

INVESTIGATIVE REPORT

Stigmatisation, Avoidance Behaviour and Difficulties in Coping are Common Among Adult Patients with Vitiligo

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Vitiligo is a non-contagious skin disorder with loss of pigmentation, often impairing patients' well-being. This study used Dermatology Life Quality Index (DLQI), Adjustment to Chronic Skin Disorders Questionnaire (ACS), Beck Depression Inventory (BDI) and additional questions to explore quality of life (QoL), coping, depression and stigmatisation and included 96 patients with vitiligo and 23 controls. Stigmatisation was common: 87/96 patients (90%) reported questions/approaches, 23/96 (24%) experienced nasty comments. Sixty-four out of 96 (66.7%) had avoided situations because of vitiligo or concealed their white spots. Sixty patients (62.5%) implied psychological stress as influential on disease's course. Patients scored higher in all questionnaires than controls (DLQI=4.9/1.6, ACS-social anxiety/avoidance =36.9/22.1, ACS-helplessness=27.3/16.0, ACS-anxious-depressive mood=19.4/15.6), except BDI (6.8/7.3). QoL of 65 patients (67.7%) was hardly impaired, 70 (72.9%) were not depressed. Treatment with pro-pseudocatalase PC-KUS reduced social anxiety/avoidance, anxious-depressive mood and depression. Patients without low-key stigmatisation scored highest in DLQI and social anxiety/avoidance. Avoidance and concealing behaviour correlated with all questionnaires' scores. *Key words: vitiligo; quality of life; coping; depression; stigmatisation; avoidance behaviour.*

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Vitiligo is an acquired, non-contagious, worldwide common skin disease, characterised by the patchy loss of the inherited skin and hair colour, often running in families (1, 2). The disease does not discriminate between genders, age groups or skin colours. The exact cause remains unknown. Several hypotheses have tried to explain the sudden loss of functioning melanocytes, including autoimmunity, oxidative stress, neural or genetic mechanisms (3–7). Some triggering factors have been identified, including hormonal changes and injuries or

emotional stress (2, 8, 9). The prevalence in the general population ranges from 0.04 to 2.1% (10).

The psychological status of patients with the disease has often been investigated. A number of publications showed that affected individuals suffer from feelings of disfigurement and psychological disturbance (11), anxiety (12), depression (13), impaired self-esteem (14) or quality of life (QoL) (14, 15) (including that of their relatives (16)), paranoia (17), embarrassment (18), sleep disturbances (19) and limited personal or sexual relationships (20, 21). However, the published findings are not always in agreement, for example depression and anxiety are sometimes equally prevalent in patients and healthy controls (22–24). Experiences of stigmatisation are very common. Almost 90% of patients have been asked questions about their white spots by strangers (25), 66% described staring at them (18), almost 50% experienced rude remarks (25, 26) and 8–13% reported discrimination at work (18, 27). Importantly, the knowledge about children's life with this disease has greatly improved (28–32). Recently our own data showed that stigmatisation was highly significant on well-being of youngsters, often leading to an impaired QoL, avoidance of situations or concealing of the white spots (33). Interestingly, friendships with other children remained unaffected. In summary, vitiligo can have a negative and devastating short- and long-term effect on the course of patients' life (25, 34).

While there are a number of publications available on QoL, coping with vitiligo as a chronic skin disease is lacking in-depth investigation. To date there are only a few reports available (12, 35–38), some of them in German and with limitations¹. Research on coping, using social anxiety/avoidance, helplessness and anxious-depressive mood as indicators could introduce some new aspects into the field. In a survey, 1,023 German patients with vitiligo rated reduction of helplessness as one of their most important objectives (39). Moreover, as there is no agreement on the role of depression or

¹Jecht and Rehme used the same patient population as Schmid-Ott et al. ($n=363$) of a hospital at Castle Friedenburg/Germany; Rehme's work is an unpublished medical thesis; Cordalija used a group mixed of vitiligo and psoriasis patients. Unfortunately, some of the results are only stated for the total group and not separated for each disease.

anxiety, we wished to add more data on these topics. Therefore, our main aims for this study were exploration of QoL, coping and depression in adults with vitiligo and to compare the results with those of healthy adults.

METHODS

This controlled, questionnaire-based and cross-sectional study was carried out in agreement with the Helsinki declaration and the local Ethics Committee. All participants signed formal consent and answered the questions before seeing the doctor at the Institute for Pigmentary Disorders (IFPD).

Study instruments

Three validated questionnaires were utilised. The Dermatology Life Quality Index (DLQI) is widely used in many skin diseases (40). It contains 10 items and measures the impact of skin diseases on essential parts of the daily life over the past 7 days. Each item offers 4 possible answers: not at all/not relevant (scores 0), a little (1), a lot (2) and very much (3). The highest possible score is 30. High scores correlate with more impaired QoL (41).

The Adjustment to Chronic Skin Disorders Questionnaire (ACS) consists of 51 items and focuses on coping with chronic skin diseases (12, 42). We used 3 of the 4 main scales: Social Anxiety/Avoidance (15 items), Helplessness (9 items) and Anxious-Depressive Mood (8 items). We excluded the Itch-scratch-circle due to its irrelevancy for vitiligo. Every item contains a statement and 5 possibilities to agree: 1: not at all, 2: hardly ever, 3: quite right, 4: mostly and 5: totally. Sums can be compared with scores from the manual or literature (42). Increased scores in Social Anxiety/Avoidance (>49) indicate fear of situations where negative reactions to the skin disease are expected and also feelings of loss of attractiveness or even disfigurement. Helplessness describes feelings of loss of control regarding the disease course including hypochondriac concerns (scores >36). Anxious-Depressive Mood indicates symptoms of an adjustment disorder (scores >24) (12, 42).

Since depression has been linked to vitiligo (18, 43), we included the Beck Depression Inventory (BDI) which contains 21 items. Each offers 4 different statements scoring 0–3. The total sum can be compared with cut-off scores indicating the severity of depression: 0–9: no depression, 10–18: mild to moderate, 19–29: moderate to severe, and 30–63: severe depression (44).

Nineteen additional questions aimed at socio-demographic (age, sex, skin phototype, leisure time activities) and vitiligo-related information (duration, age at disease onset, affected body areas, family history, disease status, influential factors, stigmatisation experiences, behaviour patterns).

Statistical analysis

Statistical analysis was performed using the independent sample *t*-test (Student's *t*-test) to measure differences between means of 2 groups within the population. For more than 2 groups, the one-way ANOVA test was first of choice. The Pearson correlation analysis was utilised for linear correlation between 2 variables, whereas it was the Pearson χ^2 -test for measuring differences in distribution within sub-sets of the study population. To perform the mentioned tests, we used IBM SPSS 21.0 (IBM Corp., Armonk, New York/USA).

Patients

All patients ($n=96$), booked for an appointment at the IFPD in Greifswald/Germany, from beginning of September to end of

December 2012, were asked to participate in the study, all of whom agreed. Patients originated from 5 continents, providing an overall ethnically and culturally diverse study group.

Controls

We included 23 healthy controls, most often relatives or friends accompanying the patients during their appointments (13 males, 10 females, mean age 42.5 years, range 31–58 years). Seventeen of them had skin phototypes I–III (77.3%) and 5 had IV–VI (22.7%). There were no statistically significant differences between patients and controls regarding mean age, distribution of skin phototype groups I–III/IV–VI and gender (all $p>0.05$, *t*-test and χ^2 -test, respectively).

RESULTS

Patients' socio-demographic and disease-related features

The mean age of the study group was 41.7 years (range 18–67 years). The group included 35 males and 61 females (36.5% vs. 63.5%). The majority of patients had fair skin (skin phototypes I–III, Fitzpatrick classification; $n=81/84.4\%$), 15 patients had dark skin (skin phototype IV–VI/15.6%). Fifty-four patients were seen at the IFPD for the first time, the remaining 42 were follow-ups undergoing treatment with pro-pseudocatalase PC-KUS for at least one year (45).

Basic features

Mean duration of vitiligo was 17.4 years (range 1–51 years). The disease onset happened at a mean age of 24.1 years (range 1–62 years). Twenty-six patients (27.1%) reported other family members with vitiligo, most often the father ($n=5/26$, 5.2%), then grandmother ($n=4/26$, 4.2%), uncle ($n=3/26$, 3.1%), mother, brother (each $n=2/26$, 2.1%) and cousin ($n=1/26$, 1.0%). Moreover, some combinations were documented, including great-grandmother/father, uncle/cousin, son/daughter, mother/aunt (each $n=2/26$, 2.1%) and grandmother/brother ($n=1/26$, 1.0%).

Localisation and status of vitiligo

Affected body areas were head ($n=85/96$, 88.5%), followed by hands ($n=80/96$, 83.3%), arms ($n=73/96$, 76.0%), legs ($n=72/96$, 75.0%), trunk ($n=68/96$, 70.8%) and neck ($n=55/96$, 57.3%). Nobody reported only one affected body site. In the entire group of new patients, 44/54 (81.5%) reported worsening of their vitiligo while 10/54 (18.5%) described a stable/unchanging disease for at least 6 months. None of the treated patients ($n=42$) had progressing vitiligo after one year of treatment with NB-UVB activated pro-pseudocatalase PC-KUS, 21 patients (50.0%) described a stabilised disease, while 21/42 (50.0%) documented good repigmentation. Notably, all patients with stabilised disease had progressing vitiligo before undergoing treatment, a result based on assessing patients' charts from their first appointment.

Frequency of Koebner phenomenon and hair greying

Physical traumata (e.g. scratches, burns) as possible triggers for new white areas were documented by 41/96 patients (42.7%). More than half of the participants ($n=54/96$, 56.3%) reported grey hair on their scalp, while 33/96 patients (34.4%) had single or bundles of white hair in eyebrows or eyelashes. However, grey hair was present in 4/16 of those younger than 30 years. As the youngest member of the control group was 31 years old, a comparison to patients was impossible. However, nobody in the control group had white hair in eyebrows or eye lashes. Considering that premature hair greying in Caucasians refers to people younger than 20 years and in darker skin to 30 years of age (46, 47), no definite statement can be made regarding the prevalence of premature hair greying in our study group.

Low-key stigmatisation - a frequent experience

Questions about their appearance or other approaches by strangers (low-key stigmatisation) were reported by 87/96 patients (90.6%); 23/96 (24.0%) stated that this had happened 'very often', while 64 marked 'sometimes' (66.7%) and only 9/96 (9.4%) 'never'. High-key stigmatisation, such as 'picking on' or 'nasty' comments, had happened 'very often' to only 1/96 (1.5%) patients, while 22/96 (22.9%) had experienced it 'sometimes' and the remaining 73/96 patients (76.0%) 'never'.

Cross-tabulation between stigmatisation experiences and socio-demographics yielded no differences between those patients' sub-groups defined by gender, disease state, age at disease onset, presence of grey hair, perception that psychological stress, injuries or other diseases are influential and whether or not the individuals had a hobby (all $p > 0.05$, χ^2 -test, data not shown).

Interestingly, patients with no other affected family member reported more often low-key stigmatisation. 'Very often' was marked by 21/69 (30.4%) patients compared to those with a positive family history ($n=2/27$, 7.4%). 'Sometimes' was marked by 41/69 patients

(59.4%) vs. 23/27 (85.2%) and 'never' by 2/7.4% vs. 7/10.1% ($p=0.041$, χ^2 -test). Notably, patients with severe vitiligo on arms and trunk experienced high-key stigmatisation more frequently (Table I). Severity of vitiligo on various other body areas revealed no relationship with high-key stigmatisation regardless of minor or major disease extension (data not shown, all $p > 0.05$, χ^2 -test).

Avoidance behaviour and concealing vitiligo is independent of stigmatisation experiences

In the entire patient group, 64/96 patients (66.7%) had avoided situations because of their vitiligo, including 'swimming/bathing' ($n=14/14.6\%$), 'getting undressed in changing rooms' ($n=6/6.3\%$), 'shaking hands', 'sports' (each $n=3/3.1\%$) or 'others' ($n=6/6.3\%$). The combination of 'shaking hands/getting undressed in changing rooms' was reported by 27/96 patients (28.1%).

Two thirds of the group ($n=63/96$, 65.6%) had 'quite' or 'very often' concealed their white spots in public, the remaining 33 (34.4%) had either 'never' done this or only 'very rarely' (Table SI²). Ways of concealing were using 'clothes' ($n=15/15.6\%$), 'camouflage' ($n=14/14.6\%$), 'body positions' ($n=7/7.3\%$) or 'others' ($n=2/2.1\%$), but mostly a combination of 'clothes', 'body positions' and 'camouflage' ($n=39/40.6\%$).

Cross-tabulation revealed that neither high nor low-key stigmatisation are linked with the mentioned behaviour patterns of avoiding situations/concealing vitiligo (data not shown, $p > 0.05$, χ^2 -test). Interestingly, the majority of our patients ($n=76/96$, 79.2%) had a hobby or exercised sports in their free time, compared to 15/23 (65.2%) controls ($p=0.178$, χ^2 -test).

Generally, almost two thirds of the patients (62.5%/ $n=60$) believed that the course of their disease was influenced by 'psychological stress' and 18/96 (18.8%) related 'other diseases' to their vitiligo.

²<http://www.medicaljournals.se/acta/content/?doi=10.2340/00015555-1981>

Table I. High-key stigmatisation experiences (picked on, nasty comments) in patient subgroups showing the answer on the question "Have you ever been picked upon or has anyone ever been nasty to you because of your white spots"

Answers	Face affected		Hands affected		Arms affected		Legs affected		Trunk affected		Neck affected	
	Slightly <i>n</i> (%)	Severely <i>n</i> (%)	Slightly <i>n</i> (%)	Severely <i>n</i> (%)	Slightly <i>n</i> (%)	Severely <i>n</i> (%)	Slightly <i>n</i> (%)	Severely <i>n</i> (%)	Slightly <i>n</i> (%)	Severely <i>n</i> (%)	Slightly <i>n</i> (%)	Severely <i>n</i> (%)
Yes, sometimes ^a	11 (18.3)	8 (32.0)	2 (11.1)	15 (24.2)	4 (11.4)	13 (34.2)	5 (12.2)	9 (29.0)	3 (7.7)	8 (27.6)	6 (23.1)	7 (24.1)
No	49 (81.7)	17 (68.0)	16 (88.9)	47 (75.8)	31 (88.6)	25 (65.8)	36 (87.8)	22 (71.0)	36 (92.3)	21 (72.4)	20 (76.9)	22 75.9
Total	60	25	18	62	35	38	41	31	39	29	26	29
<i>p</i> -value	0.147		0.187		0.017		0.06		0.034		0.622	

Patients with severely affected trunk and arms are more likely to have experienced high-key stigmatisation 'sometimes' than those with only minor extension of the disease.

^aThere was just one patient who answered 'Yes, very often'. This case has been omitted for statistical reasons. Levels of significance were measured by a Pearson χ^2 -test.

Significant values are shown in bold.

Questionnaire results

Patients' mean scores were much higher in all dermatology-specific questionnaires compared to healthy controls, except for the non-dermatology-specific BDI (Fig. 1).

Grouped scores revealed that the vast majority is not affected by vitiligo

The DLQI mean score is 4.9. After grouping the scores as suggested by Gajur (48), we found that QoL of 30 patients was not influenced (scores 0–1/31.2%) and only little in 35 participants (scores 2–5/36.5%). However, the life of the remaining patients was either moderately (scores 6–10, $n=19/19.8\%$), severely (11–20, $n=10/10.4\%$) or even extremely (scores 21–30, $n=2/2.1\%$) affected.

Only one control person (4.4%) had an increased social anxiety/avoidance score, whereas this was the case in $n=21/96$ (21.9%) of the patients ($p=0.04$, χ^2 -test). There were no such differences in helplessness (4.4%/ $n=1$ vs. 18.8%/ $n=18$) or anxious-depressive mood (17.4%/ $n=4$ vs. 20.8%/ $n=20$, both $p>0.05$, χ^2 -test).

An evaluation of depression levels showed no differences between patients and controls (Fig. S1²).

Weak influence of gender and time factors

In all skin disease-specific scales, there were no significant differences between men and women. However, female patients were slightly more anxious-depressive

and depressive (both non-skin-disease-specific, Table S1²). Pearson correlation analysis also revealed no relationship of the scores with disease duration, age at disease onset or with age (Table S1²). However, analysis of age groups showed that the 20–29 years old and 60–70 years old patients had the highest mean scores in social anxiety/avoidance, anxious-depressive mood and the BDI (Table S1²).

Patients benefit psychosocially from treatment with pro-pseudocatalase

Next we wanted to know whether treatment with pro-pseudocatalase PC-KUS could affect patients' well-being. PC-KUS is a topical application of a pseudocatalase for the reduction of epidermal hydrogen peroxide (H₂O₂) levels in vitiligo. It is produced by KUS Dermatologie GmbH (Greifswald, Germany). For this purpose we compared scores of new patients to those already enrolled for at least one year. While in the DLQI there were no differences, albeit with borderline non-significance, all ACS sub-scores (except helplessness) and BDI scores were significantly higher in new patients (Table S1²). Both groups showed no differences regarding disease severity on body areas (all $p>0.05$, χ^2 -test, data not shown).

Involvement of trunk and arms make patients feel worse

Evaluation of a possible influence of the location of vitiligo yielded that a more extensive vitiligo on the trunk led to higher scores in the DLQI and all ACS sub-

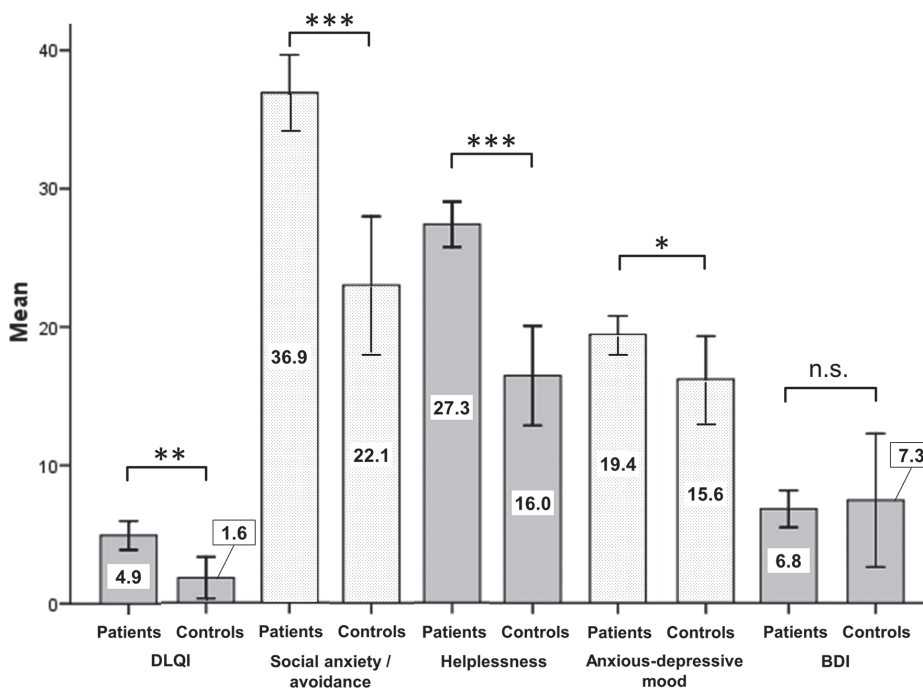


Fig. 1. Comparison of the main questionnaires' scores between patients ($n=96$) and controls ($n=23$). Patients with vitiligo scored much higher in the Dermatology Life Quality Index (DLQI) and the Adjustment to Chronic Skin Disorders Questionnaire sub-scales Social Anxiety/Avoidance, Helplessness and Anxious-Depressive Mood. The significance was weak in the subscales non-specific to skin diseases (Anxious-Depressive Mood). There was no difference measurable between patients and controls in the Beck Depression Inventory (BDI). Significance levels were determined by a *t*-test. *p*-values were 0.003 (DLQI), <0.001 (Social Anxiety/Avoidance and Helplessness), 0.015 (Anxious-Depressive Mood) and 0.775 (BDI).

scores. The BDI scores were just about not significantly different ($p = 0.059$). Severe vitiligo on arms increased social anxiety/avoidance scores. Presence of vitiligo on other body areas or of grey/white hair on scalp or in eyelashes/eyebrows was not influential (Table SI²).

Other disease-related features not relevant for well-being

Analysis of current disease state (improving/stabilised/worsening), believe that other diseases influence the disease course, positive or negative family history, inherited skin colour or whether or not patients had a hobby or engaged in sports (Table SI²) as well as age at disease onset (Tables SI² and SII²) showed no influence on patients' well-being. Interestingly, patients confirming the Koebner phenomenon scored higher in anxious-depressive mood (Table SI²).

Stigmatisation experiences and perception of psychological stress make an impact on patients

Patients, who think that psychological stress influenced their vitiligo, scored much higher in all questionnaires, except for social anxiety/avoidance and helplessness (Table SI²). Patients with no experiences of approaches or questions scored highest in the DLQI and in social anxiety/avoidance. There was no difference in the other scores compared to patients who had experienced sometimes or even often questions/approaches. Patients who reported high-key stigmatisation at least sometimes, scored higher in social anxiety/avoidance and anxious-depressive mood, but not in the other domains (Table SI²).

Behaviour patterns and questionnaires' outcome are strongly associated

Highly significant relationships exist between the occurrence of the above mentioned behaviour patterns and the questionnaires' outcome. High scores go along with higher frequencies of concealing the white spots (Fig. S2²), but also with avoidance of situations. This applies to all scores, but particularly to the DLQI, social anxiety/avoidance and helplessness (Table SI²).

DISCUSSION

Our patient group does not stick out regarding the disease-related characteristics. All features investigated were within the range provided by earlier reports, including positive family history (49–51), other affected family members (52, 53) and the presence of grey hair in patients <25 years. The prevalence of the Koebner phenomenon was higher in our group (55, 56).

To the best of our knowledge, there is only one study available that directly compares ACS scores of healthy controls and patients with vitiligo (38). In all scales,

except the BDI, our patients scored higher than the healthy subjects. However, the inevitable conclusion, that patients are generally more affected in their well-being deserves a closer look. An impressive majority of 65–80% had an only slightly impaired QoL, if any, and they were coping well. This is possibly one of the reasons that their mean DLQI score is relatively low compared to the literature (14, 57, 58). Interestingly, as there were either no or only weak differences to the control group in both non-dermatology-specific scales BDI and Anxious-Depressive Mood, it can finally be concluded that depression and vitiligo are not directly linked.

Our female patients were only slightly more impaired in their well-being compared to men, and this only in Anxious-Depressive Mood and the BDI, both non-specific to skin diseases. Other studies found more pronounced differences (15, 23, 59–61). Interestingly, the differences between patients enrolled with the IFPD and those not yet undergoing PC-KUS treatment indicate that this treatment modality is not only medically effective, it also improves patients' well-being.

Other socio-demographic or disease-related factors had no influence on well-being. Our new data can neither confirm earlier findings that darker skin colours correlated with a worse QoL (59, 62) and with increased frequencies of stigmatisation (63, 64) nor that with longer disease duration patients became less depressed (65) or that an earlier onset negatively influences QoL (61). However, patients' perception that psychological stress influences their disease course could either be caused by actual experiences or awareness that vitiligo can affect well-being. Importantly, in all questionnaires used, there was a strong correlation of scores to avoidance behaviour and concealing vitiligo. Therefore, the ACS proved to be useful for correct assessment of disease-related social anxiety/avoidance (66).

Almost all participants had experienced questions about their appearance or other approaches, much more than reported earlier (18). Given that most patients had experienced this kind of stigmatisation and implied psychological stress on the onset/worsening of their disease, it is tempting to assume that these experiences trigger significant psychological stress, supported by at least one other study (67).

Regarding the physical appearance, it is noteworthy that facial vitiligo can excellently be concealed, which is a much more difficult task for other body areas. Hence, it is not surprising, that patients with severely affected arms and trunks are more likely to experience nasty comments. Affection of these body parts and the hands (61) has been implied in poor well-being (59, 62, 68, 69) or stigmatisation (67) and could be perceived as general indicator of an extensive vitiligo. This, in turn, would support a relationship between disease localisation, size and stigmatisation and would also explain why

so many patients had frequently concealed their vitiligo or avoided situations, confirming other reports (18, 63).

Unexpectedly, we found that patients, who had never experienced low-key stigmatisation, had a worse QoL and were more socially anxious. This contradicts earlier reports which pointed to a direct and linear influence of stigmatisation. It is possible that patients without such experiences do fear these encounters (felt stigma) and in turn try to prevent them from happening, for example by avoiding situations, which then leads to a more impaired QoL. Overall, our results cannot confirm earlier findings of a direct correlation of perceived stigma and DLQI scores (59), pointing to a less important role of stigmatisation.

Taken together, vitiligo is likely to worsen patients' QoL and make these affected individuals socially more anxious, helpless and anxious-depressive, but not depressed. Therefore counselling should be considered in guiding these patients.

The authors declare no conflict of interest.

REFERENCES

- Schallreuter KU. Vitiligo. In: Hertl M, editor. *Autoimmune Diseases of the Skin Pathogenesis, Diagnosis, Management*. Wien: Springer, 2011: p. 435–462.
- Mosher DB, Fitzpatrick TB, Ortonne J-P. Abnormalities of Pigmentation. In: Fitzpatrick TB, Eisen AZ, Wolff K, Freedberg IM, Austen KF, editors. *Dermatology in General Medicine*. 2nd ed. New York, St. Louis: McGraw-Hill Book Company, 1979: p. 568–629.
- Schallreuter KU, Salem MA, Gibbons NC, Martinez A, Slominski R, Ludemann J, et al. Blunted epidermal L-tryptophan metabolism in vitiligo affects immune response and ROS scavenging by Fenton chemistry, part 1: Epidermal H₂O₂/ONOO(-)-mediated stress abrogates tryptophan hydroxylase and dopa decarboxylase activities, leading to low serotonin and melatonin levels. *FASEB J* 2012; 26: 2457–2470.
- Handa S, Dogra S. Epidemiology of childhood vitiligo: a study of 625 patients from north India. *Pediatr Dermatol* 2003; 20: 207–210.
- Schallreuter KU, Bahadoran P, Picardo M, Slominski A, Ellassiuty YE, Kemp EH, et al. Vitiligo pathogenesis: autoimmune disease, genetic defect, excessive reactive oxygen species, calcium imbalance, or what else? *Exp Dermatol* 2008; 17: 139–140; discussion 141–160.
- Glassman SJ. Vitiligo, reactive oxygen species and T-cells. *Clin Sci (Lond)* 2011; 120: 99–120.
- Schallreuter KU, Salem MA, Gibbons NC, Maitland DJ, Marsch E, Elwary SM, et al. Blunted epidermal L-tryptophan metabolism in vitiligo affects immune response and ROS scavenging by Fenton chemistry, part 2: Epidermal H₂O₂/ONOO(-)-mediated stress in vitiligo hampers indoleamine 2,3-dioxygenase and aryl hydrocarbon receptor-mediated immune response signaling. *FASEB J* 2012; 26: 2471–2485.
- Barbee JN, Sumner FC. Psychological aspects of vitiligo in negroes. *J Social Psychol* 1951; 34: 125–138.
- Manolache L, Petrescu-Seceleanu D, Benea V. Correlation of stressful events with onset of vitiligo in children. *J Eur Acad Dermatol Venereol* 2009; 23: 187–188.
- Krüger C, Schallreuter KU. A review of the worldwide prevalence of vitiligo in children/adolescents and adults. *Int J Dermatol* 2012; 51: 1206–1212.
- Salzer BA, Schallreuter KU. Investigation of the personality structure in patients with vitiligo and a possible association with impaired catecholamine metabolism. *Dermatology* 1995; 190: 109–115.
- Stangier U, Ehlers A, Gieler U. Measuring adjustment to chronic skin disorders: validation of a self-report measure. *Psychol Assess* 2003; 15: 532–549.
- Maleki M, Javidi Z, Kiafar B, Saadatian V, Saremi AK. Prevalence of depression in vitiligo patients. *Quarterly Journal of Fundamentals in Mental Health* 2005; 7: 5–11.
- Papadopoulos L, Bor R, Legg C. Coping with the disfiguring effects of vitiligo: a preliminary investigation into the effects of cognitive-behavioural therapy. *Br J Med Psychol* 1999; 72: 385–396.
- Sampogna F, Raskovic D, Guerra L, Pedicelli C, Tabolli S, Leoni L, et al. Identification of categories at risk for high quality of life impairment in patients with vitiligo. *Br J Dermatol* 2008; 159: 351–359.
- Bin Saif GA, Al-Balbeesi AO, Binshabaib R, Alsaad D, Kwatra SG, Alzolibani AA, et al. Quality of life in family members of vitiligo patients: a questionnaire study in Saudi Arabia. *Am J Clin Dermatol* 2013; 14: 489–495.
- Kökçam I, Akyar N, Saral Y, Oğuzhanoglu NK. Psychosomatic symptoms in patients with alopecia areata and vitiligo. *Turk J Med Science* 1999; 29: 471–473.
- Porter J, Beuf AH, Nordlund JJ, Lerner AB. Psychological reaction to chronic skin disorders: a study of patients with vitiligo. *Gen Hosp Psychiatry* 1979; 1: 73–77.
- Mouzas O, Angelopoulos N, Papaliagka M, Tsogas P. Increased frequency of self-reported parasomnias in patients suffering from vitiligo. *Eur J Dermatol* 2008; 18: 165–168.
- Sukan M, Maner F. The problems in sexual functions of vitiligo and chronic urticaria patients. *J Sex Marital Ther* 2007; 33: 55–64.
- Silverberg JI, Silverberg NB. Association between vitiligo extent and distribution and quality-of-life impairment. *J Am Med Acad Dermatol* 2013; 149: 159–164.
- Prčić S, Durovic D, Duran V, Vukovic D, Gajinovic Z. [Some psychological characteristics of children and adolescents with vitiligo – our results]. *Med Pregl* 2006; 59: 265–269 (in Serbian).
- Lee KK, Lee JH, Kim HW, Paik KC, Kim YC. Emotional state and personality characteristics in patients with vitiligo. *Korean Journal of Psychosomatic Medicine* 2000; 8: 88–97.
- Noh S, Kim M, Park CO, Hann SK, Oh SH. Comparison of the psychological impacts of asymptomatic and symptomatic cutaneous diseases: vitiligo and atopic dermatitis. *Ann Dermatol* 2013; 25: 454–461.
- Krüger C, Schallreuter KU. CLCI in Vitiligo. In: Linder MD, Kimball AB, editors. *Dermatological Diseases and Cumulative Life Course Impairment*. Basel: Karger, 2013: p. 102–117.
- Chun WH, Hann SK. The progression of nonsegmental vitiligo: clinical analysis of 318 patients. *Int J Dermatol* 1997; 36: 908–910.
- Porter J, Beuf AH, Lerner A, Nordlund J. Response to cosmetic disfigurement: patients with vitiligo. *Cutis* 1987; 39: 493–494.
- Schwartz R, Sepúlveda J, Quintana T. Possible role of psychological and environmental factors in the genesis of childhood vitiligo. *Rev Med Chil* 2009; 137: 53–62.
- Mazereeuw-Hautier J, Bezio S, Mahe E, Bodemer C, Eschard C, Viseux V, et al. Segmental and nonsegmental childhood vitiligo has distinct clinical characteristics: a prospective observational study. *J Am Acad Dermatol* 2010; 62: 945–949.
- Kakourou T, Kanaka-Gantenbein C, Papadopoulou A,

- Kaloumenou E, Chrousos GP. Increased prevalence of chronic autoimmune (Hashimoto's) thyroiditis in children and adolescents with vitiligo. *J Am Acad Dermatol* 2005; 53: 220–223.
31. Hill-Beuf A, Porter JD. Children coping with impaired appearance: social and psychologic influences. *Gen Hosp Psychiatry* 1984; 6: 294–301.
 32. Dertlioglu SB, Cicek D, Balci DD, Halisdemir N. Dermatology life quality index scores in children with vitiligo: comparison with atopic dermatitis and healthy control subjects. *Int J Dermatol* 2013; 52: 96–101.
 33. Krüger C, Panske A, Schallreuter KU. Disease-related behavioral patterns and experiences affect quality of life in children and adolescents with vitiligo. *Int J Dermatol* 2014; 53: 43–50.
 34. Linthorst Homan MW, de Korte J, Grootenhuis MA, Bos JD, Sprangers MA, van der Veen JP. Impact of childhood vitiligo on adult life. *Br J Dermatol* 2008; 159: 915–920.
 35. Schmid-Ott G, Kunsebeck HW, Jecht E, Shimshoni R, Lazaroff I, Schallmayer S, et al. Stigmatization experience, coping and sense of coherence in vitiligo patients. *J Eur Acad Dermatol Venereol* 2007; 21: 456–461.
 36. Jecht E. *Praktische Psychodermatologie*. In: Uhlemann C, editor. *Stress – Phänome des Lebens mit ambivalenter Wertigkeit* (6 Symposium zur Ratio und Plausibilität in der Naturheilkunde, 11th December 2004); Friedrich-Schiller-Universität Jena, Germany: Karger; 2005: 235.
 37. Rehme AM. *Stigmatisierungserleben und Krankheitsverarbeitung bei Vitiligopatientinnen und –patienten*. Hannover, Germany: Medical University; 2002.
 38. Cordalija E. *Psychische Auswirkungen von Vitiligo und Psoriasis auf das Körperbild und die interpersonalen Beziehungen*. Innsbruck, Austria: Leopold-Franzens-Universität; 2004.
 39. Radtke MA, Schafer I, Gajur AI, Augustin M. Clinical features and treatment outcomes of vitiligo from the patients' perspective: results of a national survey in Germany. *Dermatology* 2010; 220: 194–200.
 40. Lewis V, Finlay AY. 10 years experience of the Dermatology Life Quality Index (DLQI). *J Invest Dermatol Symp Proc* 2004; 9: 169–180.
 41. Finlay AY, Khan GK. Dermatology Life Quality Index (DLQI) – a simple practical measure for routine clinical use. *Clin Exp Dermatol* 1994; 19: 210–216.
 42. Stangier U, Ehlers A, Gieler U. *Fragebogen zur Bewältigung von Hautkrankheiten (FBH)*. Göttingen: Hogrefe, 1996.
 43. Mattoo SK, Handa S, Kaur I, Gupta N, Malhotra R. Psychiatric morbidity in vitiligo and psoriasis: a comparative study from India. *J Dermatol* 2001; 28: 424–432.
 44. Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. *Arch Gen Psychiatry* 1961; 4: 561–571.
 45. Schallreuter KU, Krüger C, Würfel BA, Panske A, Wood JM. From basic research to the bedside: efficacy of topical treatment with pseudocatalase PC-KUS in 71 children with vitiligo. *Int J Dermatol* 2008; 47: 743–753.
 46. Trüeb RM. Pharmacologic interventions in aging hair. *Clin Interv Aging* 2006; 1: 121–129.
 47. Lerner AB. On the etiology of vitiligo and gray hair. *Am J Med* 1971; 51: 141–147.
 48. Gajur AI. *Versorgungssituation, patientendefinierte Therapieziele und psychosoziale Belastungen von Patienten mit Vitiligo*. Hamburg: University of Hamburg; 2008.
 49. Singh M, Singh G, Kanwar AJ, Belhaj MS. Clinical pattern of vitiligo in Libya. *Int J Dermatol* 1985; 24: 233–235.
 50. Al-Khawajah MM. Photochemotherapy for vitiligo: SEVEN years' experience at a University hospital. *Ann Saudi Med* 1997; 17: 175–178.
 51. Schallreuter KU, Lemke R, Brandt O, Schwartz R, Westhofen M, Montz R, et al. Vitiligo and other diseases: coexistence or true association? Hamburg study on 321 patients. *Dermatology* 1994; 188: 269–275.
 52. Majumder PP, Nordlund JJ, Nath SK. Pattern of familial aggregation of vitiligo. *Arch Dermatol* 1993; 129: 994–998.
 53. Shah H, Mehta A, Astik B. Clinical and sociodemographic study of vitiligo. *Indian J Dermatol Venereol Leprol* 2008; 74: 701.
 54. Lerner AB. Vitiligo. *J Invest Dermatol* 1959; 32: 285–310.
 55. Dutta AK, Mandal SB. A Clinical Study of 650 Vitiligo Cases and their Classification. *Ind J Dermatol* 1969; 3: 103–111.
 56. Papadopoulos L, Bor R, Legg C, Hawk JL. Impact of life events on the onset of vitiligo in adults: preliminary evidence for a psychological dimension in aetiology. *Clin Exp Dermatol* 1998; 23: 243–248.
 57. Al Robaee AA. Assessment of quality of life in Saudi patients with vitiligo in a medical school in Qassim province, Saudi Arabia. *Saudi Med J* 2007; 28: 1414–1417.
 58. van Geel N, Ongenae K, Vander Haeghen Y, Vervaeck C, Naeyaert JM. Subjective and objective evaluation of noncultured epidermal cellular grafting for repigmenting vitiligo. *Dermatology* 2006; 213: 23–29.
 59. Kent G, Al-Abadie M. Factors affecting responses on Dermatology Life Quality Index items among vitiligo sufferers. *Clin Exp Dermatol* 1996; 21: 330–333.
 60. Gajur A, Schäfer I, Augustin M. *Versorgungssituation und Bewertung des therapeutischen Nutzens von Patienten mit Vitiligo*. *J Dtsch Dermatol Gesell* 2007; 5: S163.
 61. Karelson M, Silm H, Kingo K. Quality of life and emotional state in vitiligo in an Estonian sample: comparison with psoriasis and healthy controls. *Acta Derm Venereol* 2013; 93: 446–450.
 62. Dolatshahi M, Ghazi P, Feizy V, Hemami MR. Life quality assessment among patients with vitiligo: comparison of married and single patients in Iran. *Indian J Dermatol Venereol Leprol* 2008; 74: 700.
 63. McLeod J. *The social experience of individuals living with vitiligo [Dissertation]*. Manchester: University of Manchester; 2004.
 64. Porter JR, Beuf AH. Racial variation in reaction to physical stigma: a study of degree of disturbance by vitiligo among black and white patients. *J Health Soc Behav* 1991; 32: 192–204.
 65. Gieler U, Brosig B, Schneider U, Kupfer J, Niemeier V, Stangier U, et al. Vitiligo – coping behavior. *Dermatol Psychosom* 2000; 1: 6–10.
 66. 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.
 67. Kent G. Correlates of perceived stigma in vitiligo. *Psychology and Health* 1999; 14: 242–251.
 68. Ongenae K, Van Geel N, De Schepper S, Naeyaert JM. Effect of vitiligo on self-reported health-related quality of life. *Br J Dermatol* 2005; 152: 1165–1172.
 69. Ongenae K, Dierckxsens L, Brochez L, Van Geel N, Naeyaert JM. Quality of Life and Stigmatization Profile in a Cohort of Vitiligo Patients and the Effect of the Use of Camouflage. *Dermatology* 2005; 210: 279–285.