Stressful major life events are associated with a higher frequency of cutaneous sensory symptoms: an empirical study of non-clinical subjects

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ABSTRACT

Background Psychological stress resulting from stressful major life events is known to exacerbate a wide range of skin disorders.

Objective To examine the relationship between stressful major life events and dermatological symptoms among a non-clinical sample.

Design A cross-sectional survey.

Setting Community-based subjects from London, Ontario, Canada were recruited from the local university, schools and churches.

Participants Out of 600 consecutive, consenting volunteers 316 subjects [73 men and 243 women; age 38.7 ± 14.8 (mean ± SD) years; marital status 54% married; race 94% 'white'] completed the survey for this study. The exclusion criterion was a history of a major dermatological or medical disorder.

Main outcome measure The number of major life events experienced over the previous 6 months measured using the Social Readjustment Rating Scale (SRRS) of Holmes and Rahe, and the frequency and severity of a range of cutaneous symptoms ('burning', 'crawling sensation', 'tingling', 'pricking' or 'pins and needles', 'pain', 'tenderness' of skin, 'numbness', 'moderate to severe itching', and 'easy bruising') that the subject may have experienced over the previous month.

Results The most frequently reported body region affected was the scalp (59.5%) and the most frequently reported symptom was itching (69.3%). The total number of major life events experienced over the previous 6 months correlated with the severity of the individual cutaneous symptoms (0.22 ≤ Pearson r ≤ 0.41, P < 0.001) and with the total cutaneous symptom severity score (sum of all cutaneous severity ratings) (Pearson r = 0.40, P < 0.001). This correlation remained significant after the possible confounding effect of psychological factors on cutaneous symptoms was partialled out statistically (partial r = 0.19, P = 0.001).

Discussion We observed a direct correlation between the number of major life events experienced over the previous 6 months and cutaneous symptoms experienced over the previous 1 month by non-clinical subjects. The correlation remained significant after the effect of psychological factors was partialled out, suggesting that this relationship holds even if the subject does not acknowledge psychological distress in reaction to the major life event.

Key words: dermatology, pruritus, psychology, psychosomatic, stress
Introduction

Psychological stress, including stress from major life events, has been recognized as a precipitating factor for dermatological disorders. Psychological stress and psychopathological factors have also been associated with symptoms such as pruritus, pain, purpura and cutaneous dysaesthesias, such as burning. In order to further evaluate the relationship between major life events, stress and cutaneous symptoms, we have examined the relationship between stressful major life events, psychological factors and reports of a wide range of cutaneous symptoms among non-clinical community-based subjects who reported no prior history of major dermatological or other general medical problems. To our knowledge, no previously reported study has empirically examined this potentially important association in a non-clinical sample.

Subjects and methods

A total of 316 consecutive consenting subjects (73 men and 243 women; mean ± SD age: 38.7 ± 14.8 years; age range: 18–79 years; marital status: 54% married, 32% single, 14% widow/widower, separated or divorced; race: 94% 'white', 3% 'black', 3% 'Asian', 'native Indian' and 'other'; occupation: 23% student, 19% nurse/technician, 15% homemaker, 9.5% clerical, 9.2% managerial; 6.3% manual labourer, 4.4% professional with higher degree, 6.3% unemployed and 7% retired) from the community at large in London, Ontario, Canada completed a large battery of self-rated questions related to demographic information, skin type, psychosocial factors and cutaneous symptoms in a cross-sectional non-random survey. The exclusion criterion for the study was a current or past history of non-specific skin rashes, allergies and eczema. Out of the 600 prospective subjects who had volunteered to take a study questionnaire were not contacted individually by the research assistants if they chose not to return the questionnaire to their respective institutions.

Study questionnaire

Ratings of cutaneous symptoms

The choice of the cutaneous symptoms that the subjects were asked to rate on the questionnaire was based on reports of stress-mediated cutaneous complaints in the literature, observations made by the authors (M.A.G. and A.K.G.) in the course of their clinical work and on the results of a pilot study involving 35 non-clinical subjects (relatives and friends of patients of M.A.G.) who were asked questions about cutaneous symptoms that they believed were stress-related. Most of the symptoms reported in the pilot study that were attributed to stress and that did not have an immediate dermatologic diagnosis (e.g. acne, seborrhoeic dermatitis) were largely sensory except for the complaint of easy bruising. Based on this initial pilot data the items of the study questionnaire were developed.

In the initial survey, because of the exploratory nature of the study, the subjects were asked to rate the severity of symptoms they had experienced over the previous 1 month, and were asked to rate their various body regions separately. The rating of symptoms took into account of both the severity of the symptom
and the body region(s) affected. When reporting the frequency, a body region was reported to be affected if it was endorsed, regardless of the severity of the cutaneous symptom affecting the body region (Table 1). Twenty-two body regions were individually rated for severity of cutaneous symptoms (using the 10-point Likert-type scale described below) and were listed as follows in the survey questionnaire: ‘scalp’, ‘face’, ‘lips’, ‘tongue’, ‘inside of mouth’, ‘front of neck’, ‘back of neck’, ‘shoulders’, ‘upper back or area between shoulder blades’, ‘chest’, ‘arms’, ‘forearms’, ‘hands in general’, ‘palm(s) of hand’, ‘lower back’, ‘abdomen or stomach’, ‘groin area’, ‘hips’, ‘thighs’, ‘legs’, ‘feet in general’, ‘sole(s) of feet’. The heading of the survey read as follows: ‘Using the rating scale described below, use one number between 0 and 9 to describe whether each of the following regions of your skin was affected over the past one month by the symptoms listed. Use a rating of ‘0’ if the body region was not affected.’ The 10-point rating scale was printed on the survey questionnaire, with a rating of ‘0’ denoting ‘not at all’; a rating of ‘1’, ‘2’ or ‘3’ denoting ‘slightly’; a rating of ‘4’, ‘5’ or ‘6’ denoting ‘moderately’; a rating of ‘7’ or ‘8’ denoting ‘markedly’; and a rating of ‘9’ denoting ‘very markedly’.

The nine symptoms rated for each of the 22 body regions were as follows: ‘burning’, ‘crawling sensation’, ‘tingling’, ‘pricking’ or ‘pins and needles’, ‘pain’, ‘tender to touch’, ‘numbness’, ‘moderate to severe itching’, ‘easy bruising’. Therefore, using a severity rating between ‘0’ and ‘9’, each subject indicated the degree to which (if at all) each of the 22 body regions had been affected by the nine cutaneous symptoms listed, over the previous 1 month.

The initial psychometric analyses of the cutaneous symptom severity ratings revealed that the nine cutaneous items were intercorrelated (Pearson r = 0.4–0.8, P < 0.001). Therefore, for the purpose of this initial analysis, a composite cutaneous symptom score, labelled ‘Cutaneous 9’, was generated by adding all nine cutaneous symptom ratings affecting the 22 separate body regions.

### Ratings of stressful major life events

The Social Readjustment Rating Scale (SRRS),\(^{11}\) a major life events inventory developed by Holmes and Rahe, was used to measure stress from major life events. The SRRS has been used widely in studies of psychosocial stress and illness and the modified format used in this survey has been used in earlier studies of dermatologic patients.\(^ {12} \) The subjects were asked to rate which of a list of life events (e.g., ‘death of a spouse’, ‘divorce’, ‘marital separation’, ‘jail term’, ‘death of a close family member’, ‘personal injury or illness’, ‘marriage’, ‘fired at work’, etc.) had occurred over the previous 6 months. In the modified version of the SRRS,\(^ {12} \) rather than asking the subject to assign a stress score to an event in relation to a reference event, the subjects were asked to rate the stress associated with each event on the check-list that they had experienced over the previous 6 months.\(^ {12} \) The stress associated with each event was rated on a four-point scale with a rating of ‘1’ denoting ‘not at all’, a rating of ‘2’ denoting ‘slight degree of stress’, a rating of ‘3’ denoting ‘moderate degree of stress’ and a rating of ‘4’ denoting ‘a great deal of stress’. Therefore, in the modified version of the SRRS, one subject can endorse a major life event but ascribe no stress to the event while another subject can endorse the same event and rate it as very stressful.

The total number of major life events (SRRS-Events) experienced and the stress score attributed to the life events (SRRS-Stress) were, as expected, significantly correlated (r = 0.67, P < 0.001). In this initial study the two variables related to stressful major life events (SRRS-Events and SRRS-Stress) were examined individually in order to take into consideration the fact that any particular major life event will probably be attributed to different degrees of stress by different individuals.

### Measure of psychopathology

Psychopathological factors such as depression and anxiety may also arise as a result of stressful major life events and have (i) a direct influence on cutaneous symptoms\(^ {12} \) or (ii) an impact upon the degree of stress experienced as a result of a major life event, thereby indirectly affecting the potential impact of the major life event. A wide range of psychopathologic ratings were obtained using the Brief Symptom Inventory (BSI),\(^ {13} \) a prevalidated instrument that has been widely used among dermatologic and other medically ill patients. The BSI is a

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Table 1: Mean ± SD (rated on a 10-point scale) severity of cutaneous symptom, gender difference, and percentage of subjects who did not endorse a symptom.

<table>
<thead>
<tr>
<th>Cutaneous symptom rated</th>
<th>Overall mean ± SD severity rating (mean scores of men [n = 73] vs. women [n = 243])</th>
<th>Percentage who endorsed a rating of ‘0’ or ‘Not at all’ for all 22 body regions</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Burning’</td>
<td>6.0 ± 12.1 (4.2 ± 11.3 vs. 6.5 ± 12.3)</td>
<td>53.2 (168/316)</td>
</tr>
<tr>
<td>‘Crawling sensation’</td>
<td>5.3 ± 13.5 (1.8 ± 6.9 vs. 6.3 ± 14.8)</td>
<td>60.4 (193/316)</td>
</tr>
<tr>
<td>‘Prickling’ or ‘pins and needles’</td>
<td>6.8 ± 14.1 (4.8 ± 9.8 vs. 7.4 ± 15.1)</td>
<td>49.1 (155/316)</td>
</tr>
<tr>
<td>‘Pain’</td>
<td>6.9 ± 15.0 (4.8 ± 12.5 vs. 7.5 ± 15.7)</td>
<td>49.4 (156/316)</td>
</tr>
<tr>
<td>‘Tender to touch’</td>
<td>8.3 ± 19.0 (6.3 ± 14.4 vs. 15.1 ± 23.7)</td>
<td>53.8 (170/316)</td>
</tr>
<tr>
<td>‘Numbness’</td>
<td>5.7 ± 13.6 (3.5 ± 18.1 vs. 9.1 ± 19.3)</td>
<td>66.1 (209/316)</td>
</tr>
<tr>
<td>‘Moderate to severe itching’</td>
<td>14.4 ± 24.7 (10.7 ± 16.2 vs. 15.6 ± 26.7)</td>
<td>30.7 (97/316)</td>
</tr>
<tr>
<td>‘Easy bruising’</td>
<td>5.6 ± 13.5 (1.6 ± 6.7 vs. 6.8 ± 14.7)</td>
<td>67.7 (214/316)</td>
</tr>
</tbody>
</table>

Difference in mean severity scores between men and women significant at *P < 0.05 and **P < 0.001 using two-sample t-test.

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53-item subject-rated instrument that measures nine major psychologic symptom dimensions including: Anxiety (BSI), a dimension reflecting signs and symptoms that are associated with high levels of manifest anxiety such as trembling and feelings of terror; Depression (BSI), which assesses symptoms associated with a major depressive disorder such as a dysphoric mood, easy crying, loss of energy, feelings of worthlessness and suicidal thoughts; Phobic Anxiety (BSI), a dimension that focuses on manifestations of phobic behaviour such as avoidance of certain things, places or activities; Paranoid Ideation (BSI), which reflects a disordered mode of thinking including delusional suspiciousness; Obsessive Compulsiveness (BSI), which measures unwanted and unremitting but irresistible thoughts, impulses or actions such as repetitive thoughts about contamination and repeated hand washing; Somatization (BSI), a dimension focusing on physical symptoms such as faintness, pain and headaches, which frequently have a functional component; Interpersonal Sensitivity (BSI), a dimension focusing on feelings of personal inferiority and inadequacy, especially in comparison with others; Hostility (BSI), a dimension reflecting resentment, aggression, irritability and rage; and Psychoticism (BSI), a dimension reflecting the behavioural changes associated with psychosis such as an isolated and schizoid life-style, along with frankly psychotic symptoms such as hallucinations. The possible confounding effect of psychopathological factors on the stress from major life events and cutaneous symptoms was accounted for by statistically partialling out the effect of all nine BSI\(^1\) psychological symptom dimensions from the correlations between the variables related to stressful major life events (SRRS-Events and SRRS-Stress) and the cutaneous symptoms (Table 2).

### Statistical analysis

As discussed above, a composite Cutaneous 9 variable was derived, which was the sum of all nine cutaneous ratings. Independent sample \(t\)-tests were used to examine the differences in mean severity scores of the nine cutaneous symptoms between men and women (Table 1). Analysis of variance (ANOVA) was used to evaluate the differences in the SRRS-Events ratings between the different categories of the Cutaneous 9 variable in fig. 1.

Pearson product-moment correlations (Table 2) were carried out between each of the cutaneous ratings and (i) the total number of major life events experienced over the previous 6 months (SRRS-Events) and (ii) the major life events-related stress score (SRRS-Stress). Following this, partial correlations were obtained between the cutaneous ratings and both the SRRS-Events and SRRS-Stress, respectively, after partialling out the effects of all nine BSI psychological symptom dimensions (Table 2). The partial correlations were obtained to account for the possible confounding effect of psychological factors on cutaneous symptoms and the impact of major life events.

Table 2 Pearson correlations (and correlations after partialling out the effect of psychopathologic factors*) between nine cutaneous items and ratings of stressful major life events (SRRS)\(^n\) over the previous 6 months

<table>
<thead>
<tr>
<th>Cutaneous 9†</th>
<th>Total number of major life events (SRRS-Events)</th>
<th>Stress score from major life events (SRRS-Stress)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 'Burning'</td>
<td>(0.31^* (partial)) ((r = 0.15, P = 0.006))</td>
<td>(0.31^* (partial)) ((r = 0.16, P = 0.005))</td>
</tr>
<tr>
<td>2 'Crawling sensation'</td>
<td>(0.28^* (partial)) ((r = 0.1, P = 0.009))</td>
<td>(0.22^* (partial)) ((r = 0.05, P = 0.4))</td>
</tr>
<tr>
<td>3 'Tingling'</td>
<td>(0.31^* (partial)) ((r = 0.13, P = 0.003))</td>
<td>(0.27^* (partial)) ((r = 0.1, P = 0.3))</td>
</tr>
<tr>
<td>4 'Pricking' or 'pins and needles'</td>
<td>(0.26^* (partial)) ((r = 0.12, P = 0.004))</td>
<td>(0.22^* (partial)) ((r = 0.1, P = 0.05))</td>
</tr>
<tr>
<td>5 'Pain'</td>
<td>(0.41^* (partial)) ((r = 0.2, P &lt; 0.001))</td>
<td>(0.33^* (partial)) ((r = 0.1, P = 0.08))</td>
</tr>
<tr>
<td>6 'Tenderness'</td>
<td>(0.37^* (partial)) ((r = 0.21, P &lt; 0.001))</td>
<td>(0.29^* (partial)) ((r = 0.14, P = 0.013))</td>
</tr>
<tr>
<td>7 'Numbness'</td>
<td>(0.22^* (partial)) ((r = 0.1, P = 0.2))</td>
<td>(0.20^* (partial)) ((r = 0.1, P = 0.3))</td>
</tr>
<tr>
<td>8 'Moderate to severe itching'</td>
<td>(0.32^* (partial)) ((r = 0.13, P = 0.002))</td>
<td>(0.30^* (partial)) ((r = 0.14, P = 0.003))</td>
</tr>
<tr>
<td>9 'Easy bruising'</td>
<td>(0.30^* (partial)) ((r = 0.15, P = 0.008))</td>
<td>(0.30^* (partial)) ((r = 0.16, P = 0.005))</td>
</tr>
<tr>
<td>10 Cutaneous 9†</td>
<td>(0.40^* (partial)) ((r = 0.19, P = 0.001))</td>
<td>(0.35^* (partial)) ((r = 0.15, P = 0.007))</td>
</tr>
</tbody>
</table>

*Psychopathologic factors assessed using the nine psychological symptom dimensions measured by the Brief Symptom Inventory (BSI)\(^n\).
†Equally weighted linear combination or simple sum of nine individual cutaneous items; \( \text{df} < 0.001\).

For this exploratory study, repeated individual \(t\)-tests (Table 1) and correlations (Table 2) were carried out. When interpreting the results a conservative Bonferroni-style adjustment was considered to decrease the Type I error rate.
Results

Out of the 316 subjects, 315 rated their skin type based upon their reaction to sunlight. The following frequency of skin types was reported: 'Always burn, never tan' 8.3%; 'Always burn but sometimes tan' 28.9%; 'Sometimes burn but always tan' 54%; 'Never burn, always tan' 5.7% 'Moderately pigmented' 2.5%; and 'Black' 0.6%. Table 1 summarizes the mean score (average of 22 body regions rated) for each of the nine cutaneous symptoms along with the percentage of subjects who gave an overall rating of '0' or 'Not at all for the symptom, that is the subjects who did not endorse a particular symptom in relation to any body region. Examination of the gender differences (Table 1) for each of the nine cutaneous symptoms revealed that the scores for five out of nine items, namely, 'crawling sensation' \((P < 0.001)\), 'tingling' \((P < 0.05)\), 'pain' \((P < 0.001)\), 'moderate to severe itching' \((P < 0.05)\) and 'easy bruising' \((P < 0.001)\), were all significantly higher among the women \((N = 243)\) than the men \((N = 73)\). Age did not correlate significantly with any of the nine items \((r < 0.009, P > 0.08)\).

The frequency with which each body region was rated as experiencing cutaneous symptoms was assessed by examining the percentage of subjects who rated a particular region as experiencing any one of the nine symptoms (i.e., the region was given a rating between 0 and 9 for any one of the nine cutaneous symptoms). At least one out of nine cutaneous symptoms was reported to have affected each of the 22 body regions over the previous 6 months, and a range of cutaneous symptoms were experienced over the previous 1 month, in a community-based non-clinical sample based in London, Ontario, Canada. Cutaneous symptoms, mainly sensory in nature, were endorsed by a large number of the non-clinical participants. The most frequently experienced symptom (these frequencies include all individuals who endorsed the symptom, even those who may have endorsed experiencing the symptom to a 'slight degree' in only one body region) (Table 1) was 'moderate to severe itching', which was reported by 69.3%, followed by 'pain', which was reported by 60.8% of the subjects. Pain is often augmented by psychosomatic factors and the high frequency of cutaneous pain may also in part reflect pain in deeper structures. Furthermore, pain and pruritus share the same central pathways and the two symptoms are expected to co-occur. About 50% of subjects reported experiencing sensations of 'burning', 'tingling', 'pricking' or 'pins and needles' and/or their skin being 'tender to touch'. About 40% of subjects reported experiencing a 'crawling sensation' affecting their skin and over 30% reported a sensation of 'numbness' and/or 'easy bruising' of their skin.

The severity ratings of each of the nine symptoms revealed a parallel between frequency and severity – the ratings of 'moderate to severe itching' and 'pain' had the highest mean scores (Table 1) while the mean scores for 'crawling sensation', 'numbness' and 'easy bruising' were the lowest, as was their frequency of endorsement (Table 1). The women reported significantly higher ratings than the men for several symptoms, including 'crawling sensation' \((P < 0.001)\), 'pain' \((P < 0.001)\), 'easy bruising' \((P < 0.001)\), 'tingling' \((P < 0.05)\) and 'moderate to severe itching' \((P < 0.05)\). Therefore, whenever there was a gender difference, the women were more symptomatic than men, which is consistent with the demography of psychosomatically mediated physical complaints involving most organ

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Discussion

We examined the relationship between stressful major life events (as measured by the SRRS of Holmes and Rahe\(^{11}\)) experienced over the previous 6 months, and a range of cutaneous symptoms experienced over the previous 1 month, in a community-based non-clinical sample based in London, Ontario, Canada. Cutaneous symptoms, mainly sensory in nature, were endorsed by a large number of the non-clinical participants. The most frequently experienced symptom (these frequencies include all individuals who endorsed the symptom, even those who may have endorsed experiencing the symptom to a 'slight degree' in only one body region) (Table 1) was 'moderate to severe itching', which was reported by 69.3%, followed by 'pain', which was reported by 60.8% of the subjects. Pain is often augmented by psychosomatic factors and the high frequency of cutaneous pain may also in part reflect pain in deeper structures. Furthermore, pain and pruritus share the same central pathways and the two symptoms are expected to co-occur. About 50% of subjects reported experiencing sensations of 'burning', 'tingling', 'pricking' or 'pins and needles' and/or their skin being 'tender to touch'. About 40% of subjects reported experiencing a 'crawling sensation' affecting their skin and over 30% reported a sensation of 'numbness' and/or 'easy bruising' of their skin.

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symptoms such as tingling and pricking may have been subject to recall bias. Our initial findings need to be followed up with a larger study to validate these results.

When the intermediary effect of psychopathological factors was partialled out statistically, a smaller degree of variance in the severity of the composite Cutaneous 9 variable was explained by SRRS-Events (partial $r = 0.19$, $P = 0.001$) and SRRS-Stress (partial $r = 0.15$, $P = 0.007$). The partial correlation with SRRS-Events remained significant ($P = 0.009$) after a conservative Bonferroni-style adjustment was made to account for the increase in the Type I error rate as a result of nine individual correlations, while the partial correlation between Cutaneous 9 and SRRS-Stress became marginally significant ($P = 0.063$) after the adjustment. This suggests that the degree of stress experienced is strongly influenced by the psychological state of the subject and a larger degree of the variance in SRRS-Stress was determined by psychological factors.

Our preliminary study of community-based non-clinical subjects has empirically shown a significant correlation between stressful major life events and cutaneous symptoms that were largely sensory in nature except for easy bruising. To our knowledge, this has not been formerly demonstrated. The cutaneous complaints in the survey questionnaire were based on pilot data, and it is possible that some cutaneous symptoms were not included in the check-list of symptoms. In addition, we did not include first-onset dermatologic disorders such as psoriasis, atopic dermatitis, etc., which are known to be precipitated by stress, in our survey. This initial paper focuses primarily on subject-reported cutaneous complaints, and does not address the pathophysiological mechanisms underlying these observations. The cutaneous symptoms were rated retrospectively and the less specific symptoms such as tingling and pricking may have been subject to recall bias. Our initial findings need to be followed up with a prospective study that is likely to provide a more precise profile of the nature of stress-related cutaneous symptoms. The pathophysiological processes underlying the development of stress-mediated cutaneous symptoms require further investigation.

Various psychoneuroimmunological processes involving both the nervous and endocrine systems can theoretically be important factors in the pathogenesis of stress-mediated cutaneous symptoms. The correlation between the number of major life events experienced over the previous 6 months (fig. 1) and cutaneous symptoms remained significant even after the confounding effect of psychological factors was controlled for statistically. This suggests that the experience of major life events alone may be associated with cutaneous symptoms, independent of the subjects' conscious psychological reaction to the event.

References
