
A tale of two cities – the effect of low intensity conflict on prevalence and characteristics of musculoskeletal pain and somatic symptoms associated with chronic stress

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ABSTRACT

Although both acute and chronic stress leads to pain, the precise characteristics of this association have not been well defined. Sderot is an Israeli town exposed to repeated missile attacks. Ofakim, a town of similar demographic and socioeconomic characteristics, had not been targeted, as of the period of our study. We examined the occurrence and characteristics of pain and related somatic symptoms in Sderot and Ofakim.

Methods. One thousand and twenty-four individuals in Sderot and 1006 in Ofakim were interviewed regarding pain, somatic symptoms, mood, trauma-exposure, and general health status.

Results. Significantly higher levels of trauma-related symptoms and somatic symptoms were noted in Sderot compared with Ofakim ($p < 0.001$). Chronic widespread pain (CWP) was more common in Sderot (11.1%) than Ofakim (8.3%; OR 1.37, $p = 0.038$). Women were more likely (13.9% vs. 9.3%; OR 1.45, $p = 0.06$) than men (8.9% vs. 7.3%, OR 1.24, $p = 0.37$) to experience CWP in Sderot vs. Ofakim. Amongst males, chronic regional pain (CRP) was more common in Sderot (19.2%) than in Ofakim (14.2%; $p = 0.036$). Pain severity in Sderot was significantly higher than in Ofakim ($p < 0.001$).

Conclusions. Similar to previous studies that have suggested that chronic stress is associated with chronic pain, this study demonstrates significantly increased rates of somatic complaints, including pain, fatigue and IBS-like symptoms, among individuals in Sderot compared with Ofakim, as well as significantly higher rates of trauma-related symptoms. Thus, a fibromyalgia-like symptoms cluster was more likely to be found in Sderot compared with Ofakim.

Widespread pain was reported as being significantly more frequent by inhabitants of Sderot compared with Ofakim. These results have relevance to both the general population and for populations enduring chronic stress.

Background

Chronic pain is common. Although epidemiological estimations vary, most population-based studies suggest that approximately 10% of the population suffers from chronic widespread pain (CWP), and 20% suffer from chronic regional pain (CRP) (1-3). In general, both CRP and CWP are approximately 1.5–2X as common in women than men. At the “tip of the iceberg” of CWP are individuals who have CWP and diffuse tenderness, and meet criteria for fibromyalgia (FM) (4). Considerable biological evidence has indicated that FM and a number of related pain syndromes are at least in part due to augmented pain and sensory processing, leading to hyperalgesia and allodynia (5-7). Most of the “stress-related” pain syndromes are felt to be due to the interplay between a genetically susceptible background (8) and appropriate environmental triggers including a variety of biological stressors, as well as psychological factors, such as anxiety and depression (9, 10). A number of population-based studies have suggested that if individuals suffer from psychological distress, their risk of subsequently developing regional or widespread pain is approximately 1.5–3X as likely as those in the population that do not have distress (11-14). The unusual military and political conditions along the border between Israel and the Palestinian Gaza strip have created an opportunity to evaluate the role of ongoing chronic stress on the occurrence of pain and related somatic

symptoms. Sderot and Ofakim are two towns located in southern Israel. Sderot is situated about 1 kilometre from the frontier of the Gaza strip, while Ofakim is situated 24 kilometres to the south-east. Sderot and Ofakim are similar in history, climate, ethnic background, geographical location and socioeconomic characteristics. They differ, however, in one major aspect. Since the beginning of the second Palestinian uprising thousands of missiles have been fired from the Gaza strip into Israel, many landing in and around Sderot, causing both injuries and fatalities. Due to its greater distance from the border, the town of Ofakim has not been targeted.

The primary objective of the current study was to compare the populations of Sderot and Ofakim regarding the prevalence, distribution and impact of chronic pain. Information was collected regarding somatic symptoms, pain (both localised and widespread), anxiety, stress, and related medical symptoms. Our hypothesis was that the ongoing stress inflicted on Sderot would cause an increase in such symptoms in comparison with Ofakim, and that whatever excess symptoms were seen in Sderot might be due to chronic stress. These data could help understand the characteristics of pain associated with chronic psychological stress, and improve our understanding of the pathogenesis of chronic pain and FM.

Methods

The study was conducted as a telephone-based population survey. Demographic data was collected as well as was information regarding the presence of chronic pain and related symptoms. One thousand seven hundred and fifty households were contacted in Sderot and 1939 in Ofakim, with 59% and 52% participation respectively. A total of 2,030 interviews were conducted. The interviews were conducted between March and June 2008. The survey was conducted by the B.I. and the Lucille Cohen Institute for Public Opinion Research, which is an academic research institute specialising in public surveys. The Tel Aviv Medical Center Institutional Review Board approved the study.

Study sample

The study sample included inhabitants of Sderot and Ofakim aged 18 and above. All interviews were conducted either in Hebrew or Russian.

Sampling technique

Participants comprised a random sample of households in Sderot and Ofakim extracted from the database of the Israeli national telephone company. Within each household a single adult was selected over the age of 18.

Study questionnaire

The questionnaire was comprised of the following parts:

- Demographics data.
- Pain. Individuals who reported the presence of pain were questioned regarding the time-course of pain and involvement of body areas. Individuals were asked to specify whether pain was local, *i.e.* restricted to arms, legs, neck or back, restricted to the head (headaches), widespread, *i.e.* involving both arms, legs, neck and back, directly connected to a recent physical trauma or related to a malignant disorder. Responders were further questioned about referral to medical treatment due to pain, use of analgesic medications, and loss of work due to pain.
- Other somatic symptoms, including sleep disorders, headaches, fatigue, morning stiffness, paresthesia, feeling of swelling in face/hands, and irritable bowel symptoms.
- Anxiety and depression.

Assessment of trauma and post-traumatic symptoms

For the assessment of post traumatic symptoms we utilised an 18-item questionnaire (Appendix I), structured after the DSM-IV-TR criteria for PTSD and the Screen for Posttraumatic Stress Symptoms (SPTSS) (15, 16). Individuals were asked to rate the frequency each item, *i.e.* never, once a week or less, 2–4 times a week, 5 times a week or more. Individuals were questioned about recent exposure to trauma or the recent exposure of a close family member to a traumatic event.

- Information was collected regarding general health status, and religious beliefs.

Data analysis

Data were analysed using SPSS software version 16.02. The level of significance was set at 0.05. Differences in pain and trauma between Sderot and Ofakim inhabitants were tested with the non-parametric Z-test. Percentages were calculated excluding the missing data. Differences in severity of pain and PTSD were tested with *t*-tests for independent samples. A factor analysis of the PTSD items was used to examine the option of using a composite PTSD score, and internal consistency of the PTSD items was measured with Cronbach's alpha. The total PTSD score was composed of the mean of the items. Pearson correlations were used to test the relationships between severity of pain and PTSD. Control of anxiety, depression and PTSD regarding the differences of pain between Sderot and Ofakim inhabitants was measured with analyses of covariance, defining pain as a dummy variable and using anxiety, depression and PTSD as covariates.

Results

Demographics

Individuals interviewed in Sderot and Ofakim were compared regarding gender, education, employment status, reason for lack of employment, average monthly income, marital status and level of religiosity. The results, which were compared using the Pearson Chi square test, showed no difference between the populations on any of the parameters except level of religiosity (Table I).

Characteristics of pain

Table II presents a comparison of chronic regional pain, chronic widespread pain, pain related directly to recent trauma and pain related to malignancy in Sderot and Ofakim. Data regarding pain-related events, *e.g.* consultation with a physician, treatment with analgesics/NSAIDs, pain-related loss of work is also presented. (All data related to pain persisting three months or longer).

Table I. Demographic data of individuals from Sderot and Ofakim.

Town	Sderot (n=1024)	Ofakim (n=1006)
Female/Male (%)	52.7/47.3	49.2/50.8
Age >40 (%)	37.8	35.0
Married (%)	68.3	67.9
Education (beyond high school) (%)	49.6	51.4
Currently unemployed (%)	42.2	45.2
State "medical problems" as reason for unemployment (%)	20.8	13.0
At or below average income* (%)	70.8	73.2

*Household average income (by Israeli National Bureau of Statistics).

Table II. Characteristics of regional pain, widespread pain and pain-related events in Sderot and Ofakim.

Characteristics of pain	Sderot (n=1024)	Ofakim (n=1006)	p-value
Chronic regional – all (%)	19.9	19.5	0.80
Chronic regional – Females (%)	20.6	24.9	0.10
Chronic regional – males (%)	19.2	14.2	0.036
Chronic (>3 months) widespread pain – all (%)	11.1	8.3	0.038
Chronic (>3 months) widespread pain – females (%)	13.0	9.3	0.06
Chronic (>3 months) widespread pain – males (%)	8.9	7.3	0.37
Severity of pain – all -% (SD)	3.63 (3.85)	2.88 (3.53)	0.001
Severity of pain – females -% (SD)	4.21 (4.04)	3.56 (3.75)	0.001
Severity of pain – males -% (SD)	2.97 (3.50)	2.22 (3.16)	0.001
"Very severe pain" (%)	11.42	7.55	0.01
Pain related to recent physical injury (%)	2.83	1.98	0.25
Pain related to malignancy (%)	0.97	0	0.002
Duration of pain (months)	1.51	1.19	0.001
Consulted physician due to pain (%)	39.3	34.9	0.04
Treated with analgesic due to pain (%)	34.9	30.2	0.026
Treated with NSAIDS due to pain (%)	18.85	13.81	0.002
Lost days of work due to pain (%)	14.65	10.14	0.002
Stopped working due to pain (%)	8.10	5.76	0.044
Pain related hospitalisation (%)	9.0	8.05	0.47
Referred for imaging due to pain (%)	27.33	25.35	0.27

Chronic widespread and regional pain (CWP, CRP)

Chronic widespread pain (CWP) was present among 11.1% of the inhabitants of Sderot and 8.3% of the inhabitants of Ofakim ($p=0.038$, odds ratio=1.37). It was present among 8.9% of males in Sderot, and 7.3% of males in Ofakim ($p=0.37$, odds ratio=1.24), and among 13.0% of females in Sderot, and 9.3% of females in Ofakim ($p=0.06$, odds ratio=1.45). Controlling for self-reported anxiety has left the general difference in CWP significant ($p=0.046$), while controlling for self-reported depression has turned it non-significant ($p=0.40$). Controlling for the composite score of PTSD turned the difference non-significant as well ($p=0.45$).

Chronic widespread pain (CWP)

Of those who experienced pain, CWP was present among 21.0% of the inhabitants of Sderot and among 17.3% of the inhabitants of Ofakim ($p=0.14$, odds ratio=1.27). It was present among 18.5% of males in Sderot, and 18.7% of males in Ofakim ($p=0.97$, odds ratio=0.99), and among 22.8% of females in Sderot, and 16.4% of females in Ofakim ($p=0.051$, odds ratio=1.51). Chronic regional pain (CRP) was present among 19.9% of the inhabitants of Sderot and 19.5% of the inhabitants of Ofakim ($p=0.80$, odds ratio=1.03). It was present among 19.2% of males in Sderot, and 14.2% of males in Ofakim ($p=0.036$, odds ratio=1.44), and among 20.6% of females in Sderot, and 24.9%

of females in Ofakim ($p=0.10$, odds ratio=0.78). Controlling for anxiety has turned the general difference in CWP among males non-significant ($p=0.22$), as did the control of depression ($p=0.10$). However, controlling for the PTSD composite score left the difference significant ($p=0.031$). Of those who experienced pain, CRP was present among 37.8% of the inhabitants of Sderot and among 40.6% of the inhabitants of Ofakim ($p=0.37$, odds ratio=0.89). It was present among 40.1% of males in Sderot, and 36.3% of males in Ofakim ($p=0.42$, odds ratio=1.18), and among 36.1% of females in Sderot, and 43.6% of females in Ofakim ($p=0.06$, odds ratio=0.73).

Severity of pain

The mean severity of pain reported by inhabitants of Sderot was 3.63 (on a scale of 0–10, $SD=3.85$) and was significantly higher than the mean severity of pain in Ofakim inhabitants which was 2.88 ($SD=3.53$) ($p<0.001$). The mean severity of pain reported by male inhabitants of Sderot was 2.97 ($SD=3.50$) and was significantly higher than the mean severity of pain reported by male inhabitants of Ofakim, which was 2.22 ($SD=3.16$) ($p<0.001$). The mean severity of pain reported by female inhabitants of Sderot was 4.21 ($SD=4.04$) and was significantly higher than the mean severity of pain reported by female inhabitants of Ofakim, which was 3.56 ($SD=3.75$) ($p=0.008$). Controlling for anxiety left the difference for the total population and females significant ($p=0.002$, $p<0.001$, respectively), yet it turned the difference for males non-significant ($p=0.96$). Controlling for depression turned all differences non-significant (total population: $p=0.93$, males: $p=0.24$, females: $p=0.22$). Of those who experienced pain, the mean severity for inhabitants of Sderot was 6.76 ($SD=2.56$), which was significantly higher than the mean severity of pain in Ofakim 5.90 ($SD=2.85$) ($p<0.001$). Mean severity of pain reported by males in Sderot was 5.97 ($SD=2.63$), significantly higher than the mean severity of pain reported by males in Ofakim 5.41 ($SD=2.73$) ($p=0.031$). Mean severity of pain reported by

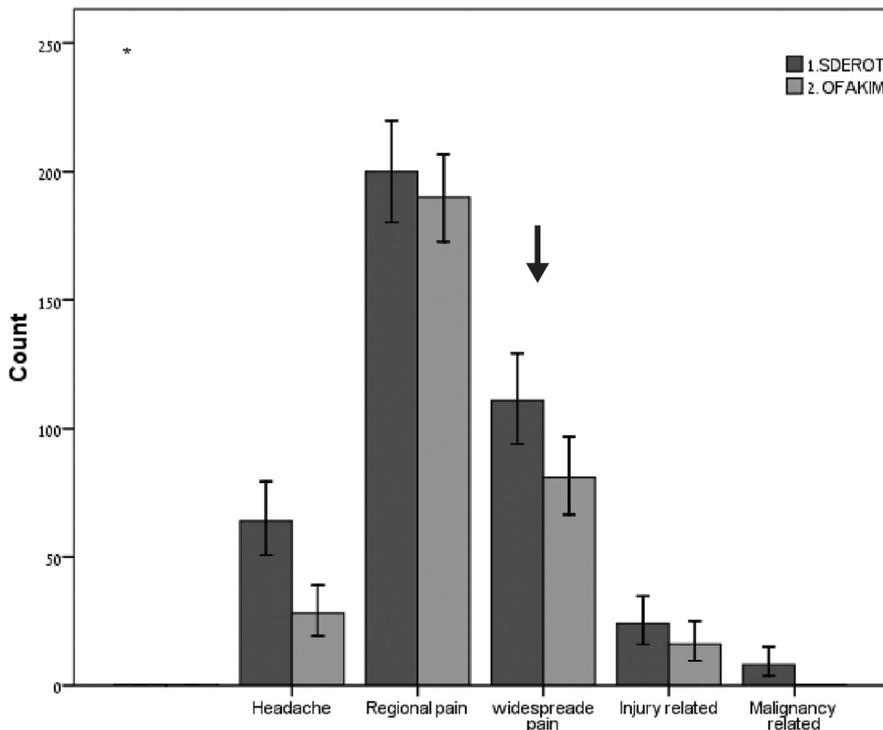


Fig. 1. Comparison of widespread pain in Sderot and Ofakim. A significantly higher frequency of chronic widespread pain was observed in individuals in Sderot when compared with Ofakim ($p < 0.05$; SE presented). Arrow indicates significant difference in frequency of widespread pain.

females in Sderot was 7.36 (SD=2.35), significantly higher than the mean severity of pain reported by females in Ofakim 6.24 (SD=2.88) ($p < 0.001$). Controlling for anxiety turned these differences non-significant (total population: $p = 0.96$, males: $p = 0.96$, females: $p = 0.53$). Controlling for depression left the difference for females significant ($p = 0.043$), yet it turned the differences for the total population and males non-significant ($p = 0.16$, $p = 0.79$, respectively).

Experience of trauma

Trauma was experienced by 54.7% of the inhabitants of Sderot (or their relatives) compared with 17.1% of the inhabitants of Ofakim ($p < 0.001$). CWP was experienced by 11.2% of those who reported experiencing trauma and by 7.6% of those who reported not experiencing trauma ($p = 0.012$). Among those who experienced pain, CWP was experienced by 21.2% of those who reported experiencing trauma and by 17.4% of those who reported not experiencing trauma ($p = 0.18$). CRP was experienced by 21.5% of those who

reported experiencing trauma and by 18.4% of those who reported not experiencing trauma ($p = 0.12$). Among those who experienced pain, CRP was experienced by 40.8% of those who reported experiencing trauma and by 42.2% of those who reported not experiencing trauma ($p = 0.69$). Differences were non-significant when comparing CRP for males and females who experienced trauma between Sderot and Ofakim.

Frequency of somatic complaints

As demonstrated in Figure 1a, statistically significant differences were observed between individuals from Sderot and Ofakim on every one of the 10-item questionnaires used for assessing the severity of somatic symptoms. Thus, individuals in Sderot reported significantly higher levels of sleep disturbances, headaches, fatigue, morning stiffness, paresthesias, sensation of swelling, irritable bowel symptoms, anxiety, and depression compared with individuals in Ofakim ($p < 0.001$).

Since the internal validity of these items was high (Cronbach's alpha=0.85), we constructed a *compound somatic com-*

plaint index, based on the average of these items. The compound somatic index was significantly higher among individuals from Sderot compared with individuals from Ofakim ($p < 0.001$) (Table II). Figure 2a presents the frequency of 10 major somatic symptoms among individuals from Sderot and Ofakim. Figure 2b illustrates the high frequency of anxiety in Sderot, compared with Ofakim.

Evaluation of general health status

Individuals interviewed were asked to assess their general health status on a scale from 0 to 10 on which 10 notes excellent health while 0 notes an extremely bad health condition. On this scale inhabitants of Ofakim rated their general health status as 7.26 versus 6.72 on a scale of 1 to 10 ($p < 0.01$).

Discussion

In accordance with previous studies, which have suggested that chronic stress can be associated with widespread or regional musculoskeletal pain, our results support other population-based studies by suggesting a moderate association between chronic stress and widespread pain. Individuals in Sderot had high rates of trauma and stress, and much higher levels of other somatic symptoms. They were also moderately more likely to experience either chronic regional or widespread pain. These data also suggested that the excess stress-related pain in Sderot was more likely to be widespread in women and more regional in men, and more severe in intensity.

These results are in accordance with similar findings reported by a number of UK researchers that have performed population-based studies examining the psychological *predictors* of chronic regional or widespread pain. These studies have consistently shown that individuals with high baseline levels of psychological distress are somewhat more likely to subsequently develop chronic regional or widespread pain (OR 1.5–2) (2, 17–19). Our study showed very similar odds ratios for the increased prevalence and severity for “stress-related” pain seen in Sderot vs. Ofakim.

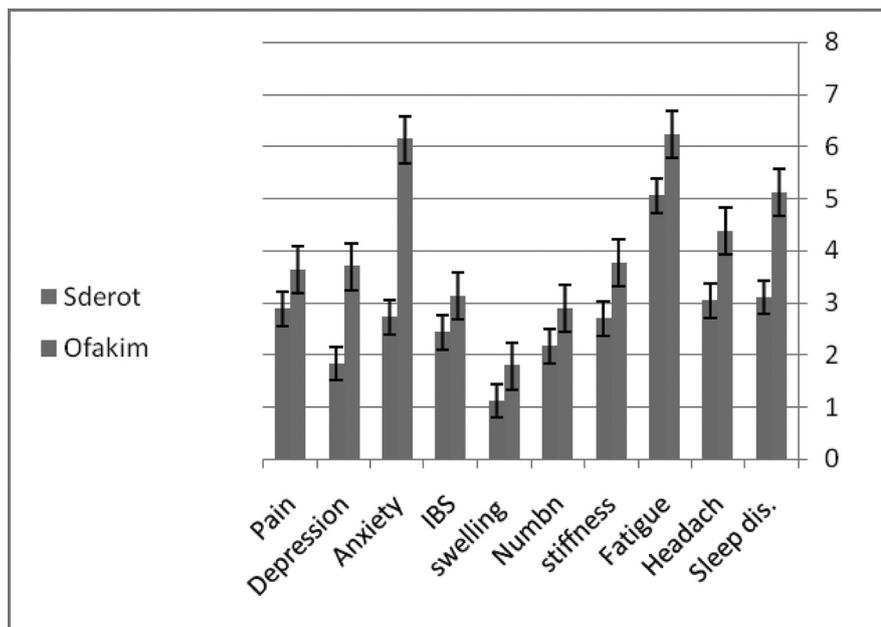


Fig. 2a. Comparison of frequencies of 10 major physical symptoms between inhabitants of Sderot and Ofakim. Significantly higher scores were obtained for all the somatic symptoms presented in Sderot compared with Ofakim ($p < 0.05$; SE presented) IBS: Irritable Bowel disease; Swelling: (Feeling of) Facial swelling; Numbn: Feeling of numbness of paresthesia in fingers.

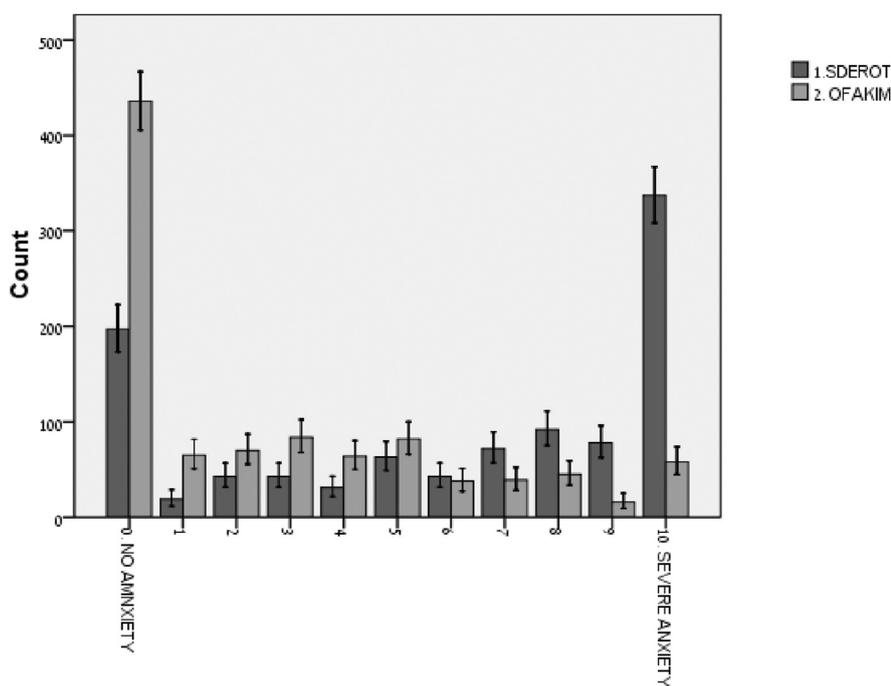


Fig. 2b. Frequency and severity of anxiety in Sderot and Ofakim. The frequency of severe anxiety is significantly higher in Sderot when compared with Ofakim ($p < 0.05$; SE presented).

Our results demonstrate the deleterious physical effect of ongoing stress inflicted by military conflict on a civilian population. Stress is a well known factor influencing physical as well as mental health (20-22). Additionally, war is

a situation with far-reaching negative consequences regarding human health (23-25).

The pathogenetic mechanism(s) through which stress can lead to the development of widespread pain and

related symptoms is not completely understood. The human stress response is mediated primarily by activity of the corticotropin-releasing hormone (CRH) nervous system, located in the hypothalamus, and of the locus-ceruleus-norepinephrine/autonomic (sympathetic/LC-NE) nervous system in the brain stem. The type of stress and the environment in which it occurs also impact on how the stress response is expressed. Female gender, worry or expectations of chronicity, and inactivity or time-off-work following the stressor, make it more likely to trigger the development of pain and other somatic symptoms (10). Natural catastrophic events, such as earthquakes or floods, seem to be significantly less likely to lead to chronic somatic symptoms than manmade disasters, such as chemical spills, or war (26). Traumatizing experiences have been shown to be frequent among FM patients and to be correlated with dissociative symptoms (27).

From this background it is clear that the conditions in Sderot have been highly conducive for the development of somatic symptoms in more ways than one. In this case, stress has been long lasting (7 years) and the calamity has been clearly manmade. Many individuals have lost work, thus amplifying the functional impact. It is particularly noteworthy that in the present study individuals in Sderot reported not only increased pain, but described significantly higher levels of a broad spectrum of somatic symptoms including numbness, IBS-like symptoms, paresthesia, swelling and headache. Thus, these individuals described symptoms which are typical of the spectrum observed in FM and other components of the chronic multisymptom illness (CMI) (28). Our results demonstrate an association between prolonged stress and the occurrence of a cluster of symptoms that for a rheumatologist would evoke a likely diagnosis of FM. Although pain has frequently been associated with stress in the past (29, 30), to our knowledge this is the first time the association of stress with such a broad spectrum of symptoms has been demonstrated on an epidemiological basis.

Besides the clear differences observed

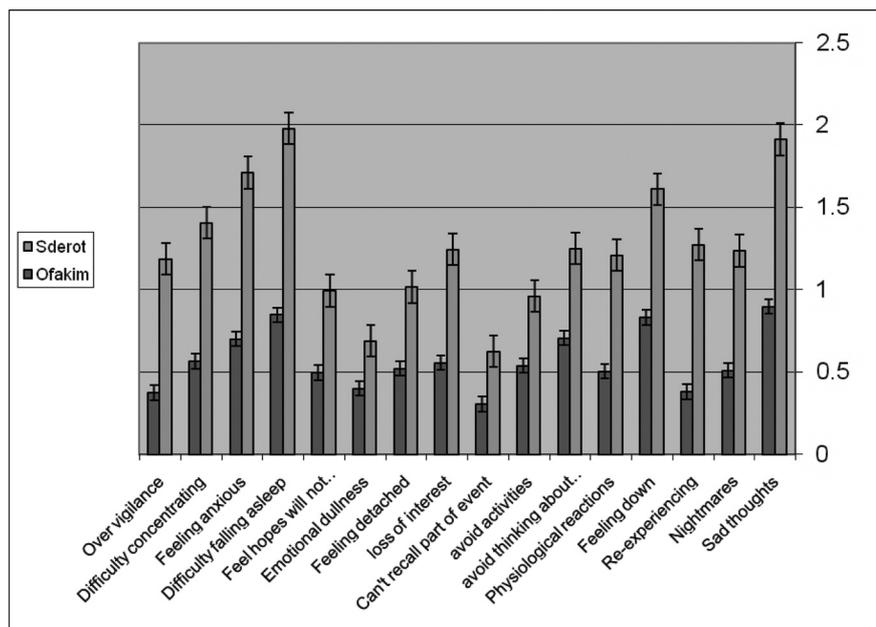


Fig. 3. Trauma related symptoms among individuals in Sderot and Ofakim.

As demonstrated by the figure, significantly higher results were obtained on the trauma-related questions in individuals from Sderot, compared with individuals from Ofakim ($p < 0.05$; SE presented). Y-axis: self reported scale: 0-never, 1- once a week or less, 2-2-4 times a week, 3-5 times a week or more

between Sderot and Ofakim on this broad spectrum of somatic symptoms, as well as on the quantitative scales of pain, the actual difference in the frequencies of widespread pain between the towns was also significant, although relatively modest. Moreover, as described above, controlling for the self-report of depression rendered both the difference in frequency of widespread pain as well as the severity of pain non-significant. Thus, in analysing this data, it would appear that it is not pain *per se* which is induced by ongoing stress, but rather the spectrum of physical as well as emotional symptoms comprising the chronic multisymptom illnesses. Our results also suggest differences in the characteristics of this stress-related pain in women and men. While females in Sderot tended to suffer more frequently from chronic widespread pain than their counterparts in Ofakim, males were significantly more likely to suffer from chronic regional pain. Thus, there may be differences in the way ongoing stress affects the different genders and in the linkage to development of pain. In the current study, response rates of around 50% were achieved. Although we consider this a relatively high rate, it is obviously possible that the charac-

teristics of responders are not identical with those of non-responders. Thus, non-responders could theoretically be more highly traumatised and thus reluctant to respond. We acknowledge this limitation as an inherent caveat of the current study design.

Conclusion

In the current study we have demonstrated the effect of ongoing missile attacks on the civilian population of the Israeli town of Sderot, compared with the town of Ofakim. Significantly increased rates of somatic complaints, including pain, fatigue and IBS-like symptoms, as well as significantly higher rates of trauma-related symptoms, were reported by individuals in Sderot. Widespread pain was reported significantly more frequently by inhabitants of Sderot compared with Ofakim but was not independent of increased self-reported depression. Thus, a fibromyalgia-like symptoms cluster was more likely to be found in Sderot compared with Ofakim. These results strengthen the relationship between low-intensity military conflict and the development of "unexplained" somatic complaints, and draw attention to the need for medical resource allocation to such areas in

order to meet these needs. The results highlight the contribution of external "environmental" factors such as stress to the occurrence of chronic pain as part of a spectrum of related somatic and affective symptoms. It remains to be investigated to what extent these external factors may interplay with a genetic predisposition in the pathogenesis of this symptom array.

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Appendix

Items included in the trauma-assessment questionnaire

- Recurrent thoughts or mental imagery related to a traumatic event
- Nightmares related to a traumatic event
- Re-experiencing of a prior traumatic event
- Feeling down when thinking about a traumatic event
- Feeling physiological responses such as increased sweating, racing pulse *etc.* when reminded of a traumatic event
- Attempting not to think about a traumatic event
- Attempting to avoid activities or people who remind you of a traumatic event
- Not being able to remember an important part of a traumatic event
- Loss of interest in activities which one usually considered important
- Feeling distant or alienated from people near you
- Feeling emotional dullness such as being unable to cry or to feel love
- Feeling that one's plans or hopes for the future will not come true, *e.g.* that one will not have a career, marriage, children or a long life
- Difficulty falling asleep or remaining asleep
- Feelings of unrest or outbursts of anger
- Difficulty with concentration such as flight of thought during conversation, difficulty following a plot of a TV show, difficulty remembering what one reads
- Feelings of over-vigilance such as turning to see who is behind you, feeling uncomfortable turning your back to the door *etc.*