

## REVIEW

# Vitiligo – a disease: A position paper on stigmatization, life quality impairment and psychosocial comorbidity

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## Summary

Vitiligo is a common disorder characterized by the visible loss of skin pigmentation. Non-segmental vitiligo (NSV) is the major subtype. The disease is caused by autoimmune-mediated destruction of melanocytes. Vitiligo leads to stigmatization and a significant reduction in quality of life. Disregarding the psychosocial burden, vitiligo is sometimes viewed solely as a cosmetic problem and, according to a global survey, is diagnosed on average only after 2.4 years. This delay contributes to a considerable burden of disease, including suicidal ideation. Stigmatization promotes the development of psychological comorbidities such as anxiety and depressive disorders, with prevalence rates varying by country and study (0.1%–67.9%). Data for Germany are heterogeneous and largely based on estimates. Due to psychosocial factors, the inflammatory component, and a higher incidence of somatic comorbidities, NSV may be regarded as an inflammatory systemic disease. We recommend optimizing care by incorporating the assessment of quality of life as a standard in routine care, in addition to monitoring disease activity. Moreover, early screening for psychological comorbidities is crucial to initiate appropriate treatment before the condition becomes chronic and cumulative (irreversible) impairments occur. The goal is a personalized and patient-centered integrated care approach that sustainably improves the health status of those affected.

## KEYWORDS

anxiety disorder, depression, pigmentation, psychodermatology, skin disease

## INTRODUCTION

Vitiligo is a disease characterized by a usually clearly visible loss of skin color due to the loss of melanocytes, the pigment-forming cells of the skin. Non-segmental vitiligo (NSV), the most common form, is generally considered an autoimmune disease. Genetic disposition and increased vulnerability of melanocytes to, among other factors, oxidative stress and mechanical irritation result in a CD8<sup>+</sup>-mediated immune reaction.<sup>1</sup> Inflammatory somatic

comorbidity, such as atopic dermatitis, and other autoimmune diseases are common. The approval of the Janus kinase 1/2 inhibitor ruxolitinib as first vitiligo-specific topical therapy is an important step towards better patient care.<sup>2</sup> Although national guidelines<sup>3</sup> and international consensus recommendations on diagnostics and therapy of this disease are available,<sup>4,5</sup> there is considerable need for more targeted and efficient personalized therapeutic concepts.

Vitiligo is quite frequently misjudged as purely cosmetic problem. Patients are stigmatized and rejected as untreatable. Recent studies demonstrate that vitiligo has considerable and serious psychosocial consequences. This

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aggravates the inadequate clinical care of affected patients. It is, therefore, the aim of this review and position paper to bring vitiligo, including its, often significant, impairment of quality of life and the frequently present psychological comorbidity, into the center of attention of German dermatological care. To optimize the clinical care of patients, we propose an integrated interdisciplinary approach that equally considers somatic and psychosocial factors in line with the biopsychosocial model.

## VITILIGO IS A COMMON DISEASE WORLDWIDE

The first analysis concerning the worldwide prevalence of vitiligo was based on more than 50 studies on adults and children and calculated a prevalence of 0.06%–2.28% in the overall adult population and of 0.0%–2.16% in children.<sup>6</sup> A current meta-analysis with 103 studies found a pooled prevalence from 0.2% (based on 82 population-based studies) to 1.5% (based on point prevalences from 22 hospital-based studies).<sup>7</sup> Two newer questionnaire surveys from the USA,<sup>8</sup> as well as Europe (including Germany as participating country with 75 patients from  $n = 6,590$  respondents), USA, and Japan,<sup>9</sup> on the confirmed and unconfirmed diagnosis of vitiligo showed overall prevalences of 1.11% and 1.3%, respectively, with up to 40% of cases in the USA lacking a formal diagnosis. For Germany, a recent study analyzed diagnostic data of a large statutory health insurance company ( $n = 1,619,678$ ) from 2014 and primary data of a large cohort of employees aged 16–70 examined by dermatologists from 2004 to 2014 ( $n = 121,783$ ). The determined prevalence was 0.17% and 0.77%, respectively.<sup>10</sup> Given that only reported, billing-relevant ICD diagnoses were depicted, however, a significant number of unidentified cases must be assumed. Current epidemiological data on age-dependent development of incidence and prevalence of vitiligo in the last 10 years have not yet been completed.

## PATIENTS WITH VITILIGO LACK ADEQUATE CLINICAL CARE

A number of studies have demonstrated that the therapy of patients with vitiligo is inadequate. In a German-wide questionnaire study from 2006–2007, for example, only 38.7% of all patients ( $n = 1,023$ ) had a patient benefit index of  $> 1$  corresponding to a minimum benefit by the available therapies.<sup>11</sup> Given that the therapeutic field of vitiligo remained unchanged until recently, it is unlikely that these numbers have changed in recent years. A recent, globally performed cross-sectional study with 17 participating countries from seven geographic regions demonstrates the lack of adequate clinical care and the impact of vitiligo on psychosocial health.<sup>12,13</sup> Adult patients with vitiligo ( $n = 3,541$ ) were asked about the effect of the dis-

ease on their lives. In addition, healthcare professionals ( $n = 1,203$ ) were asked regarding diagnosis and performed therapy. On average, patients received their formal diagnosis 2.4 years after the onset of skin changes. 44.9% of the patients reported previous misdiagnosis. Moreover, 56.7% of the questioned patients reported being told by physicians that the disease could not be treated. The inadequate therapy had profound consequences for everyday life of the affected patients. More than 40% of the respondents reported that vitiligo affected their daily lives. The activities associated with distress included choosing clothes, social activities, shaking hands, and intimate activities with the partner. Approximately 25% of the respondents reported that the disease affected their professional career choice.<sup>13</sup> More than half of the respondents reported that “their life would have been completely different without vitiligo”, and that they suffered from a mental health condition, such as anxiety disease or depressive disorder (see below). Unfortunately, no such epidemiological data and information on treatment history are available for patients with vitiligo in Germany.

## VITILIGO IS A STIGMATIZING DISEASE

Stigmatization is understood as multi-layered construct comprising the dimensions (1) identification and labelling of a difference, (2) linking the difference to a negative stereotype, (3) social distancing and distinction between “us” and “them”, and (4) loss of status and discrimination by rejection and exclusion accompanied by direct social and economic consequences.<sup>14</sup> The construct can be divided into external stigmatization and self/internal stigmatization. In this context, the former indicates discrimination of a group of people based on stereotypes and prejudices against a certain characteristic while the latter indicates self-discrimination due to internalized stereotypes and prejudices. Accordingly, a recently developed conceptual model of stigmatization in visible skin diseases includes an external and an internal dimension and considers also the interaction between these dimensions and the impact of sociodemographic and disease-specific factors on stigmatization.<sup>15</sup>

Irrespective of the form of stigmatization, the consequences for those affected are serious (Figure 1a–c). It has been demonstrated that the experience of stigmatization impairs the quality of life, results in more anxiety and depressive disorders, and even an increased risk of suicidal ideation in individuals with skin diseases.<sup>15,16</sup> A recent systematic literature review on psychosocial consequences of vitiligo could show that the feeling of stigmatization is the most common psychosocial burden of those affected.<sup>17</sup> Overall, eight studies included in the review ( $n = 2$  in Germany,  $n = 1$  each in India, Nepal, UK, and  $n = 3$  in the USA) analyzed stigmatization in vitiligo. However, none of the studies used a validated questionnaire. In



**FIGURE 1** Vitiligo as a disease potentially leading to stigmatization, psychosocial comorbidity and life quality impairment. Involvement of visible areas such as (a) face and neck, (b) hands but also (c) gender and extent as well as (b) skin color have impact on the burden of disease.

addition, no distinction was made between external and self-stigmatization, an important aspect with respect to the development of interventions to reduce stigmatization. Moreover, given that seven of the eight studies are eight years old or older, an update of the data acquisition concerning the experience of stigmatization of people with vitiligo is required against the background of the enormously increased use of social media in recent years, as it can be assumed that the topic has changed since then due to the widespread availability and increased use of social media.

The assessment of stigmatization in children and adolescents with vitiligo is of particular importance to prevent the development and/or chronification of psychological comorbidity, such as anxiety and depressive disorders.<sup>18</sup> *Missed opportunities* and other negative psychosocial consequences of developing vitiligo may result in cumulative and potentially irreversible impairment (*cumulative life course impairment*) during the course of the disease.<sup>19</sup>

Other studies from Germany are concerned with adult patients.<sup>20</sup> In one study, the extent of stigmatization was assessed in a sample of 363 vitiligo patients with the *Questionnaire on Experience with Skin Complaints* (QES) taking visible areas into account. The study showed a significant impact of gender on the QES scales “retreat” ( $p = 0.03$ ) and “composure” ( $p \leq 0.001$ ). Women retreated more often and were more worried than men. The visibility of lesions had also a significant impact. Compared to the group with invisible areas, the group with “visible” areas showed significantly higher values in the scales “retreat” ( $p = 0.034$ ) and “self-esteem” ( $p = 0.041$ ).<sup>20</sup>

The utilization of validated measurement tools is important for detection and assessment of stigmatization experience. A recently published systematic literature review on measurement instruments for stigmatization in visible skin diseases could recommend the use of twelve out of the utilized 21 instruments.<sup>21</sup> Most validated instruments were available for leprosy, followed by psoriasis and burns.

No validated instrument for the use in vitiligo was identified. Accordingly, the available data on stigmatization of people with vitiligo in Germany are insufficient. To collect these data in a systematic and standardized manner, existing questionnaires, for example, the *Perceived Stigmatization Questionnaire* should be adapted and validated for vitiligo and/or new questionnaires should be developed.

A systematic review on interventions for destigmatization of, among others, vitiligo with overall 19 studies is available.<sup>22</sup> The results indicate that patients may benefit from cognitive behavioral therapy with respect to handling of vitiligo and living with the disease. However, the effect of the program was not evaluated by direct assessment of self-stigmatization, but via related constructs, such as body image, self-esteem, and quality of life.<sup>23</sup> Such a program is currently not available for Germany, studies on additional therapeutic procedures are largely lacking.

## LIFE QUALITY IMPAIRMENT DUE TO VITILIGO

Extent and form of stigmatization have a direct effect on the quality of life of patients with skin diseases including vitiligo.<sup>15</sup> Concerning measurement instruments for the health-related quality of life (QoL), the *Dermatology Life Quality Index* (DLQI)<sup>24</sup> is globally the most commonly used ( $n = 144$  publications) *Patient-Reported Outcome Measure* (PROM) in vitiligo patients.<sup>25</sup>

It is, however, not a specific *Health-Related (HR) PROM* for vitiligo. With the DLQI, symptoms, such as pruritus, burning, soreness, and pain (question 1 of DLQI), are assessed that are not typical symptoms of vitiligo, although pruritus has been described as occasional symptom in an Indian cohort of vitiligo patients.<sup>26</sup> The *Children’s DLQI* (C-DLQI), which is dermatologically just as unspecific, is used even less often. Although a number of validated HR-QoL instruments for skin diseases are available, *Vitiligo (Viti)QoL*<sup>27</sup> and *Vitiligo Impact Patient Scale* (VIPs)<sup>28</sup> as vitiligo-specific

instruments have so far been used only 15 times and seven times, respectively, in published studies.<sup>25</sup> Currently, the assessment of QoL plays no role in routine care in Germany, while this is a standardized procedure in patients with psoriasis vulgaris or atopic dermatitis eligible for systemic therapy with biologics or systemic JAK inhibitors. In other chronic-inflammatory skin diseases like chronic urticaria, disease-specific scores, such as *Urticaria Quality of Life Questionnaire* (CU QOL) or *Urticaria Control Test* (UCT) are available as validated well-established measurement instruments allowing quantification of the specific therapy success.

Due to this situation, only a very limited number of studies on the measurement of life quality impairment of patients with vitiligo is currently available in Germany. The most comprehensive study to date was a German-wide questionnaire campaign from 2009 on 3,319 patients performed by two German vitiligo self-help associations. The survey included children and adults, although no specific DLQI for children was used. In  $n = 1,023$  returned questionnaires, the mean DLQI was 7.0 (7.5 in women, 5.5 in men). In comparison, patients with psoriasis vulgaris had a DLQI of 8.6.<sup>29</sup> 24.6% of patients with vitiligo had a DLQI  $\geq 10$  indicating severe impairment of QoL. There was a significant correlation between the extent of QoL impairment and the *willingness to pay* (WTP), a construct for assessment of the disease burden ( $\chi^2 = 65.43$ ,  $p \leq 0.001$ ). The WTP was highest in patients with vitiligo aged 30–60 years and correlated with disease duration and affected body surface area. Of the patients with vitiligo, 32.9% reported that they would pay more than 5,000 € for complete remission.<sup>29</sup> In another small study of Krüger and Schallreuter from 2015, the mean DLQI in adult patients ( $n = 96$ ) was higher than in controls (4.9 vs. 1.6,  $p = 0.03$ ), but the control cohort was proportionally smaller ( $n = 23$ ) and consisted of friends and relatives of the surveyed patients limiting the interpretability of the results.<sup>20</sup> In a third, even smaller randomized controlled trial comparing the effect of 0.1% tacrolimus ointment under occlusion in 30 adult vitiligo patients versus placebo, the mean DLQI of the affected patients was again higher with 12.4,<sup>30</sup> which may indicate the particular therapeutic situation of the treated study cohort. To our knowledge, there are no newer studies on vitiligo-specific impairment of QoL for Germany.

A large number of studies found a higher mean DLQI in patients with involvement of visible areas (face and hands) and genital region. Moreover, the quality of life was more severely impaired in young adulthood than in patients above 60 years of age. In addition, the percentage of body surface area affected by vitiligo often results in a higher DLQI.<sup>25,31</sup> Patients with darker skin types usually have a higher DLQI than fair-skinned individuals. Furthermore, many studies showed a higher DLQI in unmarried or divorced patients with vitiligo than in married patients.<sup>25</sup> In a recent review on global measurement of the DLQI in patients with vitiligo heterogeneous results on quality of life were also found in certain geographic region, for exam-

ple, in Saudi Arabia. Here, mean DLQI values between 4 and 14.82 were determined,<sup>25</sup> although this might have methodological reasons.

Based on the few studies using the C-DLQI, the impairment of quality of life in children affected by vitiligo was mostly low to moderate. In children there was, however, a significant correlation between impairment of HR-QoL and age. Only a very small proportion (4.1%) of those aged 15–17 reported no impairment of QoL due to vitiligo. As expected, comorbidities, such as diabetes mellitus or thyroid disease, resulted in a higher impairment of QoL in patients with vitiligo. Two smaller studies indicate that relatives of patients with vitiligo also experience QoL impairment, which increases with the age of those affected.<sup>25</sup>

Despite the marked negative impact of vitiligo on quality of life and the reported clinical treatment success, none of the therapeutic options for vitiligo recommended in the current S1 guideline<sup>3</sup> have so far resulted in significant improvement of the measured QoL.<sup>25</sup> This might be due to the limited efficacy of the current therapies and/or the limited validity of the general instruments used to assess the QoL in patients with vitiligo.

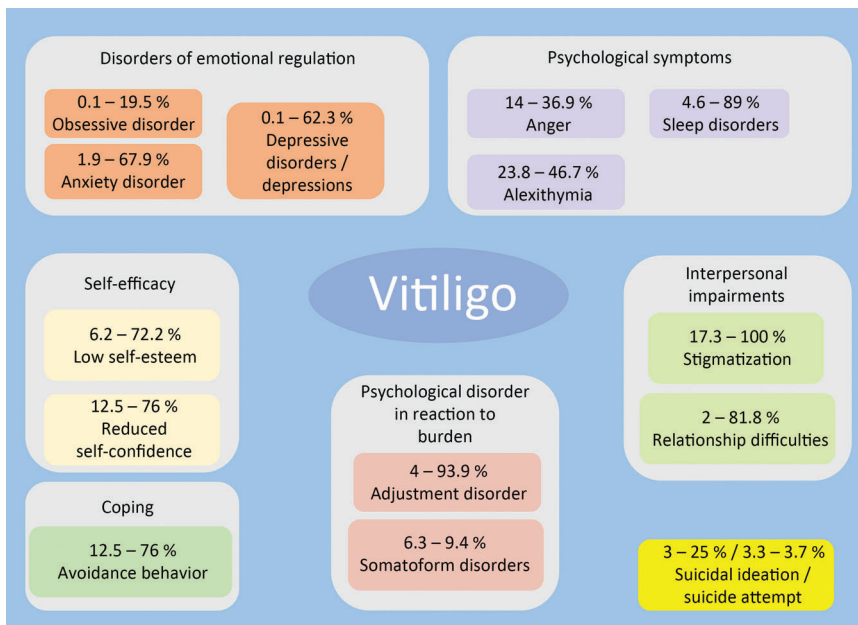
The VitiQoL, which was recently used in a large epidemiological study on patients with vitiligo, allows for a more disease-specific assessment of the QoL.<sup>9</sup> The VitiQoL was assessed in altogether  $n = 35,694$  patients from the USA, Europe, and Japan in addition to the prevalence. From Germany, 6,590 patients participated. The prevalence was 1.1% ( $n = 75$  patients). In the total study cohort, the VitiQoL was positively associated with age, disease extent, disease progression, therapy management, and time since diagnosis. Patients with vitiligo lesions on face and hands/wrists had higher VitiQoL scores. Another study from the USA confirms the more severe impairment of VitiQoL in female patients with vitiligo, greater extent or facial involvement, and in patients of Hispanic origin. A recent study from France could also show that visible vitiligo lesions and disease extent, measured as percentage of affected body surface area, present important influencing factors for general and vitiligo-specific HR-PROs (VitiQoL and VIPs). Moreover, both instruments could identify differences concerning the impairment of QoL between subgroups of patients with vitiligo in a sensitive manner.<sup>32</sup>

In conclusion, there are only few, mostly older and/or comparatively small studies with methodological limitations on the assessment of disease-specific QoL impairment in patients with vitiligo in Germany. Moreover, no data on the assessment of disease burden of patients with vitiligo based on validated HR-PRO questionnaires, such as VIPs, are available in Germany.

## PSYCHOLOGICAL COMORBIDITY IN VITILIGO

Recent systematic reviews and meta-analyses show that vitiligo is associated with various psychosocial and psychological comorbidities (Figure 2).<sup>17,33–35</sup> Depressive

**FIGURE 2** Psychosocial comorbidity of vitiligo. Depicted are symptoms, disturbances and disorders in their global incidence which varied depending on examined country and methodology. The frequencies are based on a meta-analysis of 168 clinical studies in the years 1979–2012.<sup>17</sup>



symptoms, depressive disorders (41 studies), and anxiety disorders (20 studies) were reported most commonly in the altogether 168 studies included in the most recent review.<sup>17</sup> Other reported psychological disorders include adjustment disorders (12 studies), suicidal ideation (8 studies), sleep disturbance (7 studies), obsessive disorders (5 studies), and somatoform disorders (3 studies). In addition, psychosocial burden and accompanying symptoms are often reported. Ten studies alone report on relationship difficulties including sexual dysfunction and eight studies report on stigmatization. In addition, avoidance behavior (9 studies), reduced self-consciousness (8 studies), anger (6 studies), alexithymia (4 studies), and low-self-esteem (4 studies) are reported.<sup>17</sup>

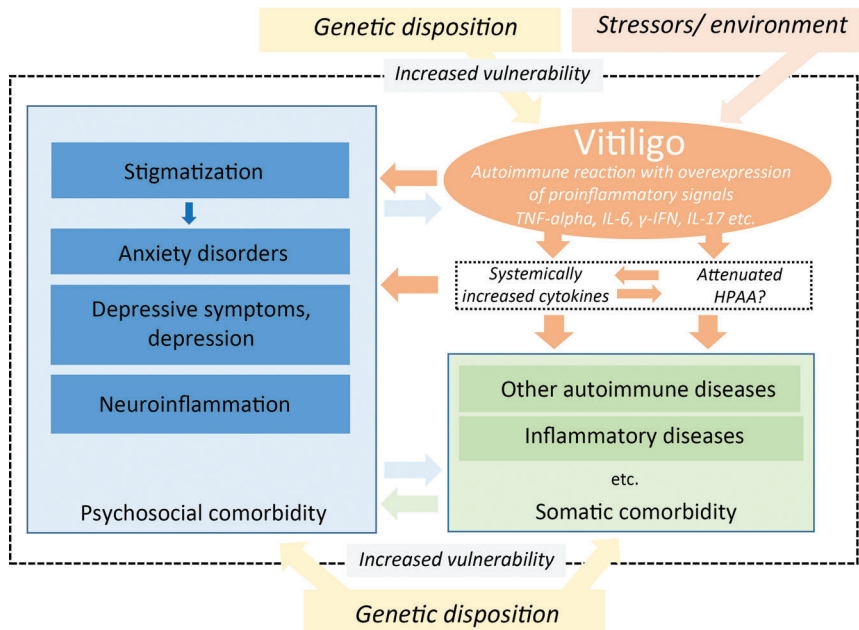
The presence of psychosocial comorbidity is associated with certain sociodemographic and clinical parameters, which require, therefore, special attention in practice. Especially women,<sup>33,35</sup> younger patients and patients without partner, as well as patients with low education status are affected. Vitiligo-specific parameters associated with higher psychological burden include lesions in visible areas or in the genital region, large body surface area affected, longer disease duration ( $\geq 5$  years), skin type IV–VI or non-Caucasian origin,<sup>33</sup> NSV, and positive family history.<sup>17</sup>

The prevalences of psychological comorbidity may vary widely. The prevalence of depressive symptoms is, for example, 24% in Caucasian populations and 35% in affected patients of Asian origin.<sup>33</sup> Reasons for this variation may include different study designs and measurement instruments, but also sociocultural aspects, such as different visibility of lesions depending on skin type according to Fitzpatrick or religious beliefs and associated regionally different social experiences of stigmatization. For adequate care, it is, therefore, essential to assess the psychosocial disease burden while taking the sociocultural context into account.

For Germany, data on anxiety,<sup>20,36,37</sup> depressive symptoms and disorders,<sup>18,37</sup> adjustment disorders,<sup>38</sup> avoidance behavior,<sup>20,36</sup> self-esteem,<sup>36</sup> emotional impairment, and anger are available.<sup>39</sup> The studies show that patients with vitiligo have a higher prevalence of anxiety disorders compared to healthy individuals. This was measured by various scales:

- *Adjustment to Chronic Skin Disorders Questionnaire* (German version: *Marburger Hautfragebogen*) in the scale “social anxiety/avoidance”: 21.9% of vitiligo patients showed increased scores compared to 4.4% of healthy individuals ( $p = 0.04$ ).<sup>20</sup>
- Interaction Anxiety Questionnaire: scales *fear of deviation from standard* ( $p \leq 0.001$ ), *fear of self-assertion* ( $p \leq 0.05$ ), *fear of challenges* ( $p \leq 0.05$ ).<sup>37</sup>
- Individuals with visibly affected skin areas showed significantly higher scores in the scale “social anxiety/avoidance” compared to individuals without visible areas ( $p = 0.02$ ).<sup>36</sup>

Data on depression are, however, less conclusive. While affected individuals show significantly higher scores in the scale “anxious-depressive” (*Adjustment to Chronic Skin Disorders Questionnaire*) than healthy individuals (20.8% vs. 17.4%,  $p = 0.01$ ),<sup>20</sup> no significant differences between those affected and healthy controls were found in the depression-specific instrument *Beck Depression Inventory*.<sup>20</sup> It seems, however, that longer disease duration is associated with higher depression scores highlighting the need for adequate and early therapeutic intervention. Involvement of visible areas is associated with significantly more depressive symptoms than involvement of invisible areas ( $p = 0.04$ ).<sup>36</sup> For Germany, no data are available on clinically diagnosed anxiety disorders and depressions. Overall, the data on



**FIGURE 3** Model of vitiligo as a systemic inflammatory disease. Depicted are interactions which – based on an increased intrinsic vulnerability – not only lead to vitiligo but also to somatic and psychosocial comorbidity. *Abbr.:* IL, interleukin; IFN, interferon; HPAA, Hypothalamic-pituitary-adrenal axis; TNF, tumor necrosis factor

psychological comorbidity of vitiligo in Germany remain insufficient or the results of available studies are heterogeneous. Robust data are required for a comprehensive evaluation of psychosocial disease burden.

## VITILIGO – AN INFLAMMATORY SYSTEMIC DISEASE?

Against the background of genetic predisposition<sup>40</sup> and association with inflammatory diseases (such as atopic dermatitis and psoriasis vulgaris),<sup>41</sup> autoimmune diseases (for example, thyroid diseases<sup>42</sup> and diabetes mellitus<sup>43</sup>), as well as non-autoimmune diseases (like sensorineural hearing loss<sup>44</sup> or components of the metabolic syndrome<sup>45</sup>), and in view of the already mentioned psychological comorbidity, the question arises whether non-segmental vitiligo as main representative of vitiligo may represent an inflammatory systemic disease (Figure 3).

The concept of inflammatory systemic disease with both cardiovascular and metabolic comorbidity, as well as psychological comorbidity has been established in psoriasis vulgaris.<sup>46</sup> Here, metabolic inflammation, triggered by certain patterns of circulating cytokines like interleukin (IL)-23, IL-17, tumor necrosis factor (TNF)- $\alpha$ , IL-6, and IL-8, is viewed as pathogenetic key element that may contribute, in addition to psychosocial factors, also to inflammation-related development of anxiety symptoms and depressive symptoms.<sup>47</sup> Newer neuroendocrinological studies indicate that attenuation of the responsiveness of the hypothalamic-pituitary-adrenal axis (HPAA) is present in many patients with psoriasis vulgaris. The reduced systemic cortisol levels promote the metabolic inflammation.<sup>48</sup>

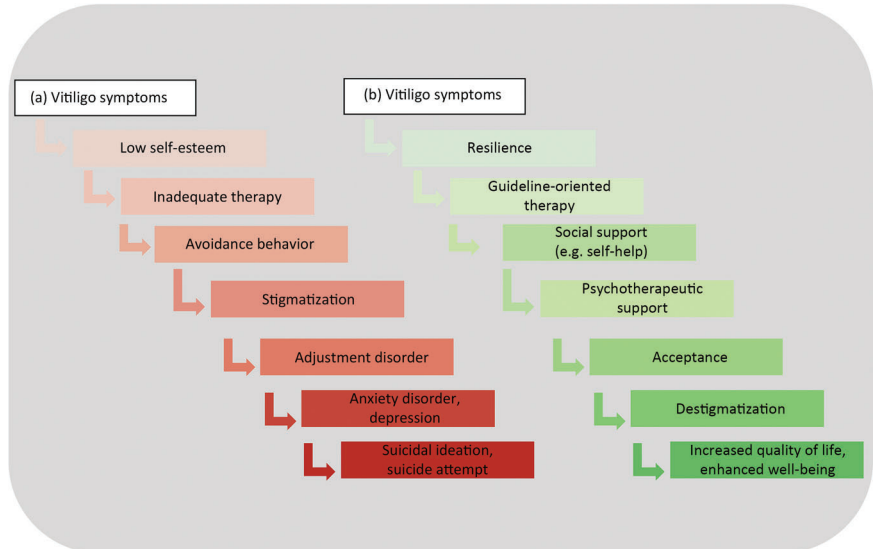
In patients with NSV, the cutaneous expression of cytokines of the innate immune system is also upregulated.

The blood levels of such cytokines, but also of IL-17, are elevated.<sup>49,50</sup> Moreover, melanocytes are closely embedded in the neuroendocrine system of the skin and secrete neuroendocrine mediators themselves.<sup>51</sup> In a recent pilot study, increased peripheral levels of corticotropin-releasing hormone (CRH) and reduced concentrations of brain-derived neurotrophic factor (BDNF) have been detected in blood of vitiligo patients. In this study, a positive correlation was observed between the serum level of CRH and the degree of depressive symptoms and anxiety, measured with PHQ-9 and GAD-7 scores.<sup>52</sup> Whether altered neuroendocrine signals of the skin modulate the immune response in vitiligo or whether the classical HPAA is altered in patients with vitiligo, thus affecting the disease including psychosomatic comorbidity and/or associated diseases, has not yet been investigated.

## PRACTICAL RECOMMENDATIONS FOR OPTIMIZED CARE OF PATIENTS WITH VITILIGO AND FURTHER RESEARCH

In conclusion of the presented data, vitiligo can be accompanied by both considerable physical and psychological comorbidity and requires, therefore, a holistic approach and treatment. The medical treatment should be performed in a guideline-directed manner. In view of the high incidence and prevalence of psychosocial burden and psychological diseases in vitiligo, a respective diagnostic workup and, if necessary, psychotherapeutic co-treatment is useful and should be considered to improve the well-being of affected patients in the long term, avoid chronification of the disease and its comorbidity, and prevent destructive disease courses (Figure 4).

**FIGURE 4** Model of potential disease courses of vitiligo. (a) Destructive course due to insufficient health care which is associated with high psychosocial comorbidity. (b) Course during guideline-oriented holistic health care.



Currently, we recommend the following approach for comprehensive care of patients with vitiligo:

- Measurement of the disease-specific impairment of QoL by VitiQoL should be implemented in routine care of all patients with vitiligo. However, the DLQI allows for direct comparison with other chronic skin diseases including the side effect profile of current and future therapies. Therefore, inclusion of this HR-PROM is useful.
- In general, psychological burden and comorbidity (especially stigmatization, anxiety diseases and depressive disorders) should be assessed during history assessment and screened in a clinical setting (for example, by GAD-2 and PHQ-2) as soon as possible.
- If relevant psychosocial factors and psychological comorbidity are suspected, professional diagnostics and, if necessary, treatment should also be initiated at an early stage.

To improve the study-based evidence and enable a more precise, personalized planning of the care of patients with vitiligo, we recommend the following approach:

- Multicenter studies could generate representative data on care, assessment of psychological comorbidity, and assessment of impairments of relevant psychosocial dimensions, including stigmatization, impairment of quality of life, and other factors like well-being. This should be performed for both adults and children and adolescents. Measurement instruments for assessment of stigmatization in vitiligo should be (further) developed and the validation evidence should be improved.
- *Awareness* campaigns could contribute to information and effective interventions for the fight against public stigmatization and self-stigmatization in Germany.
- The implementation of telemedicine and *eHealth* solutions may present future-orientated treatment options, for example, via integration of telemedicine and digital

healthcare solutions using AI algorithms for precise diagnosis and evaluation of the individual disease burden.

- Basic research on the role of neuroendocrine-immune interactions in patients with vitiligo may contribute to a better understanding of the interrelation between skin, immune system, nervous system, psyche, and endocrine system with respect to pathogenesis and therapy of all vitiligo subtypes.

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#### CONFLICT OF INTEREST STATEMENT

M. B. has received honoraria from AbbVie, Incyte, MSD and Pfizer (companies involved in developing medication for vitiligo) for advisory functions.


He has also received honoraria from AbbVie, Incyte, Janssen-Cilag and Pfizer for giving scientific presentations on vitiligo. He is subinvestigator or deputy principal investigator in clinical trials from AbbVie, Incyte and Pfizer on patients with vitiligo.

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