related to executive functions (HTQ/IV item 22), the rest (HTQ/IV items 31, 34-37) are linked to social

aspects: trust, unable to help other, feeling ashamed or humiliated (both social emotions), or feeling as a jinx. Based on that, it looks like having a socially preserved modality and a socially weakened modality. Average responses to those items per modality are shown at Figure 4.
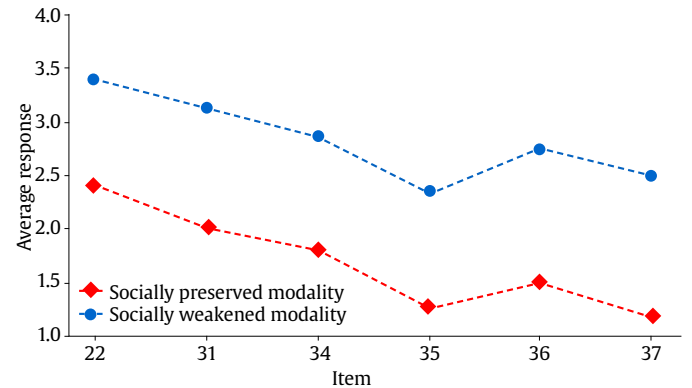

Figure 4. Main Variables Distinguishing PTSD Modalities Average Values.

Those items are related with interpersonal difficulties and, in a lesser degree, with affect dysregulation, two of the three clusters featuring complex PTSD (CPTSD) (Hyland et al., 2017). HTQ part IV item 27 has been identified as the one at HTQ differencing both syndromes (Elklit, 2014). There was a significantly statistical difference between the two as expected, but its effect size was smaller than the items selected.

There is a constantly wide distance between average responses by both modalities, preserved across all six items. Considering

Table 4. ANOVA Results and η^2 Effect Size of Main Variables Distinguishing PTSD Modalities

Item	F value	p	η^2
22 - Feeling unable to make daily plans	56.41	< .01/44[*]	.329[1]
31 - Feeling no trust in others	48.33	< .01/44[*]	.296[1]
34 - Feeling powerless to help others	47.82	< .01/44[*]	.294[1]
35 - Feeling ashamed of the hurtful or traumatic events that have happened to child	47.82	< .01/44[*]	.294[1]
36 - Feeling humiliated by their experience	53.74	< .01/44[*]	.318[1]
37 - Feeling that child is a jinx to himself/herself and his/her family	71.11	< .01/44[*]	.382[1]

Note. Fcrit(0.999, 1, 115) = 14.49; [1]η^2 >.14, large effect size.
[*]p < .01/44 (Bonferroni adjusted).

prevalence, socially preserved modality was 57.3% of PTSD cases. Socially weakened modality represented a 42.7%.

Due to its relation to PTSD severity, having a classification criteria could be useful for both future research and practical purposes. A NCC model was trained for the identification of PTSD modalities. A 100 folds cross validation process was done to calculate an average accuracy. A 75% of data were used to train the model, and the rest of 25% was used to test it ($accuracy_{average}$ = .89; $accuracy_{best}$ = 1.0). Confusion matrix, shown at Table 5, also shows very good classification performance.

Table 5. NCC Confusion Matrix[7]

		Predicted	
		+	-
Actual	+	TP = 17	FN = 1
	-	FP = 1	TN = 11

Modalities, socially preserved (sp) and socially weakened (sw) have their centroids for items 22, 31, 34, 35, 36, and 37 calculated for each PTSD modality is as follows:

$$\vec{\mu}_{sp} = (2.46, 2.12, 1.9, 1.28, 1.44, 2.12)$$

$$\vec{\mu}_{sw} = (3.27, 3.11, 2.84, 2.35, 2.7, 3.11)$$

When a person assessed with the HTQ, the score at those items is used to calculate its Euclidean distance to each centroid.

$$\hat{y} = \text{argmin}_{m \in M} \|\vec{\mu}_m - \vec{x}\|$$

The two modalities are the two possible values of $\hat{y} \in \{sp, sw\}$ So, the final decision maid corresponds to the shortest distance.

Beyond classification, other psychological variables showed statistically significant differences and medium or large effect sizes. Table 6 list them.

All Table 6 variables show higher scores for socially weakened modality.

The diagnosis of PTSD was strongly related to the number of traumatic experiences suffered, $F(1, 519) = 82.364$, $p < .001$, $\eta^2 = .137$. The mean number of traumatic experiences for preadolescents with

Table 6. ANOVA Results and η^2 Effect Size of Additional Variables with Medium to Large Effect Sizes per PTSD Modality

Item	F value	p	η^2
17 - Poor memory	30.67	< .01/44[*]	.210[2]
18 - Feeling exhausted	15.31	< .01/44[*]	.117[2]
19 - Troubled by bodily pain or physical problems	20.69	< .01/44[*]	.152[2]
24 - Feeling that child is the only one who suffered these events	19.26	< .01/44[*]	.143[2]
25 - Feeling that others don't understand what happened to him/her	26.04	< .01/44[*]	.185[2]
26 - Feeling guilty for having survived	34.23	< .01/44[*]	.229[2]
27 - Blaming himself/herself for things that have happened	28.93	< .01/44[*]	.201[2]
30 - Feeling others are hostile to child	24.05	< .01/44[*]	.173[2]
33 – Hopelessness	23.38	< .01/44[*]	.169[2]
38 - Finding out or being told by other people that child has done something that child can't remember	21.21	< .01/44[*]	.156[2]
39 - Feeling as though child is split into two people and one of him is watching what the other is doing	28.80	< .01/44[*]	.200[2]
43 - Feeling of tightness in the chest and a choking sensation	20.23	< .01/44[*]	.150[1]

Note. Fcrit(0.999, 1, 115) = 14.49.; [1]η^2 >.06, medium effect size; [1]η^2 >.14, large effect size.
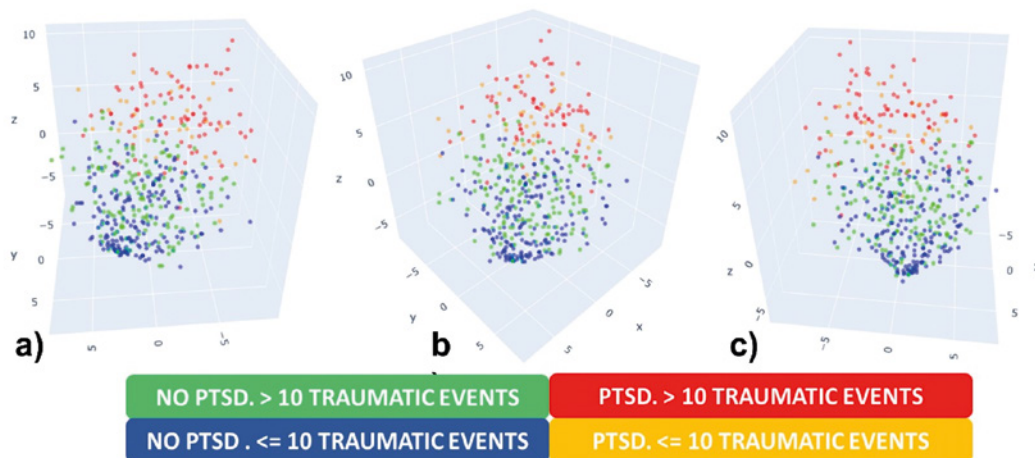[*]$p < .01/44$ (Bonferroni adjusted).

Figure 5. Data Distribution per PTSD Diagnosis and Number of Traumatic Events Suffered[8].

PTSD was 14.28 (*SD* = 4.91), while for those who were not diagnosed with PTSD the mean was 9.52 (*SD* = 5.39) traumatic experiences.

Thabet and Vostanis (1999) stated a relation between number of traumatic events and PTSD severity. In order to get some insights about this, Figure 5 was done adding information about the number of experienced traumatic events to Figure 1.

Average experienced traumatic events were 10.77, as mentioned before. That is why 10 or less traumatic events are shown with one color, and 11 or more traumatic events are shown in a different color, separating data points below or above average value.

A distribution pattern can be seen in which data points tend to distribute in the following order, from bottom to top: 1) non-PTSD children having experienced 10 traumatic events or lesser (blue points), 2) non-PTSD children having experienced more than 10 traumatic events (green points), 3) PTSD children having experienced 10 traumatic events or lesser (orange points), and 4) PTSD children having experienced more than 10 traumatic events (red points). This trend in distribution is compatible with the idea of repeated traumatic events progressively impacting on children mental health state.

Analyzing the diagnosis of PTSD based on the type of traumatic experience suffered, we found that 12 types of traumatic events seem to play an important role in the development of this pathology. Table 7 shows the data of the factors that were significant, after applying the Bonferroni correction, ordered from highest to lowest frequency for the cases in which it was found that they had suffered the traumatic experience.

Table 7. Percentages of preadolescents diagnosed with PTSD who had not suffered the traumatic event and who had, and values of χ^2 for the events that were significant.

Traumatic event	NO %	YES %	$\chi^2(1)$	*p*
Disappearance of friend	23.39	45.07	14.856	.000
Diseases without medical care	16.98	41.84	38.899	.000
Forced to leave his/her home	19.09	36.97	20.640	.000
Lacked shelter	22.07	36.60	11.749	.001
Physical injury of family	18.92	36.00	19.244	.000
Lack of food and water	19.79	34.33	14.056	.000
Witnessed someone being harmed	20.90	34.29	11.589	.001
Forced to flee home	18.75	32.97	13.437	.000
Witnessed chemical attacks	19.84	32.82	11.251	.001
Exposed to combat situation	16.32	32.02	15.368	.000
Witnessed corpses	17.71	31.31	11.568	.001
Witnessed mosques desecration	14.79	30.69	13.446	.000

Note. Bonferroni adjustment significant *p* < .0013.

Discussion

The study found that all evaluated preadolescents experienced traumatic events during the 51-day war, with no significant differences based on gender or place of residence. Most witnessed the destruction of residential areas and religious sites, were exposed to fighting, lost their homes, and witnessed chemical attacks. Many sought shelter indoors or were internally displaced to underserved areas in the Gaza Strip. Numerous teenagers witnessed injuries, deaths, and violent events involving friends and family. Approximately 15% of preadolescents aged 11 to 13 suffered physical injuries during the war, affecting individuals of all ages and genders across the Gaza Strip. The impact of the war was widespread, with half of the adolescents experiencing a lack of food and clean water, and around 7% facing starvation, highlighting the extensive destruction reported by UNRWA (2014). The effects of malnutrition in adolescents could have serious long-term effects (Khoroshinina, 2005).

Data reveals that a significant number of preadolescents suffered attacks that according to the Geneva Convention could be considered

torture against children and must be persecuted (O'Donnell & Liwski, 2010). When directly asked, 28.21% of the evaluated preadolescents reported witnessing torture, with 18.81% indicating that the torture, arrests, or executions affected family members. Moreover, 7.68% of the preadolescents reported personal experiences of torture during detention. Additionally, 6.74% were compelled to physically harm someone, 6.73% experienced imprisonment, and 5.76% were used as human shields. Disturbingly, 3.07% of preadolescents, comprising 10 girls and 6 boys, reported being sexually assaulted, while 5.57% witnessed sexual abuse and rape. The reported data, aligning with findings from other studies (Kadir et al., 2019), is likely underestimated due to the cultural taboo surrounding sexuality in this population. The stigma attached to such incidents, impacting the family's honor and the victim, often leads to concealment of such experiences (Abu-Odeh, 2010; Weishut, 2015).

The study revealed that 26.29% of preadolescents experienced PTSD, aligning with findings in previous research indicating high resilience levels among this age group, facilitating recovery over time (Planellas et al., 2020). Despite concerns about potential malingering for protection, the data in this study fall within the lower band of the PTSD variation observed in various global studies, suggesting a nuanced interaction between resilience and motivation (Steel et al., 2009).

Characteristics such as gender, age, and place of residence did not influence the presence of PTSD in the evaluated population. Instead, the determining factor was the number of traumatic experiences, with a higher number correlating with an increased likelihood of suffering from PTSD. Specific traumatic experiences, such as the disappearance of a friend, lack of medical care, forced displacement, and exposure to combat situations, appeared to play a more significant role in PTSD development than others.

Distinct patterns of distribution and classification were identified for both psychological variables and PTSD diagnoses. Preadolescents with and without PTSD were clearly distinguishable through various techniques, revealing a discernible trend from fewer to more traumatic events and from no PTSD diagnosis to PTSD diagnosis when graphing data from psychological variables.

Two PTSD modalities emerged: socially preserved and socially weakened. The primary variables distinguishing them were linked to social relationships, influencing the effectiveness of social support and indicating a more severe form of PTSD. The socially weakened modality was characterized by feelings of being unable to make daily plans, eroded executive function, lack of trust in others, powerlessness to help others, shame and humiliation from traumatic events, and a sense of being a jinx to oneself and one's family—indicating eroded social relations, emotions, and trust. All six variables exhibited more severe scores in cases associated with the socially weakened modality.

The socially weakened modality demonstrated more severe psychological conditions across various variables: a) affected memory processes, including poor memory and being informed of actions the child could not remember (for a better understanding, see the *Continuous accessibility model of memory* by Manzanero & Morales-Valiente, 2024), b) poor physical condition, involving exhaustion, bodily pain, and a feeling of tightness in the chest, c) negative thoughts related to social cognition, such as feeling isolated in suffering, perceiving a lack of understanding from others, and sensing hostility from others, d) negative emotions linked to social survival, self-blame, and depression-related hopelessness, and e) an affected self-concept, manifesting as a sense of being split into two people with one observing the actions of the other.

Conclusions

The study reveals significant psychological impacts on preadoles-cents in the Gaza Strip following the attacks, emphasizing the pre-

valence of post-traumatic symptoms affecting emotional well-being and daily functioning. The findings underscore the urgent need for psychological support in communities affected by such traumatic events. Similar to other research, 26.29% of preadolescents were found to suffer from PTSD, aligning with the notion of their generally high resilience. The study acknowledges the potential for over reporting due to malingering but notes that the prevalence falls within the lower range observed in various studies.

Data analysis techniques provided insights into the relationship between psychological variables, PTSD, and the number of traumatic events experienced. Clear patterns emerged in the distribution and classification of these variables, allowing for the differentiation of preadolescents with and without PTSD. The analysis also identified two PTSD modalities: socially preserved and socially weakened. The socially weakened modality exhibited more severe psychological conditions across various dimensions, including memory processes, physical well-being, thoughts, emotions, and self-concept. The study proposes a classifier system (NCC) for further research and potential applications in understanding and treating PTSD. Whether those two modalities correspond to PTSD and CPTSD is not clear from data and needs additional research.

Understanding the effects of past wars on preadolescents in Gaza and distinguishing between different types of PTSD could facilitate comprehension of the current Israeli attacks on Palestine (Gaza and the West Bank). It can also aid in determining the type of intervention needed to minimize the impact on the mental health of Palestinian youth, enhancing their resilience through social support.

Conflict of Interest

The authors of this article declare no conflict of interest.

Acknowledgments

Notes

[1]After data collection a new version of the HTQ adaptaed to DSM-5 has been developed (Berthold et al., 2019).

[2]For each preadolescent, a large set of values is available (greater that 100), but it cannot be graphed being so many variables. Similar set of values, corresponding to two preadolescents, should be near, due to its similarity. Diverging set of values, also corresponding to two preadolescents, should be distant, due to its dissimilarity. MDS performs a dimensionality reduction preserving as much as possible the relative distances between all samples, providing a 3D point to represent each set of values of each preadolescent. This 3D points can now be graphed and explored to see its distributions and groupings.

[3]SVC takes two groupings and build the best distinction criteria (a hyperplane) separating both groups. SVC is trained with classified samples (from the training set) and uses its classification labels to reduce classification error (supervised learning). The level of accuracy classifying samples from both groups in the testing dataset is assessed. If accuracy is high, the initially detected grouping get evidence support. Both groups are different enough.

MLR does the same as SVC in a different way. Coincidental results will add addition evidential support of the differences between detected groups.

KM-NCC does the same as SVC and MLR but with a different algorithm that uses unsupervised learning. KM-NCC uses the training dataset to group by geometrical proximity. Then, distance to the centroid of each group is used for classification. Testing dataset is used to assess classification accuracy. Again, coincidental quality of classification ends up supporting the visually detected groupings.

[3]DS analyses were done using Python v3.8.8, ipython v7.22.0, conda v4.10.1, numpy v1.19.5, scipy v1.6.2, statsmodels v0.13.5, pandas v1.2.4, scikit-learn v0.24.1, matplotlib v3.3.4 and plotly v5.4.0.

ML code accessible at: https://github.com/jav-ier/PTSD_Modalities.

[4]All variables (traumatic events experienced, physical condition, and psychological variables) reduced to 3D points through MDS and colored by PTSD presence or absence.

[5]Traumatic events experienced, physical condition, and psychological variables, reduced to 1 value per variable group through MDS. Values obtained combined as 3D points and colored by PTSD presence or absence. a) Initial view. b) Initial view rotated 45 degrees right. c) Initial view rotated 90 degrees right. Points colored by PTSD diagnosis.

[6]Traumatic events experienced, physical condition, and psychological variables, reduced to 1 value per variable group through MDS as in Figure 2. a) Initial view. b) Initial view rotated 45 degrees right. c) Initial view rotated 130 degrees right. PTSD points are distinguished by PTSD modality. Red and blue points correspond to both PTSD modalities.

[7]Many true positive (TP) and negative (TN) cases were correctly classified. Very few positive (FP) and negative (FN) cases were incorrectly classified. It was a very well-balanced classifier, with TP and TN rates giving a b_acc = (TPR + TNR) / 2 = 1.0.

[8]Same as Figure 1 highlighting the number of traumatic events suffered for both PTSD and non-PTSD cases.

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