

ORIGINAL ARTICLE

Acne relapses: impact on quality of life and productivity

B. Dreno,¹ C. Bordet,² S. Seite,³ C. Taieb,^{4,5,*} for the 'Registre Acné' Dermatologists

¹Department of Dermatology-Oncology, Hôtel-Dieu, Nantes University Hospital Centre, Nantes, France

²DATA CHAMP, Lyon, France

³La Roche-Posay Dermatological Laboratories, Levallois-Perret, France

⁴Scientific direction, European Market Maintenance Assessment, Fontenay-sous-Bois, France

⁵Public Health, Hôpital Necker Enfants Malades, AP-HP, Paris, France

*Correspondence: C. Taieb. E-mail: Charles.taieb@emma.clinic

Abstract

Background Acne is a common skin disease that mostly affects teenagers, with a negative impact on quality of life. Recently, adult acne and acne relapses have increased in frequency, for yet unknown reasons.

Objective This non-interventional, real-life study sought to investigate the rate of acne relapses and their impact on quality of life and productivity (loss/absenteeism) among teenagers and adults.

Methods An online self-administered questionnaire was proposed to ≥ 15 -year-olds suffering from acne who spontaneously consulted their dermatologist. To ensure homogeneous assessment of acne severity, the global acne severity scale was applied. Quality of life was assessed via Cardiff Acne Disability Index (CADi), SF12-physical score and SF12-mental score questionnaires. Productivity loss or absenteeism in middle/high school was estimated based on the number of days off work or school over the last 30 days.

Results Overall, 1048 questionnaires were considered assessable, with 448 (43%) mild acne, 434 (41%) moderate acne and 166 (16%) severe acne. Overall, 755 (72%) participants were in middle/high school, 267 (25%) employed and 26 (3%) with no professional activity. Considering the population by age groups, 68% ($n = 716$) were ≤ 20 -year-olds and 32% ($n = 332$) > 20 -year-olds, with a mean age of 20.26 (SD: 7.43) years. Acne relapses were reported by 44% of respondents. Analyses revealed that poorer quality of life scores was observed in acne relapsers vs. non-relapsers, with a significant difference for CADi scores ($P < 0.01$) in > 20 -year-olds. Acne-related absenteeism was recorded in 5.7% of cases. On multivariate analyses, after adjusting for other variables, acne relapse was proven a significant determinant of absenteeism/productivity loss.

Conclusion This real-life study first demonstrated acne relapse rates of 44%, which appeared to be generation-dependent, affecting 39.9% of ≤ 20 -year-olds vs. 53.3% of > 20 -year-olds. Acne relapses were significantly associated with impaired quality of life and productivity loss/absenteeism.

Received: 16 October 2018; Accepted: 3 December 2018

Conflicts of interest

The authors have no conflict of interest to declare.

Funding sources

The study was supported by La Roche-Posay Dermatological Laboratories. None of the industry professionals have contributed to the publication.

Introduction

Acne vulgaris, a chronic disease of the pilosebaceous follicle, causes non-inflammatory lesions like open or closed comedones, superficial inflammatory lesions like papules and pustules, and deep inflammatory lesions, namely nodules. Healing of acne often produces scarring. In the 'Objectifs Peau' study, published by the French Society of Dermatology (SFD), acne prevalence was 6.22% [95% CI: 5.89–6.56%] among > 15 -year-olds.¹ Acne

accounts for most of the consultations with dermatologists in France, with an ever-increasing number of relapses observed.^{2,3} Acne has long been considered a disease that mainly affects adolescents, though it may persist into adulthood, with a 60% prevalence of acne reported in women aged 20–29 years vs. 26% in those aged 40–49 years.⁴ In female adult acne, two acne types are distinguished depending on onset time: (a) 'persistent acne' is a disease continuation from adolescence, representing about

80% of adult acne cases; (b) 'late-onset acne' first presents at adulthood, representing about 20%.³ According to Yentzer *et al.*,⁵ one-third of all dermatology visits for acne in the United States are accounted for by women >25 years.

While a familial predisposition has been linked to more frequent acne relapses, possibly related to a genetic component,⁶ acne severity and response to treatment are impacted by numerous external factors. In a paper published in 2018, Dréno *et al.*⁷ proposed the concept of acne exposome defining the sum of all environmental factors influencing acne occurrence, duration and severity. These exposome factors may be classified into six categories as follows: nutrition, medication, occupational factors, pollutants, climatic factors, and psychological and lifestyle factors.

While acne is neither a devastating nor life-threatening condition, it is significantly linked to increased psychosocial burden, with major implications on patient quality of life and self-esteem.^{8–10} This skin condition is reported to shake the psyche of sufferers in a way comparable to that of chronic medical conditions like asthma, diabetes or epilepsy.¹¹

According to Gollnick *et al.*,¹² there is a widespread misunderstanding among both physicians and lay people, who generally perceive acne as a simple, self-limited affliction of adolescents. According to these authors, acne is not an acute condition but rather a chronic one in continuous change as to its severity and body distribution. Well-established findings have confirmed the benefit of applying topical retinoids as maintenance therapy, and if need there is, systemic therapy.^{13,14} These agents were shown to minimize the potential of relapse increasingly considered as being part of the natural acne history.¹⁵

With this background in mind, this survey sought to collect further information on acne relapses in a real-life setting and to investigate their impact on quality of life and productivity loss/absenteeism in a French observational cohort. Without being representative of the general French population from an epidemiological point of view, our cohort recruited patients spontaneously consulting private dermatologists in town areas for acne issues. Therefore, our patient population primarily consisted of adolescents and young adults.

Material and methods

This was an observational study in a real-life setting, being non-interventional and pragmatic in nature. It was registered as a 'MR003' trial. Overall, 600 French private dermatologists were invited to participate, 422 of whom accepted this invitation, with 213 actively recruiting patients. This study did not influence usual patient management, meaning that no examination or treatment was stipulated, and the physician's prescribing freedom was maintained, with no written informed consent required.

A self-administered digital questionnaire, created by the group of dermatologist and patient-reported outcome experts co-authoring this study, was proposed to patients aged

>15 years suffering from acne who spontaneously consulted their dermatologist, for a first consultation or follow-up. The survey's purpose was explained to all patients who were informed that participation was completely voluntary and that they may choose either not to participate or stop participating at any time, irrespective of their current or future management. There were no inclusion criteria regarding age, except the minimum age, nor were there any restrictions concerning acne age of onset, duration or severity. Acne diagnosis was established by the dermatologist of the respondent, as was the global acne severity (GEA) score.¹⁶

Tools: GEA scale

We chose the GEA scale for its being well-known to most dermatologists as a fast and simple evaluation of acne severity. It is a global validated scale based on both photographs and acne patients, with good agreement in investigators' acne assessments and suitable for France and Europe. This instrument enabled us to ensure accurate subgroup classification. The GEA scale was outlined on a participation card given to each patient, as illustrated in Table 1. Patients with Grade 1 or 2 were categorized as 'mild acne', those with Grade 3 'moderate acne' and those with Grade 5 and 6 as 'severe acne'. The GEA scale was completed by the dermatologist, with subjects scoring 0 excluded from analysis.

Quality of life was assessed using the following two distinct questionnaires: the first one specific to acne [Cardiff Acne Disability Index (CADI)], and the second one non-specific (SF12).

The CADI is a short questionnaire featuring five questions,¹⁷ designed for adolescents and young adults suffering from acne. Being self-explanatory, it can be distributed to the patient to be filled out without requiring detailed explanations, typically taking just 1 min to complete.

The SF12 is a short version of the SF-36, namely a generic quality of life tool,¹⁸ which is widely employed in current practice and calculates two scores: a mental quality of life score (MS) and physical quality of life score (PS).

Table 1 Grading criteria for acne severity [global acne severity scale (GEA scale)]

0	No lesion	Residual pigmentation and erythema might be present
1	Almost no lesions	Sparse open or closed comedones and papules
2	Mild	Easily identifiable; less than half of the face affected. A few open or closed comedones and papulo-pustules
3	Moderate	More than half of the face affected; numerous papulo-pustules, numerous open or closed comedones, one nodule might be present
4	Severe	Whole face affected, covered with numerous papulo-pustules, open or closed comedones and few nodules
5	Very severe	Highly inflammatory acne covering the whole face, with nodules

Loss of productivity

In health economics, it is usual to measure the resources consumed over short time periods to ensure data quality, despite risking data fragility and integrity as to the memory of subjects responding to the questionnaire. Collected data are then extrapolated to 12 months or to the target population concerned. For our research, we selected a 30-day period in reference to which the subjects were questioned about their absence at work/school, absences being specifically accounted for by acne.

Acne relapses

When the subject answered the question 'Do you have the impression that your acne reappears at regular intervals' with 'Yes', relapse was deemed confirmed. If so, details on relapse frequency, location and intensity were retrieved.

Statistical analyses

The number of patients for each categorical variable was recorded according to acne severity, namely mild, moderate or severe, assessed by the dermatologist.

Continuous variables were expressed as mean \pm SD and confidence intervals for each group, along with test *P*-values for differences between severe and mild-moderate groups. The *P*-values testing paired data for differences comparing mild with moderate, then moderate with severe acne, were likewise recorded. A multivariate analysis was performed using stepwise regression (backward elimination), with an initial selection of all variables with partial *t*-test *P*-values <0.20 .

Results

Patient population

Overall, 1055 questionnaires were collected, five of whom scored 0, with accordingly no lesions; in two other questionnaires, $<1\%$ was filled in; these seven questionnaires were deemed unassessable. Consequently, 1048 questionnaires were considered assessable, with 716 (68%) pertaining to ≤ 20 -year-olds and 332 (32%) to >20 -year-olds. The patient socio-demographical characteristics are outlined in Table 2. The responders were categorized based on GEA scores, assessed by the dermatologist: 448 (43%) suffering from mild acne, 434 (41%) from moderate acne and 166 (16%) from severe acne. Acne severity distribution by age group is detailed in Table 3.

Acne relapses

In answer to the question 'Do you have the impression that your acne reappears at regular intervals', 463 (44%) responders declared their acne reappeared vs. 566 (54%) stating the opposite, while 19 (2%) provided no answer. The mean age in years of the acne relapse group was significantly higher ($P < 0.0001$) than that of the non-relapse group, namely 21.32 ± 7.72 (CI: 20.62–22.04) vs. 19.38 ± 6.95 (CI: 18.8–19.96).

Table 2 Patient demographics and acne characteristics depending on acne severity evaluated by the dermatologist

	Mild acne (n = 448)	Moderate acne (n = 434)	Severe acne (n = 166)	<i>P</i> -value
Demographic characteristics				
Gender				
Female	351 (78)	324 (75)	95 (57)	<0.001
Male	97 (22)	110 (25)	71 (43)	—
Weight				
Mean	58.7 (11.6)	59.7 (12.1)	60.4 (9.7)	0.16
CI	[57.6–59.7]	[58.5–60.8]	[58.9–61.9]	—
<i>P</i> -value		0.20	0.47	—
Professional status				
Professional activity	132 (29)	97 (22)	38 (23)	0.37
Middle/high school	307 (69)	323 (74)	125 (75)	0.71
Age				
Mean	21.2 (8.5)	19.7 (6.6)	19.4 (6.1)	0.07
CI	[20.4–22]	[19–20.3]	[18.5–20.4]	—
<i>P</i> -value		<0.01	0.69	—
Disease duration				
Mean	6.7 (7.4)	0.7 (98.4)	6 (5.7)	0.35
CI	[6–7.4]	[–8.8 to 10.2]	[5.1–6.9]	—
<i>P</i> -value		0.22	0.27	—
Acne localization				
Acne on the face				
Yes	442 (98.9%)	431 (99.6%)	165 (99.4%)	0.79
Acne on the trunk				
Yes	158 (35.4%)	222 (50.8%)	96 (57.8%)	<0.001

Table 3 Acne severity by age group

	≤ 20 -year-olds n = 716	>20 -year-olds n = 332
Mild acne	39.39% (n = 282)	50.00% (n = 166)
Moderate acne	43.72% (n = 313)	36.45% (n = 121)
Severe acne	16.90% (n = 121)	13.55% (n = 45)

The relapse prevalence in ≤ 20 -year-olds was 39% vs. 50% in >20 -year-olds, the difference being statistically significant. Of those reporting relapses, regardless of their acne severity, 92.4% declared having suffered from several relapses within the year, with 74.1% reporting the same location and 66.1% the same severity. Details on relapse frequency, location and severity assessed by the patient are presented in Table 4, in relation to acne severity assessed by the physician, and to age group.

While suffering acne relapse, 35.2% of patients expressed a feeling of fatality and 31.7% of anger, while 17.9% reported no strong feelings. Among the latter, 27% were mild acne sufferers vs. 8% severe acne sufferers. Overall, 67% of patients declared their acne had left marks, 37% it had left scars and 24% it had left both. Among those suffering from marks or scars, 39.10%

Table 4 Acne relapses recorded by the patient according to acne severity assessed by the dermatologist and to age group

	Patient population of ≤20-year-olds			P-value
	Mild acne 39.39% (n = 282)	Moderate acne 43.72% (n = 313)	Severe acne 16.90% (n = 121)	
Relapse declared				
Yes	107 (39%)	134 (44%)	45 (38%)	0.48
Frequency of relapse				
About once a year	4 (4%)	5 (4%)	3 (7%)	—
Several times a year	103 (96%)	128 (96%)	42 (93%)	0.37
Relapse location				
Mostly in different areas	5 (5%)	8 (6%)	0 (0)	0.04
Mostly in the same area	87 (81%)	94 (70%)	28 (62%)	0.01
Relapse intensity				
Same intensity	75 (70%)	89 (66%)	21 (47%)	—
Less and less severe	20 (19%)	16 (12%)	5 (11%)	0.88
More and more severe	12 (11%)	29 (22%)	19 (42%)	<0.001
Acne leave marks				
Yes	71 (66%)	90 (67%)	31 (69%)	0.78
Acne leave scars				
Yes	28 (26%)	45 (34%)	26 (58%)	<0.001
	Patient population of >20-year-olds			P-value
	Mild acne 50.00% (n = 166)	Moderate acne 36.45% (n = 121)	Severe acne 13.55% (n = 45)	
Relapse declared				
Yes	81 (50%)	66 (55%)	30 (67%)	0.07
Frequency of relapse				
About once a year	5 (6%)	7 (11%)	1 (3%)	0.45
Several times a year	73 (90%)	53 (80%)	29 (97%)	0.21
Relapse location				
Mostly in different areas	6 (7%)	6 (9%)	3 (10%)	0.91
Mostly in the same area	63 (78%)	50 (76%)	21 (70%)	0.46
Relapse intensity				
Same intensity	66 (81%)	46 (70%)	9 (30%)	—
Less and less severe	5 (6%)	7 (11%)	1 (3%)	0.97
More and more severe	10 (12%)	13 (20%)	20 (67%)	<0.001
Acne leave marks				
Yes	55 (68%)	45 (68%)	20 (67%)	0.88
Acne leave scars				
Yes	31 (38%)	25 (38%)	17 (57%)	0.06

reported they did not know what to do. Details on the patient's perception about relapses, and on the presence of acne leave marks and acne leave scars are provided in Table 4, according to acne severity assessed by the physician, and to age group.

When looking at relapse, marks and scars these were significantly more frequent in women than in men. In addition, in women who describe a late-onset acne (≥ 20 years), a relapse rate of 62% was declared (details are given in Table 5).

Quality of life and productivity loss

In the >20-year-olds, significant differences in mean CADI scores were observed between acne relapse and non-relapse

Table 5 Acne relapses recorded by the patient according to sex

	Male (n = 278)	Female (n = 770)	P-value	Female late-onset acne (n = 64)
Relapse	104 (37.41%)	359 (46.62%)	0.004	40 (62.5%)
Acne leave marks	59 (56.73%)	253 (70.47%)	0.0042	34 (85%)
Acne leave scars	29 (27.88%)	143 (39.83%)	<0.0000	22 (55%)

patients: 6.6 ± 3.4 (6.1–7.2) vs. 5.6 ± 3.5 (5–6.2) ($P < 0.01$). No difference was noted in the ≤ 20 -year-old group (Table 6).

Table 6 Quality of life scores among patients depending on age group and declared relapse status

	≤20-year-olds			>20-year-olds		
	No relapse	Relapse	P-value	No relapse	Relapse	P-value
SF12-PS						
Mean ± SD	57.3 ± 5.4	56.6 ± 4.9		55.8 ± 6.3	55.4 ± 7.1	—
CI	[56.8–57.9]	[56–57.2]	ns	[54.8–56.9]	[54.4–56.5]	ns
SF12-MS						
Mean ± SD	43.4 ± 10.8	42.3 ± 10.8		40.8 ± 11.3	39.1 ± 10.5	—
CI	[42.4–44.5]	[41–43.5]	ns	[39–42.7]	[37.5–40.7]	ns
CADI						
Mean ± SD	4.8 ± 3.3	5.2 ± 3.2		5.6 ± 3.5	6.6 ± 3.4	—
CI	[4.5–5.2]	[4.8–5.6]	ns	[5–6.2]	[6.1–7.2]	<0.01

CADI, Cardiff Acne Disability Index; CI, confidence interval; SF12-MS, SF12 mental score; SF12-PS, SF12 physical score.

Table 7 shows that in the ≤20-year-olds, mean SF12 mental scores significantly differed ($P = 0.001$) between subjects complaining of acne leave marks or scars (41.10 ± 10.97 [39.6–42.6]) and those who did not (45.63 ± 9.39 [43.4–47.9]). No such difference was found in >20-year-olds. Significantly, more-altered mean CADI scores were recorded when comparing subjects complaining of acne leave marks or scars vs. those with no such complaints, irrespective of the age group (<0.001).

Overall, 59 (5.7%) patients reported having been absent from work/school, with a significant rate difference between relapse and non-relapse patients (6.6% vs. 3.6%; $P < 0.01$) (Table 8). In patients with absenteeism, absenteeism duration was 1.9 days in relapse patients vs. 1.3 days in non-relapse patients, with a statistically significant difference ($P = 0.04$).

In the ≤20-year-old group, 4.8% reported absenteeism, with a significant difference between relapse and non-relapse patients (6.64% vs. 3.66%; $P < 0.01$; Table 7). In patients declaring relapses, absenteeism duration over the last 30 days tended to be longer in relapse vs. non-relapse patients, without statistically significant difference.

In the >20-year-old group, 7% reported absenteeism, with a significant difference between relapse and non-relapse patients (11.3% vs. 2.0%; $P < 0.001$; Table 7). In patients declaring

relapses, absenteeism duration over the last 30 days was significantly longer in relapse vs. non-relapse patients (2.1 days vs. 1 day, $P < 0.01$).

Upon multivariate analysis, acne relapse was a significant determinant of absenteeism/productivity loss. After adjusting for other variables, such as acne intensity, the ‘relapse’ factor remained a significant determinant in the model.

Discussion

The ‘Objectifs Peau’ study, recently conducted by the French Society of Dermatology (SFD), was the first to clearly reveal that work absenteeism occurred for all acne severity levels, in France. Our observational data thus confirm the ‘Objectifs Peau’ findings, with 5.7% of our cohort reporting absenteeism from work/school. Another key finding revealed by our study was the determinant impact of acne relapse on both quality of life and absenteeism in the two population subtypes.

Very few studies have been focused on acne relapses, along with their link to absenteeism and productivity loss in both teenager and adult acne patients. There is thus an enormous acne apprehend acne relapses, which occurred at high rates, namely in 44% of cases.

Table 7 Quality of life scores among patients with acne leave marks or scars

	≤20-year-olds			>20-year-olds		
	With acne leave marks or scars	Without acne leave marks or scars	P-value	With acne leave marks or scars	Without acne leave marks or scars	P-value
SF12-PS						
Mean ± SD	56.39 ± 5.13	57.11 ± 4.17		55.40 ± 7.26	55.48 ± 6.42	—
CI	[55.7–57.1]	[50.1–58.1]	ns	[54.2–56.7]	[53.3–57.8]	ns
SF12-MS						
Mean ± SD	41.10 ± 10.97	45.63 ± 9.39		38.83 ± 10.64	40.11 ± 9.76	—
CI	[39.6–42.6]	[43.4–47.9]	0.001	[37.0–40.7]	[36.8–47.4]	ns
CADI						
Mean ± SD	5.71 ± 3.26	3.68 ± 2.69		7.04 ± 3.46	5.16 ± 2.90	—
CI	[5.3–6.2]	[3.1–4.3]	<0.001	[6.5–7.6]	[4.2–6.1]	<0.001

CADI, Cardiff Acne Disability Index; CI, confidence interval; SF12-MS, SF12 mental score; SF12-PS, SF12 physical score.

Table 8 Absenteeism prevalence depending on age group and declared relapse status

	Global	No relapse	Relapse	P-value
Absence over the last 30 days		<i>n</i> = 537	<i>n</i> = 433	—
n	59	18	41	<0.01
%	5.7%	3.66%	6.64%	—
Average number of missed days among subjects reporting an absence				
Mean ± SD	1.73 ± 1.31	1.92 ± 1.49	1.33 ± 0.68	—
CI	[1.4–2.1]	[1.4–1.8]	[1.0–1.7]	0.04
≤20-year-olds				
		No relapse	Relapse	P-value
Absence over the last 30 days		3.66%	6.64%	<0.01
Average number of missed days among subjects reporting an absence				
Mean ± SD		1.4 ± 0.73	1.74 ± 1.37	ns
CI		[1.0–1.8]	[1.1–2.4]	—
>20-year-olds				
		No relapse	Relapse	P-value
Absence over the last 30 days		0.02	0.11	<0.01
Average number of missed days among subjects reporting an absence				
Mean ± SD		1 ± 1	2.1 ± 1.61	<0.01
CI		[1–1]	[1.3–2.8]	—

CI, confidence interval.

Another interesting observation was that 73% of respondents were women, whereas this female predominance was not reported by most epidemiological studies, at least not in teenagers. This high female prevalence in our cohort may be, at least partially, explained by several factors. Firstly, we essentially approached dermatologists working in town areas, which may account for more female participants, as more women in town vs. rural areas tend to consult a dermatologist. Secondly, female patients may be more keen to fill in questionnaires, as they tend to be more interested in health and beauty issues. This interpretation is reinforced by the observation that among patients with severe acne, the gender ratio appeared to be more balanced (57% vs. 43%).

Another essential finding was the impact of acne recurrence on patient quality of life, with CADI scores significantly altered in relapse vs. non-relapse patients, especially among the >20-year-olds. Additionally, quality of life expressed by SF12 mental and CADI scores was significantly altered among patients with acne leave marks and scars, regardless of the age group. Several studies have previously reported high emotional and social distress levels in acne patients comparable to those recorded in patients with chronic disabling conditions like psoriasis, epilepsy or arthritis.^{19,20}

Another crucial finding coming out of our analysis is that acne relapse significantly impacts absenteeism/productivity loss, with a statistically significant difference between relapse and non-relapse patients in both the overall patient population and the two age groups. It must be emphasized that, independently of acne severity and other variables, those suffering from relapses were found more likely to miss work/school.

While the difference in the number of days out of work/school, namely 1.9 days vs. 1.7 days, may seem anecdotal at first glance, this is a wrong perception that must be corrected. We have to keep in mind that the number of days off work/school in our survey refers only to the last 30 days prior to survey participation that only involves a very small sample. Extrapolated to the entire French population over 15 years of age affected by acne, notably 3.3 million French citizens according to 'Objectifs Peau', 188 000 French citizens would likely suffer from acne recurrences.¹ In Metropolitan France, the total number of days lost on account of acne relapses would total 350 000 days.

This highlights the need to appropriately manage acne patients, even those with 'only' mild-to-moderate acne. Of note is that acne severity in our survey was established by the dermatologist in charge using a widely-accepted scale, which is another study strength. To end with, this survey should only be considered an initial step in further assessing acne relapse rates, along with their significant impact on quality of life and productivity loss/absenteeism. Further research on acne relapses should focus on better characterizing the group of patients who experience more psychological distress or absenteeism, and possibly require further assistance by a mental healthcare professional.

References

- Richard MA, Corgibet F, Beylot-Barry M *et al.* Sex- and age-adjusted prevalence estimates of five chronic inflammatory skin diseases in France: results of the «OBJECTIFS PEAU» study. *J Eur Acad Dermatol Venereol* 2018; **32**: 1967–1971. <https://doi.org/10.1111/jdv.14959>.

- 2 Dréno B. Recent data on epidemiology of acne. *Ann Dermatol Venereol* 2010; **168**: 474–485.
- 3 Dréno B, Layton A, Zouboulis CC *et al.* Adult female acne: a new paradigm. *J Eur Acad Dermatol Venereol* 2013; **27**: 1063–1070.
- 4 Collier CN, Harper JC, Cafardi JA *et al.* The prevalence of acne in adults 20 years and older. *J Am Acad Dermatol* 2008; **58**: 56–59.
- 5 Yentzer BA, Hick J, Reese EI, Uhas A, Feldman SR, Balkrishnan R. Acne vulgaris in the United States: a descriptive epidemiology. *Cutis* 2010; **86**: 94–99.
- 6 Di Landro A, Cazzaniga S, GISED Acne Study Group *et al.* Family history, body mass index, selected dietary factors, menstrual history, and risk of moderate to severe acne in adolescents and young adults. *J Am Acad Dermatol* 2012; **67**: 1129–1135.
- 7 Dréno B, Bettoli V, Araviiskaia E, Sanchez Viera M, Bouloc A. The influence of exposome on acne. *J Eur Acad Dermatol Venereol* 2018; **32**: 812–819.
- 8 Do JE, Cho SM, In SI, Lim KY, Lee S, Lee ES. Psychosocial aspects of acne vulgaris: a community-based study with Korean adolescents. *Ann Dermatol* 2009; **12**: 125–129.
- 9 Dunn LK, O'Neill JL, Feldman SR. Acne in adolescents: quality of life, self-esteem, mood, and psychological disorders. *Dermatol Online J* 2011; **17**: 1.
- 10 Tasoucla E, Gregoriou S, Chalikias J *et al.* The impact of acne vulgaris on quality of life and psychic health in young adolescents in Greece. Results of a population survey. *An Bras Dermatol* 2012; **87**: 862–869.
- 11 Shuster S, Fisher GH, Harris E, Binnell D. The effect of skin disease on self image. *Br J Dermatol* 1978; **99**: 18–19.
- 12 Gollnick HP, Finlay AY, Shear N; Global alliance to improve outcomes in acne. Can we define acne as a chronic disease? If so, how and when? *Am J Clin Dermatol* 2008; **9**: 279–284.
- 13 Nast A, Dréno B, Bettoli V *et al.* European evidence-based (S3) guidelines for the treatment of acne. *J Eur Acad Dermatol Venereol* 2012; **26**: 1–29.
- 14 Layton AM, Dreno B, Gollnick HP, Zouboulis CC. A review of the European Directive for prescribing systemic isotretinoin for acne vulgaris. *J Eur Acad Dermatol Venereol* 2006; **20**: 773–776.
- 15 Morales-Cardona CA, Sánchez-Vanegas G. Acne relapse rate and predictors of relapse following treatment with oral isotretinoin. *Actas Dermosifiliogr* 2013; **104**: 61–66.
- 16 Dréno B, Poli F, Pawin H *et al.* Development and evaluation of a Global Acne Severity Scale (GEA Scale) suitable for France and Europe. *J Eur Acad Dermatol Venereol* 2011; **25**: 43–48.
- 17 Motley RJ, Finlay AY. Practical use of a disability index in the routine management of acne. *Clin Exp Dermatol* 1992; **17**: 1–3.
- 18 Lim LL, Fisher JD. Use of the 12-item short-form (SF-12) health survey in an Australian heart and stroke population. *Qual Life Res* 1999; **8**: 1–8.
- 19 Mallon E, Newton JN, Klassen A, Stewart-Brown SL, Ryan TJ, Finlay AY. The quality of life in acne: a comparison with general medical conditions using generic questionnaires. *Br J Dermatol* 1999; **140**: 672–676.
- 20 Lasek RJ, Chren MM. Acne vulgaris and the quality of life of adult dermatology patients. *Arch Dermatol* 1998; **134**: 454–458.