

Association of psychological stress with skin symptoms among medical students

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ABSTRACT

الأهداف: لتقييم العلاقة بين التوتر النفسي والأعراض الجلدية بين طلبة الطب.

الطريقة: أجريت هذه الدراسة المقطعية خلال الفترة من يناير إلى يونيو 2015م. حيث تم إرسال استبيان الكتروني يحوي كل من استبانة التوتر المحسوس، واستبانة شكاوى الجلد المبلغ عنها ذاتياً إلى 1435 من الطلبة الجامعيين بكلية الطب.

النتائج: تم التحليل النهائي للبيانات من 529 (36.9%) طالب. قسمنا الطلبة إلى 3 مجموعات: الأقل توتراً، عددهم 135، ومقياس استبانة التوتر المحسوس أقل من 0.39؛ الأعلى توتراً، عددهم 136، ومقياس استبانة التوتر المحسوس أعلى من 0.61؛ متوسطي التوتر، عددهم 258. ارتبط كل من الأكبر سناً، والإناث، وخلال أسابيع الامتحانات، والسنة الرابعة والخامسة من مرحلة دراسة الطب بأعلى مستويات التوتر المحسوس ($p < 0.01$). عند المقارنة مع الطلبة الأقل توتراً، وجدنا أن الطلبة الأعلى توتراً يعانون أكثر من قشور فروة الرأس ($p \leq 0.0001$)، وطفح جاف، وثآليل ($p \leq 0.0001$)، وبثور ($p \leq 0.0001$)، وحكة جلدية ($p \leq 0.0001$)، وطفح يدين به حكة ($p \leq 0.0001$)، فقدان شعر ($p \leq 0.0001$)، وندف الشعر ذاتياً ($p = 0.008$)، وقشور جلدية ($p = 0.012$)، وتقرق مزعج ($p = 0.016$)، وقضم الأظافر ($p = 0.028$)، وأنواع أخرى من الطفح الوجهي ($p = 0.028$).

الخلاصة: قد تظهر حالات جلدية شائعة متنوعة في حال التوتر النفسي عند طلبة الطب.

Objectives: To evaluate the association between psychological stress and skin symptoms among medical students.

Methods: A cross-sectional study was carried out between January and June 2015. Electronic survey consists of Perceived Stress Questionnaire (PSQ) and Self-Reported Skin Complaints Questionnaire were distributed to all 1435 undergraduate students at College of Medicine, King Saud University (KSU), Riyadh, Saudi Arabia.

Results: Final analysis was performed on data from 529 (36.9%) students. Students were divided into three groups: least stressed students, $n=135$, PSQ index < 0.39 ; highly stressed students, $n=136$, PSQ index > 0.61 ; and moderately stressed students, $n=258$. Older age, female gender, during exam weeks, and fourth and fifth years of medical school (all $p < 0.01$) were associated with the highest perceived stress levels. When compared to least stressed students, highly stressed students suffered from more oily, waxy patches or flakes on scalp ($p \leq 0.0001$), dry/sore rash ($p \leq 0.0001$), warts ($p \leq 0.0001$), pimples ($p \leq 0.0001$), itchy skin ($p \leq 0.0001$), hands itchy rash ($p \leq 0.0001$), hair loss ($p \leq 0.0001$), pull-out own hair ($p = 0.008$), scaly skin ($p = 0.012$), troublesome sweating ($p = 0.016$), nails biting ($p = 0.028$), and other rashes on face ($p = 0.028$).

Conclusion: Various common skin conditions could appear in context of psychological stress among medical students.

Saudi Med J 2018; Vol. 39 (1): 59-66
doi: 10.15537/smj.2018.1.21231

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Received 21st September 2017. Accepted 6th December 2017.

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Several studies have demonstrated a strong relationship between psychological stress (PS) and individuals' health. That are including but not limited to cardiovascular diseases, bronchial asthma, and irritable bowel syndrome.¹⁻³ Stress refers to the consequence of an organism's failure to respond adequately to mental, emotional, or physical demands, actual or imagined.⁴ Psychological stress occurs when an individual perceives that environmental demands tax or exceed his or her adaptive capacity.⁵ Upon perception of PS, the central stress response leads to the activation of 2 major neuroendocrine systems; the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system to enable the organism's adaptation to it.⁶ This stress response leads to variable physiological consequences. Exposure to chronic stress is generally considered to cause more long term health problems than acute stress, since chronic stress is most likely to result in prolonged and/or permanent physiological, emotional, and behavioral responses that may have a role in the etiology and or exacerbation of diseases.⁷

It is well known that the demands placed on medical students pose a tremendous challenge to their well-being, leading to a high rate of psychological distress.⁸⁻¹⁰ Medical students are well-known to have high stress-levels in comparison to other students of higher education.^{11,12} The reported prevalence of PS among medical students using various measurements ranges from 30% to 63.7%.^{8,13-23}

Psychological stress may adversely affect the emotional, social, and psychological well-being of medical students.²⁴ A recent systematic review reveals that the summary estimate of the prevalence of depression or depressive symptoms among medical students was 27.2% and that of suicidal ideation was 11.1%.²⁵ Psychological stress has many negative consequences on the skin which include impaired stratum corneum cohesion, disturbance of permeability barrier, alteration of the antimicrobial properties of the epidermal barrier, delayed wound healing, compromised epidermal innate immunity, and cutaneous homeostasis might be adversely affected.²⁶⁻³⁰ Thus alter immunity, favor progression of infections, and have the potential to affect chronic inflammatory skin diseases. Furthermore,

some reports exist in favor of the role of psychosocial factors in the etiology and or exacerbation of certain dermatological diseases, for instance, atopic dermatitis, urticaria, psoriasis, rosacea, vitiligo, acne, and alopecia areata.^{31,32} However, Picardi et al³³ stated, in their review on stress measurements in skin diseases, that "although a great number of papers on this subject have been published, unfortunately there appears to be a paucity of controlled studies adopting standardized methods for measuring stress".

The goal of the present study is to evaluate the association between PS and various skin symptoms among medical students.

Methods. Study design and setting. We used a cross-sectional design. All students at the College of Medicine, King Saud University (KSU), Riyadh, Saudi Arabia were invited to participate through their university email. The electronic survey was distributed to all 1435 medical students. Two email reminders were sent out to medical students: the first one was 3 days after the first email, and the second one was 6 days after the first email. The survey was available between January 1, 2015 and June 30, 2015. All students at College of Medicine, KSU were included in this study. However, all other subjects and uncompleted surveys were excluded. This study was approved by the KSU Institutional Review Board. All volunteers provided informed consent and were free to withdraw from the study at any time.

Survey instruments. The survey collected demographic information, including age, gender, school year, previous skin diagnoses and current study status namely, in a more relaxed period after the mid-year break or in a stressful period during exam weeks. Participants were asked to fill out 2 questionnaires: the Perceived Stress Questionnaire (PSQ) and the Self-Reported Skin Complaints Questionnaire (SSCQ).

1) Perceived stress questionnaire. The Perceived Stress Questionnaire is a validated 30-item measure formulated to describe experiences of stress applicable across a variety of situations. Perceived Stress Questionnaire emphasizes cognitive perceptions rather than emotional states or specific life events.³⁴ The PSQ has been used to quantify perceived stress, and it was specifically intended for psychosomatic research.^{34,35} The PSQ has demonstrated good predictive values for stress-related diseases.³⁵ Participants were instructed to consider the past 4 weeks "PSQ-recent" to rate the frequency of occurrence of the described experience on a 4-point scale: almost never, sometimes, often, and usually. Items were coded from 1 to 4 in accordance with Levenstein et al.³⁴ The PSQ index ranges from 0 to 1. Higher scores indicate more severe perceived stress.³⁴

Disclosure. Authors have no conflict of interests, and the work was not supported or funded by any drug company. This study was supported by the College of Medicine Research Center, Deanship of Scientific Research, King Saud University, Riyadh, Kingdom of Saudi Arabia.

2) Self-reported skin complaints questionnaire.

The self-reported skin complaints questionnaire is a validated 10-item survey. Self-reported skin complaints questionnaire is a simple instrument to evaluate skin morbidity in an adult population. This uses self-reported skin complaints to predict clinical skin morbidity. This has been used in several large cross-sectional community-based studies.³⁶⁻³⁹ The answers to all items are scored on a 4-point scale: 1 = no; 2 = yes, a little; 3 = yes, quite a lot; and 4 = yes, very much.³⁶ We modified the SSCQ by adding 6 items to assess specific complaints under the 10th item "other skin problems". The additional items are the following: hair shedding, hair pulling, nail-biting, itchy scalp, scaly scalp, and facial scales. The answers to the modified SSCQ items were dichotomized so the answer "no complaints" was compared with the other 3 answers ("a little", "quite a lot", and "very much"). Thus, the new items only distinguished whether the student had the symptom or not.

Statistical analysis. All data analyses were performed using Predictive Analytics Software (PASW) version 18 (SPSS-IBM, Chicago, IL, USA). Descriptive statistics for quantitative variables were presented as mean \pm standard deviation (SD). The significance of differences was assessed using an independent t-test for continuous variables. Analysis of variance (ANOVA) with post hoc analysis was used to determine significance between groups. Statistical significance was set at $p < 0.05$.

Since there are no cut-off scores for the Perceived Stress Questionnaire, the study participants were divided into 3 groups based on the 25th and 75th

percentiles of the PSQ index: least stressed (LS) (scores ≤ 25 th percentile); highly stressed (HS) (scores ≥ 75 th percentile); and moderately stressed (MS) (all other scores).

Odds ratios (OR) and 95% confidence intervals were calculated to assess whether the highest stressed group had a higher probability of having skin complaints compared to the least stressed group. The answers for the modified SSCQ items were dichotomized to allow for the computation of OR.

Results. Participant's characteristics. Of the 1435 students invited for the study, 5 responses were later dropped from the analysis due to incomplete data. The final analysis was performed on data from 529 (36.9%) students. Participants were between the ages of 18 and 24 years (mean = 20.6 ± 1.6 ; mode = 19); 208 (39.3%) were male and 321 (60.7%) were female. Further demographic information is displayed in Table 1.

Table 2 - Difference in response rate per gender and year of study.

Variables	No. of invited students	No. of non-respondents	No. of respondents	P-value
<i>Gender</i>				0.0001
Male	841	633 (75.3)	208 (24.7)	
Female	594	273 (46.0)	321 (54.0)	
<i>Academic standing</i>				0.0001
1 st	306	128 (41.8)	178 (58.2)	
2 nd	258	124 (48.1)	134 (51.9)	
3 rd	308	228 (74.0)	80 (26.0)	
4 th	279	172 (61.6)	107 (38.4)	
5 th	284	254 (89.4)	30 (10.6)	

Table 1 - Demographic data of study participants.

Characteristic	Least stressed students (scoring ≤ 25 th percentile) n=135	Moderately stressed students n=258	Highly stressed student (scoring ≥ 75 th percentile) n=136	Total n=529
Age, years (mean \pm SD)	20.2 \pm 1.42	20.6 \pm 1.57	20.99 \pm 1.58	20.6 \pm 1.6
<i>Gender</i>				
Male	63 (30.3)	110 (52.9)	35 (16.8)	208 (39.3)
Female	72 (22.4)	148 (46.1)	101 (31.5)	321 (60.7)
<i>Academic standing</i>				
First year	51 (28.7)	92 (51.7)	35 (19.7)	178 (33.6)
Second year	51 (38.1)	65 (48.5)	18 (13.4)	134 (25.3)
Third year	15 (18.8)	37 (46.3)	28 (35.0)	80 (15.1)
Fourth year	13 (12.1)	52 (48.6)	42 (39.3)	107 (20.2)
Fifth Year	5 (16.7)	12 (40.0)	13 (43.3)	30 (5.7)
<i>School status</i>				
Immediately after school break	73 (32.0)	111 (48.7)	44 (19.3)	228 (43.1)
During exam weeks	62 (20.6)	147 (48.8)	92 (30.6)	301 (56.9)

Table 3 - Perceived stress level and dermatological complaints among medical students.

Characteristic	Least stressed students (scoring \leq 25th percentile) n=135	Moderately stressed students n=258	Highly stressed student (scoring \geq 75th percentile) n=136	Total n=529
<i>PSQ index</i>				
Mean \pm SD	0.31 \pm 0.06	0.50 \pm 0.06	0.71 \pm 0.08	0.5 \pm 0.16
Mode	0.4	0.5	0	0.5
Range	0.11 - 0.39	0.4 - 0.6	0.61 - 0.93	0.11 - 0.93
<i>Skin complaints [n (%)]</i>				
Itchy skin	40 (29.6)	99 (38.4)	75 (55.1)	214 (40.5)
Dry/sore rash	31 (23.0)	82 (31.8)	59 (43.3)	172 (32.5)
Scaly skin	25 (18.5)	80 (31.0)	69 (50.7)	174 (33.0)
Itchy rash on your hands	27 (20.0)	43 (16.7)	43 (31.6)	113 (21.4)
Pimples	68 (50.4)	161 (62.4)	105 (77.2)	334 (63.1)
Other rashes on your face	22 (16.3)	47 (18.2)	49 (36.0)	118 (22.3)
Warts	9 (6.7)	23 (8.9)	18 (13.2)	50 (9.5)
Troublesome sweating	32 (23.7)	86 (33.3)	62 (45.6)	180 (34.1)
Loss of hair	80 (59.3)	164 (63.6)	111 (81.6)	355 (67.2)
Oily, waxy patches on scalp and/or flakey scalp (or dandruff)	47 (34.8)	120 (46.5)	95 (69.9)	262 (49.5)
Bite your nails	44 (32.6)	82 (31.8)	57 (41.9)	183 (34.6)
Pull-out your own hair	31 (23.0)	77 (29.8)	58 (42.6)	166 (31.4)
Total complaints	456	1064	801	2321 (438.7)
<i>Number of complaints in the participants [n (%)]</i>				
0 complaints	16 (11.9)	17 (6.6)	1 (0.7)	34 (6.4)
1 complaints	20 (14.8)	22 (8.5)	2 (1.5)	44 (8.3)
2 complaints	17 (12.6)	32 (12.4)	9 (6.6)	58 (11.0)
3 complaints	22 (16.3)	43 (16.7)	9 (6.6)	74 (14.0)
4 complaints	15 (11.1)	48 (18.6)	17 (12.5)	80 (15.1)
5 complaints	20 (14.8)	28 (10.9)	26 (19.1)	74 (14.0)
6 complaints	11 (8.1)	24 (9.3)	24 (17.6)	59 (11.2)
7 complaints	7 (5.2)	14 (5.4)	12 (8.8)	33 (6.2)
8 complaints	3 (2.2)	14 (5.4)	12 (8.8)	29 (5.5)
9 complaints	3 (2.2)	5 (1.9)	14 (10.3)	22 (4.2)
10 complaints	1 (0.7)	6 (2.3)	5 (3.7)	12 (2.3)
More than 10 complaints	0	5 (1.9)	5 (3.7)	10 (1.9)
Total no. of participant with skin complaints	119 (88.1)	241 (93.4)	135 (99.3)	495 (93.6)
<i>Previous skin diagnosis [n (%)]</i>				
Psoriasis	0	5 (1.9)	0	5 (0.9)
Eczema (atopic dermatitis)	10 (7.4)	26 (10.1)	18 (13.2)	54 (10.2)
Acne	30 (22.2)	53 (20.5)	43 (31.6)	126 (23.8)
Seborrheic dermatitis	0	0	3 (2.2)	3 (0.6)
Alopecia	0	0	0	0
Urticaria	0	0	1 (0.7)	1 (0.2)
Vitiligo	0	1 (0.4)	0	1 (0.2)
Total	40 (29.6)	85 (32.9)	65 (47.8)	190 (35.9)

Table 2 shows the statistically significant difference in response rate between participants and non-participants with regard to gender or academic standing/years of study ($p=0.0001$ for both). The table shows that females participated in the study more than males. In addition, just over 58% of first year students and 51.9% of second year students participated in the study, more than other

students, while fifth year students (10.6%) participated least.

Perceived stress among medical students. The mean PSQ index for the group was 0.5 ± 0.16 (mode = 0.5, range = 0.11-0.93). The group was divided into LS, MS, and HS students. Least stressed students scoring was <25 th percentile; (n=135, mean=0.31, SD=0.06, PSQ

index <0.39); HS students scoring was >75th percentile (n=136, mean=0.71, SD=0.08, PSQ index >0.61); and MS students (n=258, mean=0.50, SD=0.06) (Table 3).

Age, gender, academic standing and school status were not equally distributed among the 3 perceived stress level groups ($p=0.0001$, $p=0.001$, $p=0.001$, and, $p=0.002$, respectively). Older age, female gender, during exam weeks, and fourth and fifth years of medical school were associated with the highest perceived stress levels (Table 1); thus, adjusted OR was calculated accordingly.

Most commonly self-reported skin complaints. Skin complaints among medical students are listed in Table 3. The most common skin complaints were loss of hair (67.2%), followed by pimples (63.1%), oily, waxy patches on scalp and/or flakey scalp (dandruff) (49.5%), and itchy skin (40.5%). Warts (9.5%) were the least cited complaint. When compared to LS students, HS students suffered from significantly more oily, waxy patches on scalp and/or flakey scalp (or dandruff), dry/sore rash, warts, pimples, itchy skin, itchy rash on their hands, hair loss, pull-out their own hair, scaly skin, troublesome sweating, nails biting, and other rashes on their face (Table 4).

Number of self-reported skin complaints for each student. In HS group, students had several skin complaints that were "5 complaints" (19.1%), followed by 6 and 4 complaints (17.6% and 12.5%, respectively), which is more than that in MS and LS groups (Table 3).

Previously diagnosed dermatological diseases. Previous skin diagnoses are shown in Table 3. The most frequent diagnoses were acne (23.8%) and eczema (10.2%), both of which were the most frequent

diagnoses in the HS group (31.6% and 13.2%, respectively). Seborrheic dermatitis was only reported in the HS group. No statistically significant differences were noted between highly stressed and least stressed students in respect to previous skin diagnoses.

Discussion. The present study further supports the strong relationship between high stress perception and common skin conditions. Highly stressed medical students had higher prevalence of oily, waxy patches on scalp and/or flakey scalp (dandruff), dry/sore rash, itchy skin, itchy rash on their hands, and hair loss, warts, and acne. They also pull-out their own hair, bite their nails, and report troublesome sweating more frequently than less stressed medical students. Furthermore, the number of skin complaints by each highly stressed students were higher than less stressed students. Therefore, various common skin conditions could appear in context of psychological stress among medical students.

Our findings agree with Schut et al⁴⁰ who reported on PS and skin symptoms in American undergraduate college students. Schut et al⁴⁰ demonstrated that heightened stress levels are associated with pruritus, alopecia, oily/waxy/flaky patches on the scalp, hyperhidrosis, scaly skin, onychophagia, trichotillomania, and itchy rash on hands. Our findings also correlate well with other literature in this field.⁴¹⁻⁴⁶

Perceived stress has a greater effect than the stressful event itself. When people face the same stressful situation, they may react differently. Psychological characteristics, personality, and previous experiences are likely to influence an individual's perception

Table 4 - Self-reported skin complaints among highly stressed compared to least stressed medical students.

Skin complaints	P-value	Crude OR (95% CI)	Adjusted OR (95% CI)
Itchy skin	≤0.0001	2.92 (1.77, 4.81)	2.76 (1.54- 4.93)
Dry/sore rash	≤0.0001	2.57 (1.52, 4.35)	4.04 (2.09-7.80)
Scaly skin	0.012	4.53 (2.62, 7.85)	4.36 (2.27-8.38)
Itchy rash on your hands	≤0.0001	1.85 (1.061, 3.223)	2.42 (1.12-4.85)
Pimples	≤0.0001	3.34 (1.977, 5.635)	2.92 (1.54,5.58)
Other rashes on your face	0.028	2.89 (1.627, 5.143)	4.74 (2.38-9.43)
Warts	≤0.0001	2.14 (1.023, 4.940)	3.00 (1.13-7.98)
Troublesome sweating	0.016	2.67 (1.586, 4.497)	2.94 (1.59,5.44)
Loss of hair	≤0.0001	2.99 (1.721, 5.218)	2.23 (1.16,4.30)
Oily, waxy patches on scalp and/or flakey scalp (or dandruff)	≤0.0001	4.43 (2.607, 7.220)	4.10 (2.23,7.56)
Bite your nails	0.028	1.49 (0.909, 2.449)	1.94 (1.07,3.49)
Pull-out your own hair	0.008	2.50 (1.475, 4.220)	2.29 (1.25,4.22)

OR - odds ration, CI - confidence interval

and appraisal of stressful situations and how well the individual adapts or copes with the stressor; thereby, influencing the magnitude, duration, and quality of the physiological reaction.⁴⁷⁻⁴⁹ The present study found that female gender had a higher perceived stress levels. This is consistent with previous reports demonstrating that female gender is especially affected by stress during daily routines and during schooling.^{37,50,51} We also found that during exam week's students suffer from more stress, which could be explained by exam fear, lack of study time, or sleep deprivation. Sleep deprivation is an intrinsic stressor that is increased in the modern lifestyle. Several studies revealed that sleep deprivation affects cognition,^{52,53} immune system,^{54,55} hormonal secretion, and metabolism.⁵⁶⁻⁵⁸ In contrast to Schut et al's³⁷ finding of no significant relationship between academic standing and the students PS levels, we found that the fourth and fifth years of medical school were associated with the highest perceived stress levels.

Being a medical student is a well-known risk factor for PS. Overall prevalence of stress among medical students in Saudi Arabia was 63.7% and severe stress was 25%,⁸ while the prevalence of stress was 31.2% in the United Kingdom,¹⁵ 29.6%-46.2% in Malaysia,^{19,21,23} 57% in Singapore,¹⁸ and 61.4% in Thailand.²²

More than 30% of dermatologic disorders are influenced by psychological and psychiatric factors.⁵⁹ An increasing number of studies have revealed that some skin diseases are caused, or exacerbated by, chronic PS, associated with certain personality traits, or a complication of psychiatric disorders.^{31,32,60} The role of PS has been described in a wide range of skin diseases, including atopic dermatitis, psoriasis, seborrhoeic dermatitis, urticaria, acne vulgaris, telogen effluvium, alopecia areata, pruritus, prurigo nodularis, and lichen planus.^{31-33,60-62}

There is a complex neuro-immuno-cutaneous-endocrine network that may mediate the interplay between PS and skin disorders. Upon PS exposure, 2 major neuroendocrine systems are activated: HPA axis and the autonomic nervous system (sympathetic and cholinergic). Psychological stress alters HPA axis hormones, in addition to the secretion of stress mediators including, neuropeptides and cytokine profiles. Therefore, PS influences the immune response.⁶ All cutaneous and skin-infiltrating cell of the immune system have receptors for stress mediators, that includes mast cells, langerhans cells, neutrophils, and eosinophils (the protagonists of innate immunity), as well as B and T cells (the protagonists of specific adaptive immunity).⁶³ Furthermore, there is a peripheral HPA axis in the skin that is equivalent to the central HPA axis.⁶ Therefore,

skin under stress releases inflammatory cytokines, and locally produces CRH, ACTH, and glucocorticoids, in addition to sprouting of substance P+ nerve fibers.⁶⁴ There is evidence that under chronic stress, the effects on the skin are complex and strongly caused by neuroendocrine and immune alterations that impair the ability of the skin to respond to environmental challenges. Humeral immunity predominates and there is a switch from innate nonspecific immunity and adaptive cellular, Th1-weighted response, to an adaptive Th2 profile. In addition to some errors in the specific immunity that may not properly distinguish "foreign" from "self", so it may target the body's own proteins, causing autoimmunity. Furthermore, mast cells seem to play a key role in excessive immunological responses to stress by triggering neurogenic inflammation.⁶³ These stress induced changes of the skin may play a role in the exacerbation of skin disease.

The main strength of the current study is the large population of surveyed medical students and the high response rate. The main limitation of this study is the use of a cross-sectional design, which does not allow for the determination of a causal relationship between the variables. Another limitation is the use of SSCQ rather than a dermatologist diagnosis. However, SSCQ is a validated instrument. This study highlights the importance of assessing common skin problems in medical students and their high association with stress. Dermatologists should be aware that these conditions could appear in context of emotional stress.

Acknowledgment. This study was supported by the College of Medicine Research Center, Deanship of Scientific Research, King Saud University, Riyadh, Kingdom of Saudi Arabia.

References

1. Steptoe A, Kivimäki M. Stress and cardiovascular disease. *Nat Rev Cardiol* 2012; 9: 360-370.
2. Rosenberg SL, Miller GE, Brehm JM, Celedón JC. Stress and asthma: novel insights on genetic, epigenetic, and immunologic mechanisms. *J Allergy Clin Immunol* 2014; 134: 1009-1015.
3. Qin HY, Cheng CW, Tang XD, Bian ZX. Impact of psychological stress on irritable bowel syndrome. *World J Gastroenterol* 2014; 20: 14126-14131.
4. Selye, H. The Stress of Life. New York: McGraw-Hill; 1956.
5. Cohen S, Janicki-Deverts D, Miller GE. Psychological stress and disease. *JAMA* 2007; 298: 1685-1687.
6. Kim JE, Cho BK, Cho DH, Park HJ. Expression of hypothalamic-pituitary-adrenal axis in common skin diseases: evidence of its association with stress-related disease activity. *Acta Derm Venereol* 2013; 93: 387-393.
7. Cohen S, Kessler RC, Gordon UL. Strategies for measuring stress in studies of psychiatric and physical disorder. In: Cohen S, Kessler RC, Gordon UL, editors. Measuring stress: A guide for health and social scientist. New York (NY): Oxford University Press; 1995. p. 3-26.

8. Abdulghani HM, AlKanhal AA, Mahmoud ES, Ponnampereuma GG, Alfari EA. Stress and its effects on medical students: a cross-sectional study at a college of medicine in Saudi Arabia. *J Health Popul Nutr* 2011; 29: 516-522.
9. Compton MT, Carrera J, Frank E. Stress and depressive symptoms/dysphoria among US medical students: results from a large, nationally representative survey. *J Nerv Ment Dis* 2008; 196: 891-897.
10. Radcliffe C, Lester H. Perceived stress during undergraduate medical training: a qualitative study. *Med Educ* 2003; 37: 32-38.
11. Bíró E, Balajti I, Adány R, et al. Determinants of mental well-being in medical students. *Soc Psychiatry Psychiatr Epidemiol* 2010; 45: 253-258.
12. Wong JG, Patil NG, Beh SL, Kósa K. Cultivating psychological well-being in Hong Kong's future doctors. *Med Teach* 2005; 27: 715-719.
13. Aktekin M, Karaman T, Senol YY, Erdem S, Erengin H, Akaydin M. Anxiety, depression and stressful life events among medical students: A prospective study in Antalya, Turkey. *Med Educ* 2001; 35: 12-17.
14. Dahlin M, Joneborg N, Runeson B. Stress and depression among medical students: a cross-sectional study. *Med Educ* 2005; 39: 594-604.
15. Firth J. Levels and sources of stress in medical students. *Br Med J (Clin Res Ed)* 1986; 292: 1177-1180.
16. Guthrie E, Black D, Bagalkote H, Shaw C, Campbell M, Creed F. Psychological stress and burnout in medical students: a five-year prospective longitudinal study. *J R Soc Med* 1998; 91: 237-243.
17. Guthrie EA, Black D, Shaw CM, Hamilton J, Creed FH, Tomenson B. Embarking upon a medical career: psychological morbidity in first year medical students. *Med Educ* 1995; 29: 337-341.
18. Ko SM, Kua EH, Fones CS. Stress and the undergraduates. *Singapore Med J* 1999; 40: 627-630.
19. Zaid ZA, Chan SC, Ho JJ. Emotional disorders among medical students in a Malaysian private medical school. *Singapore Med J* 2007; 48: 895-899.
20. Miller PM, Surtees PG. Psychological symptoms and their course in first-year medical students as assessed by the Interval General Health Questionnaire (I-GHQ). *Br J Psychiatry* 1991; 159: 199-207.
21. Sherina MS, Rampal L, Kaneson N. Psychological stress among undergraduate medical students. *Med J Malaysia* 2004; 59: 207-211.
22. Saipanish R. Stress among medical students in a Thai medical school. *Med Teach* 2003; 25: 502-506.
23. Yusoff MS, Abdul Rahim AF, Yaacob MJ. Prevalence and sources of stress among Universiti Sains Malaysia medical students. *Malays J Med Sci* 2010; 17: 30-37.
24. Michalec B, Keyes CL. A multidimensional perspective of the mental health of preclinical medical students. *Psychol Health Med* 2013; 18: 89-97.
25. Rotenstein LS, Ramos MA, Torre M, Segal JB, Peluso MJ, Guille C, et al. Prevalence of Depression, Depressive Symptoms, and Suicidal Ideation Among Medical Students: A Systematic Review and Meta-Analysis. *JAMA* 2016; 316: 2214-2236.
26. O'Sullivan RL, Lipper G, Lerner EA. The neuro-immunocutaneous-endocrine network: relationship of mind and skin. *Arch Dermatol* 1998; 134: 1431-1435.
27. Panconesi E, Hautmann G. Psychophysiology of stress in dermatology. The psychobiologic pattern of psychosomatics. *Dermatol Clin* 1996; 14: 399-421.
28. Lin TK, Man MQ, Santiago JL, Scharschmidt TC, Hupe M, Martin-Ezquerro G, et al. Paradoxical benefits of psychological stress in inflammatory dermatoses models are glucocorticoid mediated. *J Invest Dermatol* 2014; 134: 2890-2897.
29. Orion E, Wolf R. Psychological stress and epidermal barrier function. *Clin Dermatol* 2012; 30: 280-285.
30. Garg A, Chren MM, Sands LP, Matsui MS, Marenus KD, Feingold KR, et al. Psychological stress perturbs epidermal barrier homeostasis. *Arch Dermatol* 2001; 137: 53-59.
31. Abdulghani M, Alsamurai, Aljubori A. Association between stress and skin disease. *MEJIM* 2010; 3: 12-19
32. Basavaraj KH, Navya MA, Rashmi R. Relevance of psychiatry in dermatology: Present concepts. *Indian J Psychiatry* 2010; 52: 270-275.
33. Picardi A, Abeni D. Stressful life events and skin diseases: Disentangling evidence from myth. *Psychother Psychosom* 2001; 70: 118-136.
34. Levenstein S, Prantera C, Varvo V, Scribano ML, Berto E, Luzi C, et al. Development of the Perceived Stress Questionnaire: a new tool for psychosomatic research. *J Psychosom Res* 1993; 37: 19-32.
35. Montero-Marin J, Piva Demarzo MM, Pereira JP, Olea M, García-Campayo J. Reassessment of the psychometric characteristics and factor structure of the 'Perceived Stress Questionnaire' (PSQ): analysis in a sample of dental students. *PLoS One* 2014; 9: e87071.
36. Dalgard F, Svensson A, Holm JØ, Sundby J. Self-reported skin complaints: validation of a questionnaire for population surveys. *Br J Dermatol* 2003; 149: 794-800.
37. Dalgard F, Holm JØ, Svensson A, Kumar B, Sundby J. Self reported skin morbidity and ethnicity: a population-based study in a Western community. *BMC Dermatol* 2007; 7: 4.
38. Dalgard F, Svensson A, Sundby J, Dalgard OS. Self-reported skin morbidity and mental health. A population survey among adults in a Norwegian city. *Br J Dermatol* 2005; 153: 145-149.
39. Dalgard F, Svensson A, Holm JØ, Sundby J. Self-reported skin morbidity among adults: associations with quality of life and general health in a Norwegian survey. *J Investig Dermatol Symp Proc* 2004; 9: 120-125.
40. Schut C, Mollanazar NK, Sethi M, Nattkemper LA, Valdes-Rodriguez R, Lovell MM, et al. Psychological stress and skin symptoms in college students: Results of a cross-sectional web-based questionnaire study. *Acta Derm Venereol* 2016; 96: 550-551.
41. Raap U, Werfel T, Jaeger B, Schmid-Ott G. Atopic dermatitis and psychological stress. *Hautarzt* 2003; 54: 925-929.
42. Yosipovitch G, Tang M, Dawn AG, Chen M, Goh CL, Huak Y, et al. Study of psychological stress, sebum production and acne vulgaris in adolescents. *Acta Derm Venereol* 2007; 87: 135-139.
43. Yamamoto Y, Yamazaki S, Hayashino Y, Takahashi O, Tokuda Y, Shimbo T, et al. Association between frequency of pruritic symptoms and perceived psychological stress: a Japanese population-based study. *Arch Dermatol* 2009; 145: 1384-1388.
44. Verhoeven EW, de Klerk S, Kraaimaat FW, van de Kerkhof PC, de Jong EM, Evers AW. Biopsychosocial mechanisms of chronic itch in patients with skin diseases: a review. *Acta Derm Venereol* 2008; 88: 211-218.

45. Bae JM, Ha B, Lee H, Park CK, Kim HJ, Park YM. Prevalence of common skin diseases and their associated factors among military personnel in Korea: a cross-sectional study. *J Korean Med Sci* 2012; 27: 1248-1254.
46. Chiu A, Chon SY, Kimball AB. The response of skin disease to stress: changes in the severity of acne vulgaris as affected by examination stress. *Arch Dermatol* 2003; 139: 897-900.
47. Dyrbye LN, Thomas MR, Shanafelt TD. Medical student distress: causes, consequences, and proposed solutions. *Mayo Clin Proc* 2005; 80: 1613-1622.
48. Cömert A, Akbaş B, Kılıç EZ, Akın Ö, Gökçe E, Göktuna Z, et al. Psychiatric comorbidities and alexithymia in patients with seborrheic dermatitis: a questionnaire study in Turkey. *Am J Clin Dermatol* 2013; 14: 335-342.
49. Picardi A, Mazzotti E, Gaetano P, Cattaruzza MS, Baliva G, Melchi CF, et al. Stress, social support, emotional regulation, and exacerbation of diffuse plaque psoriasis. *Psychosomatics* 2005; 46: 556-564.
50. Giota J, Gustafsson JE. Perceived demands of schooling, stress and mental health: changes from grade 6 to grade 9 as a function of gender and cognitive ability. *Stress Health* 2016; 17: [Epub ahead of print]
51. Albuquerque RG, Rocha MA, Bagatin E, Tufik S, Andersen ML. Could adult female acne be associated with modern life? *Arch Dermatol Res* 2014; 306: 683-688.
52. Carskadon MA. Sleep's effects on cognition and learning in adolescence. *Prog Brain Res* 2011; 190: 137-143.
53. Killgore WD. Effects of sleep deprivation on cognition. *Prog Brain Res* 2010; 185: 105-129.
54. Ackermann K, Revell VL, Lao O, Rombouts EJ, Skene DJ, Kayser M. Diurnal rhythms in blood cell populations and the effect of acute sleep deprivation in healthy young men. *Sleep* 2012; 35: 933-940.
55. Ruiz FS, Andersen ML, Martins RC, Zager A, Lopes JD, Tufik S. Immune alterations after selective rapid eye movement or total sleep deprivation in healthy male volunteers. *Innate Immun* 2012; 18: 44-54.
56. Leproult R, Van Cauter E. Effect of 1 week of sleep restriction on testosterone levels in young healthy men. *JAMA* 2011; 305: 2173-2174.
57. Leproult R, Van Cauter E. Role of sleep and sleep loss in hormonal release and metabolism. *Endocr Dev* 2010; 17: 11-21.
58. Omisade A, Buxton OM, Rusak B. Impact of acute sleep restriction on cortisol and leptin levels in young women. *Physiol Behav* 2010; 99: 651-656.
59. Gupta MA, Gupta AK. Psychiatric and psychological co-morbidity in patients with dermatologic disorders: epidemiology and management. *Am J Clin Dermatol* 2003; 4: 833-842.
60. Orion E, Wolf R. Psychologic factors in the development of facial dermatoses. *Clin Dermatol* 2014; 32: 763-766.
61. Orion E, Wolf R. Psychological factors in skin diseases: stress and skin: facts and controversies. *Clin Dermatol* 2013; 31: 707-711.
62. Misery L, Touboul S, Vinçot C, Dutray S, Rolland-Jacob G, Consoli SG, et al. Stress and seborrheic dermatitis. *Ann Dermatol Venereol* 2007; 134: 833-837.
63. Peters EM. Stressed skin?-- a molecular psychosomatic update on stress-causes and effects in dermatologic diseases. *J Dtsch Dermatol Ges* 2016; 14: 233-252.
64. Arck PC, Slominski A, Theoharides TC, Peters EM, Paus R. Neuroimmunology of stress: skin takes center stage. *J Invest Dermatol* 2006; 126: 1697-1704.