ORIGINAL RESEARCH



Canadian Consensus Guidelines for the Management of Vitiligo

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ABSTRACT

Introduction: Vitiligo remains a highly burdensome disease associated with significant autoimmune and psychosocial comorbidities. Although the therapeutic landscape has long been dominated by off-label therapy, new

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V. H. Prajapati Probity Medical Research, Calgary, AB, Canada treatments are emerging. Limited guidance on how to safely and effectively utilize available therapies poses challenges for healthcare providers. Herein, we provide generally accepted principles, consensus recommendations, and a treatment algorithm for the management of vitiligo, as developed by a panel of ten Canadian dermatologists with expertise in managing vitiligo.

Methods: The three-phase process consisted of identifying themes and research questions;

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conducting a systematic literature review; and discussing/voting on generally accepted principles, consensus statements, and a treatment algorithm using an iterative consensus process. Results: Experts agreed to 27 generally accepted principles, ten consensus statements, and a treatment algorithm. Education about vitiligo pathogenesis and repigmentation biology can help patients, caregivers, and healthcare providers set realistic expectations for treatment. Treatment should focus on repigmentation or stabilizing progression, rather than on depigmentation. Topical therapies include topical corticosteroids, topical calcineurin inhibitors, and the topical Janus kinase inhibitor ruxolitinib cream. Phototherapy, such as narrow-band ultraviolet B and excimer laser/lamp, can be used as monotherapy or in combination with other treatments. Off-label systemic therapies may be appropriate for patients with unstable or rapidly progressing disease. Surgical therapy may be suitable for patients with localized or stable recalcitrant disease. Maintenance therapy may help mitigate the risk of disease relapse.

Conclusion: Improved clarity around the benefits, risks, and limitations of available therapies has supported the development of robust guidelines and a treatment algorithm for vitiligo. Disease stabilization and repigmentation are goals that can largely be achieved, particularly when patients share a mutual understanding of vitiligo and its treatment options.

A Graphical Abstract is available for this article.

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Graphical Abstract:

Canadian Consensus Guidelines for the Management of Vitiligo

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The graphical abstract represents the opinion of the authors. For a full list of declarations, including funding and author disclosure statements, please see the full text online. © The authors, CC-BY-NC 2025. **Keywords:** Guidelines; Janus kinase inhibitor; Phototherapy; Topical calcineurin inhibitor; Topical corticosteroid; Vitiligo

Key Summary Points

Why carry out this study?

This study was undertaken to address a lack of guidance on the management of vitiligo with currently available treatment options in Canada.

The study asked how a panel of ten Canadian dermatologists with expertise in managing vitiligo would propose managing the disease.

What was learned from the study?

The panel provided generally accepted principles, consensus recommendations, and a treatment algorithm for the management of vitiligo that reflect the changing vitiligo treatment landscape.

Healthcare providers will have a better understanding of patient disease burden and assessment tools for vitiligo and be better prepared to use a wide variety of treatments in conjunction with education to optimize therapeutic outcomes for their patients.

DIGITAL FEATURES

This article is published with digital features, including a Graphical Abstract to facilitate understanding of the article. To view digital features for this article, go to https://doi.org/10. 6084/m9.figshare.28660781.

INTRODUCTION

Vitiligo is a chronic autoimmune disease characterized by melanocyte destruction that leads to skin depigmentation [1, 2]. Vitiligo is associated with autoimmune and psychosocial comorbidities, including stigmatization, which can negatively affect mental health and quality of life (QoL) [3]. The degree of the effect of vitiligo on mental health and QoL can be influenced by factors such as skin tone as well as ethnic and cultural backgrounds [3, 4].

Vitiligo is rarely associated with physical symptoms, such as pruritus and skin pain, that are characteristic of other immune-mediated inflammatory diseases (IMIDs) of the skin [5]. Many persons with vitiligo are underrecognized, misdiagnosed, and undertreated, due in part to misconceptions that there are very limited efficacious therapies and/or that the condition is primarily "cosmetic" [6, 7]. These challenges can cause substantial delays in formal diagnosis and treatment [8], which may lead to worse outcomes.

Various off-label therapies may be prescribed for patients with vitiligo, including topical corticosteroids (TCS), topical calcineurin inhibitors (TCI), phototherapy, and systemic corticosteroids [9, 10]. Emerging treatments include topical and systemic Janus kinase inhibitors (JAKi) [11]; systemic biologics, particularly those focusing on interleukin-15 (IL-15) inhibition, are in the exploratory stages of development [12]. Ruxolitinib cream, a topical JAK1/JAK2 inhibitor, is currently the only approved repigmentation therapy for the treatment of vitiligo in Canada [13], the USA [14], the UK [15], and the European Union [16]. Several systemic JAKi are currently being investigated in phase 3 clinical trials [17–19]. Repigmentation rates vary across all treatments, and the disease will frequently relapse upon discontinuation of treatment [9, 20].

A clear set of consensus treatment guidelines can facilitate optimal management of vitiligo. Herein we provide generally accepted principles, consensus recommendations, and a practical treatment algorithm for the management of vitiligo, as developed by a panel of ten Canadian dermatologists with expertise in managing vitiligo.

METHODS

An expert panel of ten Canadian dermatologists with extensive clinical and research experience in vitiligo developed practical statements and a treatment algorithm based on current scientific evidence and expert opinion. The process consisted of three phases. In the first phase of the project, themes and clinical questions were proposed at a meeting of all ten experts in November 2022.

In the second phase, a systematic literature review was conducted on the basis of specific clinical questions and population, intervention, control, and outcomes (PICO) terms identified by the experts. It aimed to address the question, "What is the range of disease burden of vitiligo?" (Supplementary Material Table 1). It also aimed to address the question, "What treatment options are available for vitiligo?" (Supplementary Material Table 2). Data extracted from the literature and expert opinion were used to draft generally accepted principles, consensus statements, and a treatment algorithm. These items were developed, validated, and then further refined by a subgroup of five of the experts (VHP, HL, IT, JR, and YM-M) at a meeting in August 2023. After this meeting, additional revisions were made asynchronously, with agreement reached among the five experts. An online survey was conducted for this subgroup to categorize statements as generally accepted principles or consensus statements.

In the third phase of the project, all ten experts attended an in-person meeting in September 2023 to discuss the generally accepted principles, as well as to vote on the final consensus statements and treatment algorithm using an iterative consensus process. Because the generally accepted principles for vitiligo were uniformly considered as foundational aspects of medical care, they were not subjected to voting. For the consensus statements and treatment algorithm, the level of agreement was assessed on a 5-point Likert scale (1, "strongly disagree"; 5, "strongly agree"). Consensus was defined as \geq 75% agreement (i.e., a mean Likert score \geq 3.75 out of 5). This article is based on previously conducted studies and does not contain any new studies with human participants or animals performed by any of the authors.

RESULTS AND DISCUSSION

Literature Search and Expert Statements

The literature search for the first question ("What is the range of disease burden of vitiligo?") resulted in ten sources for data extraction. The literature search for the second question ("What treatment options are available for vitiligo?") resulted in 57 sources for data extraction. Following discussions and an iterative consensus process, 27 generally accepted principles (Table 1) and ten consensus statements (Table 2) were adopted, details of which are provided in the next sections to guide recommendations for management. The treatment algorithm (Fig. 1) had unanimous (100%) agreement.

General Disease Considerations and Epidemiology

Vitiligo is a heterogeneous disease that is classified into distinct clinical subtypes according to morphology and distribution [2, 21]. The most common subtype included in clinical studies is nonsegmental vitiligo, wherein affected areas are present bilaterally [22]. Within nonsegmental vitiligo, many additional variants exist, including acrofacial, generalized, and mixed [21]. Segmental vitiligo is typically distinguished from nonsegmental vitiligo by its unilateral distribution and clinical stability over time [21].

Current prevalence rates estimate that vitiligo affects approximately 0.5–2.0% of the population worldwide [23, 24]; however, this may be an underestimation of the actual global burden [23]. Many cases likely go underrecognized, undiagnosed/misdiagnosed, and undertreated, due in part to pervasive misconceptions about vitiligo, such as the beliefs that vitiligo cannot be treated effectively and that it is essentially "cosmetic" in nature [6–8]. Patients and their healthcare providers may have limited understanding of the immune processes underlying vitiligo and be unaware that beneficial treatments are available [7, 8].

Table 1 Generally accepted principles for vitiligo

Statement

General disease considerations/epidemiology

Current estimates of incidence and prevalence are likely to underrepresent the actual burden of vitiligo, which tends to be underrecognized/underdiagnosed, undertreated, and poorly understood

It is important to recognize that vitiligo manifests with distinct clinical subtypes and is a heterogeneous disease. Vitiligo (nonsegmental) is the most studied clinical subtype in clinical trials

Understanding the burden of vitiligo should include the consideration of clinical subtypes, age, gender, distribution, skin type, ethno-cultural background, marital status, disease duration, and impact on QoL

Vitiligo is noteworthy among immune-mediated inflammatory diseases as it manifests primarily through changes in the appearance of the skin without physical symptoms yet significantly impacts patients' QoL

Lack of disease recognition, patient validation, and access to treatment add to the burden of vitiligo

Psychosocial, mental health, and QoL impact

Patients with vitiligo experience increased psychosocial, mental health, and QoL impact that is often underrecognized

Patients with vitiligo often experience discrimination; pediatric and adolescent populations can also struggle with teasing, bullying, and feeling self-conscious

Comorbidities

Patients with vitiligo have a higher prevalence of anxiety, depression, and suicidal ideation/behavior

Assessment tools

Although DLQI and CDLQI are health-related QoL assessment tools that have been validated in vitiligo, they do not holistically capture its burden on patients

Notwithstanding the availability of assessment tools that evaluate various quantitative aspects of vitiligo, the patient experience is critical to guiding management

General management considerations

- Management of vitiligo is multimodal and should be individualized based on disease extent, location, level, and pattern as well as psychosocial, mental health, and QoL impact
- The treatment of vitiligo will not affect associated autoimmune conditions and vice versa, unless the treatment targets a similar pathomechanism
- There is a lack of evidence on how well patients with segmental or mixed clinical subtypes of vitiligo will respond to treatment
- Affirmation and assessment of psychosocial, mental health, and QoL impact of vitiligo on patients is an essential aspect of the ongoing management
- The progression of vitiligo may be rapid or slow, but repigmentation tends to be slow

Patients with vitiligo should be educated about minimizing physical trauma to the skin to avoid Koebnerization

Patients with vitiligo should be encouraged to use sun protection to avoid sunburn and/or minimize contrast between affected and nonaffected areas

Table 1 continued

Statement

Monitoring of disease activity and treatment response for vitiligo can include baseline and serial photography by patient and/or practitioner, if available

Evidence supporting the efficacy and safety of complementary and alternative therapies is insufficient for the treatment of vitiligo

Relapse with vitiligo is common and can be treated by reinitiating therapy

Camouflage may be appropriate as monotherapy or as an adjunctive therapy in patients with vitiligo

Repigmentation and/or stabilization strategies—topical therapies

Physicians should be aware and patients should be informed of the official warning against the concomitant use of topical calcineurin inhibitors and intentional ultraviolet light exposure

Repigmentation and/or stabilization strategies—phototherapy

Narrow-band ultraviolet B phototherapy and excimer laser/lamp therapy are the recommended forms of light treatment for patients with vitiligo

Intentional sun exposure or use of recreational tanning beds are generally not recommended for the treatment of vitiligo

Unlike phototherapy for other dermatoses, phototherapy for vitiligo typically requires a protracted treatment course of $\ge 6-12$ months

There are efficacy and safety data to support the use of clinic-based excimer laser/lamp therapy either alone or in combination with other therapies for the treatment of patients with vitiligo

Repigmentation and/or stabilization strategies—surgical therapy

There are efficacy and safety data to support the use of surgical therapy for the treatment of vitiligo in patients with localized stable recalcitrant disease

CDLQI Children's Dermatology Life Quality Index, DLQI Dermatology Life Quality Index, QoL quality of life

Unlike many other IMIDs of the skin, vitiligo can negatively impact a patient's QoL without physical symptoms in the majority of patients [25]. Some patients may experience pruritus within affected areas early in the disease course, and some patients may experience burning sensations with UV light exposure [6, 26, 27]. The burden of vitiligo and its impact on QoL are largely affected by disease- and patientrelated factors. Disease-related factors associated with higher overall QoL burden include longer duration, rapid progression, more extensive affected body surface area, and involvement of visible or sensitive sites, such as the face, hands, and genitals [3, 28]. Patient-related factors eliciting greater QoL burden include age (pediatric versus adult), sex (women versus men), skin tone (Fitzpatrick skin types IV-VI

versus I–III), race (non-white versus white), and culture [3, 28–30]. Women often experience greater QoL impairment than men, which may be due to higher perceived stigma as it relates to physical appearance, relationships, and decreased prospects for marriage in some cultures [29, 31]. Lack of disease recognition, patient validation, and access to effective treatments further add to the burden of vitiligo [7].

Comorbidities and Impact on QoL

Patients with vitiligo are more likely to have other autoimmune comorbidities, such as thyroid disease, type 1 diabetes mellitus, alopecia areata, and pernicious anemia (Consensus

Statement	Level of agreement, %	Mean (SD) Likert score ^a
Comorbidities		
1. Patients with vitiligo are at a higher risk of having coexisting autoimmune disorders, including, but not limited to, thyroid disease, type 1 diabetes mellitus, alopecia areata, and pernicious anemia	86	4.3 (1.3)
Assessment tools		
2. Vitiligo-specific assessment tools such as VASI, VESplus, VitiQoL, VIS, and VIPs have been used in clinical trials but are neither essential nor practical in day-to-day clinical patient management	98	4.9 (0.3)
General management considerations		
3. Treatment of patients with vitiligo is directed toward repigmentation and/or stabilization. In exceptional cases, depigmentation may be a therapeutic option	96	4.8 (0.4)
4. Healthcare providers are encouraged to consider screening for concomitant autoimmune and mental health disorders in patients with vitiligo and refer to other healthcare providers when appropriate	96	4.8 (0.4)
5. Maintenance therapy reduces the risk of relapse in patients with vitiligo	84	4.2 (0.7)
Repigmentation and/or stabilization strategies—topical therapies		
6. Topical therapy with corticosteroids, calcineurin inhibitors, and JAKi can be considered as first-line monotherapy for the treatment of any form of vitiligo	100	5.0 (0)
7. The off-label use of topical corticosteroids, calcineurin inhibitors, and JAKi in combination with phototherapy may be used for treating patients with vitiligo	94	4.7 (0.5)
Repigmentation and/or stabilization strategies—phototherapy		
8. Phototherapy can be used alone or in combination with other therapies for the treatment of vitiligo	94	4.7 (0.6)
Repigmentation and/or stabilization strategies—systemic therapy		
9. In exceptional cases, off-label use of systemic immunomodulatory therapies can be considered for patients with unstable or rapidly progressive vitiligo. There are currently no approved systemic therapies for vitiligo	92	4.6 (0.5)
Depigmentation strategies—topical therapy		
10. Although monobenzone (monobenzyl ether of hydroquinone) is approved for depigmentation therapy in the treatment of vitiligo, it should only be prescribed in exceptional circumstances by dermatologists experienced with this therapy	98	4.9 (0.3)

Table 2 Consensus statements for vitiligo

JAKi Janus kinase inhibitor, VASI Vitiligo Area Scoring Index, VES Vitiligo Extent Score, VIPs Vitiligo Impact Patient scale, VIS Vitiligo Impact Scale, VitiQoL Vitiligo-specific quality of life

^aLikert scale ranges from 1 to 5, with higher scores indicating more agreement



Fig. 1 Algorithm for the management of vitiligo (nonsegmental) in children, adolescents, and adults. ^aVisible/sensitive areas include the head/neck (especially face), hands, axilla/inguinal region, and genital area. ^bNarrow-band ultraviolet B phototherapy alone or in combination with other treatment modalities (e.g., topical corticosteroids,

Statement 1 [Table 2]) [32, 33]. Associations between vitiligo and autoimmune comorbidities may result from shared heritability genes [33, 34].

topical calcineurin inhibitors, and topical JAK inhibitors). ^cCorticosteroids as oral mini pulse. ^dImmunomodulators include methotrexate, cyclosporine, azathioprine, minocycline, and JAK inhibitors. *JAK* Janus kinase, *QoL* quality of life

Patients with vitiligo are also at higher risk for psychosocial comorbidities [3, 28]. Prevalence rates of mental health disorders, such as anxiety, depression, sexual dysfunction, and suicidal ideation/behavior, are higher among patients with vitiligo compared with healthy control groups or those with other skin diseases (e.g., alopecia areata, atopic dermatitis, and psoriasis) [3, 35–39]. The psychosocial, mental health, and QoL burden may be higher with diseaserelated factors [3, 28], patient-related factors, and discrimination or bullying, particularly in the case of children and adolescents [40]. Anxiety, depression, and impaired QoL have also been reported among caregivers of patients with vitiligo [3, 28], particularly in cases of progressive versus stable vitiligo [41].

Assessment Tools

For healthcare providers to more effectively guide disease management, the patient's perspective must be considered alongside qualitative and quantitative assessment tools (i.e., shared decision-making). In routine clinical practice, clinicians often use rapidity of disease progression, disease extent and distribution (including involvement of visible and sensitive sites), and disease effect on QoL, as well as patient motivations and preferences, to guide management [42].

Vitiligo-specific assessment tools are available for evaluation of physician-rated measures, such as disease extent and progression or repigmentation with treatment (e.g., the Vitiligo Area Scoring Index [VASI] [43], the Vitiligo Extent Score [VES] [44], and VESplus [45]) and patientreported outcomes (e.g., Vitiligo-specific quality of life [VitiQoL] [25]; Vitiligo Impact Scale [VIS] [46]; Vitiligo Impact Patient scale [VIPs] [47]; and Vitiligo Noticeability Scale [VNS] [48]). Wood's lamp examination of the skin can be a simple and reliable adjunctive tool for visualizing cutaneous depigmentation in vitiligo, particularly in patients with lighter constitutive skin color [49] where affected areas may be less apparent. The Dermatology Life Quality Index (DLQI) [50] and Children's DLQI (CDLQI) [28, 51] questionnaires may also be used to assess QoL in patients with vitiligo [28]. Although these formal assessment tools are often obligatory for clinical trials [52], they may not be practical for everyday clinical practice (Consensus Statement 2). The DLQI and CDLQI, for example, may not sufficiently capture disease burden, despite being validated for use in vitiligo [52].

Patient Education

Effective management of vitiligo can be aided by facilitating patient awareness of measures that can be taken to reduce the risk of progression. Because of the underlying pathomechanisms of vitiligo, repigmentation tends to be a slow process regardless of disease progression speed [53]. This can be a source of frustration for patients [7]. Thus, education about vitiligo pathogenesis and repigmentation biology can help patients, caregivers, and healthcare providers set realistic expectations for treatment.

Lifestyle management strategies may also be helpful for patients. Sun safety, including sunscreen, sun-protective clothing, and sun avoidance is recommended [8]. Not only can these measures reduce the risk of sunburn within areas affected by vitiligo but also they can limit the contrast between depigmented (affected) and pigmented (unaffected) areas, and may prevent new sites of involvement from Koebnerization [54]. Avoiding skin trauma in general is important [54].

Patients can also be educated about adjunctive options to prescribed treatments. Camouflage may be used as monotherapy or an adjunctive therapy option [55]. Coverage of vitiligo with clothing or cosmetics has been found to improve overall QoL, although patients may find some methods ineffective, time-consuming, and/or expensive [55, 56]. Limited data are available regarding the efficacy of other complementary and alternative therapies for vitiligo, such as herbal remedies or dietary supplements [57].

Treatment Considerations

For most patients who desire therapy, treatment will primarily focus on repigmentation and/or stabilizing progression, rather than on depigmentation (Consensus Statement 3). Treatment approaches differ depending on the goal

of therapy, and a variety of factors warranting individualized management of vitiligo should be considered by healthcare providers when recommending a treatment plan [58]. Clinical subtype, as well as disease extent and distribution, vary among patients and can impact QoL; thus, these factors should be considered when determining treatment (Fig. 1). Currently, there is limited evidence regarding response to treatment in patients with segmental or mixed clinical subtypes, although responses may be observed in patients with short disease duration (i.e., <6 months) [59]. Regardless of vitiligo subtype, patients and healthcare providers can monitor disease progression and treatment response by taking baseline and serial photographs of affected skin for direct comparisons over time.

Given increased risks for autoimmune and psychosocial comorbidities in patients with vitiligo, healthcare providers should take into consideration concomitant disorders and refer to other healthcare providers as necessary (Consensus Statement 4). Mental health and QoL impact of vitiligo should be considered for the successful ongoing management of vitiligo. Some patients may not be aware of concomitant disorders and may require additional screening. For vitiligo treatments that specifically target its underlying immunopathogenesis, associated comorbid medical conditions will only be improved or stabilized if they progress through a similar mechanism. Less-targeted treatments, such as systemic corticosteroids, may temporarily abate multiple diseases regardless of pathomechanism [60].

It is common for vitiligo to relapse if treatment is discontinued, often within 2 years after stopping therapy, although the extent and rate of depigmentation may vary [20, 61]. Maintenance therapy may help mitigate the risk of disease relapse (Consensus Statement 5) [42], and there is evidence for some therapies (e.g., ruxolitinib cream [62] and tacrolimus ointment [63]) that this is the case. In many cases, repigmentation occurs again when therapy is reinitiated.

Repigmentation and Stabilization Strategies

Topical Therapy

Historically, first-line monotherapy for treatment of vitiligo has included TCS and TCI (Consensus Statement 6) [58]. Ruxolitinib cream (JAK1/JAK2 selective inhibitor [64]; Consensus Statement 6) is currently the only repigmentation therapy approved for the treatment of nonsegmental vitiligo in patients aged ≥ 12 years in Canada [13], the USA [14], the UK [15], and the European Union [16]. Twice-daily treatment with 1.5% ruxolitinib cream is generally well tolerated and has demonstrated significant facial and body skin repigmentation versus vehicle within 24 weeks, with continued improvement through 52 weeks [65]. These findings may reflect the key role of the JAK-signal transducer and activator of transcription (STAT) pathway in vitiligo pathogenesis, including the mediation of interferon- γ and IL-15 signaling [66]. In general, topical therapies may be used in combination with phototherapy [42]. Twice-daily treatment with 1.5% ruxolitinib cream combined with narrow-band ultraviolet B (NB-UVB) was well tolerated and effective in a phase 2 study [67]. However, there is an official warning against using TCI in combination with UV light exposure as it is not known whether TCI interferes with the skin's response to UV damage [68]. Off-label use of topical therapies approved for other indications, such as TCS [69] and TCI [70], as well as compounded prescriptions of the topical JAKi, tofacitinib [71], may also be effective in managing vitiligo (Consensus Statement 7), although prolonged or continuous use of some treatments are associated with local and systemic adverse events [58]. Treatment regimens following an intermittent or alternative schedule (e.g., 2 weeks on/2 weeks off) may mitigate safety concerns associated with prolonged TCS use [9].

Phototherapy

Phototherapy can be used as monotherapy or in combination with other treatments (Consensus Statement 8) to achieve greater levels of therapeutic success [72, 73]. The recommended forms of phototherapy for patients with vitiligo include NB-UVB and excimer laser/lamp, which have been proven to be safer and more efficacious than psoralen UVA (PUVA) or UVA1 [74, 75].

In general, a minimum course of 6–12 months is required for the treatment of vitiligo with phototherapy [76]. Initial therapy should ideally be administered two or three times per week until adequate repigmentation is achieved [61, 76]. Responses should be reassessed periodically with a decision for ongoing maintenance therapy or discontinuation being made only after 6-12 months of phototherapy. Maintenance therapy regimens may vary from once to twice weekly, and treatment can be discontinued if the repigmentation response is deemed adequate [76]. Office-based phototherapy with proper supervision is preferred over home-based phototherapy; however, home-based phototherapy may be acceptable in special circumstances [77, 78], although patients should be closely monitored to prevent misuse.

Patients should be educated on the effects of phototherapy before undergoing treatment. Phototherapy can tan unaffected skin and paradoxically render vitiligo more noticeable [76]. Patients should also be advised that tanning parlor use is not recommended for treatment of vitiligo as it may cause Koebner phenomena if sunburn occurs [54] and can lead to increased risk of skin cancer [79].

Systemic Therapy

Although no systemic therapies are currently approved for the treatment of vitiligo, off-label use of systemic immunomodulators may be appropriate for patients with unstable or rapidly progressing vitiligo (Consensus Statement 9). These agents should be used with caution owing to their risk-benefit profile, and may include corticosteroids (either transient or via pulse therapy) [80], JAKi (currently being investigated in phase 3 clinical trials) [17–19], cyclosporine [81], or methotrexate [82, 83].

Surgical Therapy

In patients with localized or stable recalcitrant vitiligo, efficacy and safety data support the use of surgical therapy as an appropriate treatment option [84-86]. Surgical techniques such as needling, cellular suspension or punch grafts, suction blister grafts, and melanocyte transplantation [87] are suitable for cases of vitiligo that have been stable for ≥ 12 months and are resistant to topical therapy or phototherapy [42] Surgical therapy may be particularly useful in cases of segmental vitiligo, which is often resistant to other forms of treatment [9]. Other clinical characteristics (e.g., disease extent and distribution) should also be taken into account when determining the appropriate surgical technique [9]. However, surgical therapies are not widely accessible in Canada.

Depigmentation Strategies

Although repigmentation to restore a patient's native constitutive skin color is typically the goal of vitiligo treatment, intentional depigmentation may be considered in exceptional cases, such as patients with treatment-resistant extensive disease [9]. Monobenzone (monobenzyl ether of hydroquinone) [88] is approved in certain jurisdictions as a depigmentation therapy for patients with vitiligo; however, it should only be used by dermatologists who are experienced with this type of treatment (Consensus Statement 10). Further, it may be difficult to obtain. Additional depigmentation strategies include pigment-specific ablative laser therapy (e.g., Q-switched ruby, alexandrite, or neodymium-doped yttrium aluminum garnet [Nd:YAG]) and cryotherapy (e.g., liquid nitrogen) [89, 90]. Depigmentation should be considered irreversible, although spontaneous repigmentation may occur and is unpredictable [91].

Limitations

These guidelines are widely applicable but most closely approximate clinical practice in Canada

given that all experts who participated in the study practice in Canada.

CONCLUSIONS

Clinical data and experience support the development of an evidence-based algorithm to guide clinicians in the management of vitiligo. Disease stabilization and repigmentation are treatment goals that can be achieved to a certain extent with appropriate therapies, though factors such as disease duration and sites of involvement may influence the response. As ongoing research efforts evaluate the burden and treatment of vitiligo, new therapeutic options continue to emerge. Healthcare providers are encouraged to discuss new treatment options with patients to develop and facilitate an individualized and realistic treatment plan.

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Data Availability. Data sharing is not applicable to this article as no new datasets were generated or analyzed during the current study.

Declarations

Conflict of interest. Vimal H. Prajapati has served as an advisor, consultant, and/or speaker for AbbVie, Actelion, Amgen, Apogee Therapeutics, Aralez, Arcutis, Aspen, Bausch Health, BioScript Solutions, Boehringer Ingelheim, Bristol Myers Squibb, Canadian Psoriasis Network, Celgene, Celltrion, Cipher, Concert, CorEvitas, Eczema Society of Canada, Eli Lilly, Galderma, GlaxoSmithKline, Homeocan, Incyte Corporation, JAMP Pharma, Janssen, Johnson & Johnson, LEO Pharma, Medexus, Novartis, Organon, Pediapharm, Pfizer, Sanofi Genzyme, Sun Pharma, Tribute, UCB, and Valeant; served as an investigator for AbbVie, AnaptysBio, Arcutis, Arena, Asana, Bausch Health, Boehringer Ingelheim, Bristol Myers Squibb, Celgene, Concert, CorEvitas, Dermavant, Dermira, Eli Lilly, Galderma, Incyte Corporation, Janssen, LEO Pharma, Meiji Pharma, Nektar Therapeutics, Nimbus Lakshmi, Novartis, Pfizer, RAPT Therapeutics, Regeneron, Reistone, Sanofi Genzyme, Sun Pharma, Takeda, and UCB; and received grants from AbbVie, Bausch Health, Janssen, LEO Pharma, Novartis, and Sanofi Genzyme. Harvey Lui has served as an advisor, consultant, investigator, and/or speaker for AbbVie, Incyte Corporation, L'Oréal, Novartis, and Vita Imaging. Yvette Miller-Monthrope has served as an advisor, consultant, and/or speaker for AbbVie, Bristol Myers Squibb, Boehringer Ingelheim, Fresenius Kabi, Galderma, Incyte Corporation, Janssen, Sanofi, Sun Pharma,

Novartis, and UCB. Julien Ringuet has served as an advisor, consultant, and/or speaker for AbbVie, Amgen, Apogee, Arcutis, Bausch Health. Boehringer Ingelheim, Bristol Myers Squibb, Eli Lilly, Galderma, Incyte Corporation, Janssen, LEO Pharma, L'Oréal, NKS Health, Novartis, Organon, Pfizer, Sandoz, Sanofi Genzyme, Sun Pharma, and UCB; and served as an investigator for AbbVie, Alumis, Amgen, Apogee, Aristea, Aslan, Bristol Myers Squibb, Celgene, Concert Pharmaceuticals, Correvitas, DICE Therapeutics, Incyte Corporation, Innovaderm, Janssen, Kyowa Kirin, LEO Pharma, Merck, Pfizer, Sanofi Genzyme, Sun Pharma, and UCB. Irina Turchin has served as a speaker, advisor, consultant, or investigator for AbbVie, Amgen, Arcutis, Aristea, Bausch Health, Bristol Myers Squibb, Boehringer Ingelheim, Eli Lilly, Galderma, Horizon Therapeutics, Incyte Corporation, Janssen, Kiniksa, LEO Pharma, Mallinckrodt, MoonLake, Novartis, Pfizer, Sanofi, Sun Pharma, UCB, and Ventyx Biosciences. H. Chih-ho Hong has served as a speaker, advisor, consultant, and/or investigator for AbbVie, Amgen, Arcutis, Bausch Health, Boehringer Ingelheim, Bristol Myers Squibb, Celgene, Cutanea, Dermira, Dermavant, DS Biopharma, Eli Lilly, Galderma. GlaxoSmithKline, Incyte Corporation, Janssen, LEO Pharma, Medimmune, Merck, Mirimar, Novartis, Pfizer, Regeneron, Sanofi Genzyme, Roche, and UCB. Charles Lynde has served as a speaker and/or consultant for AbbVie, Amgen, Aralez, Arcutis, Bausch Health, Bayer, Boehringer Ingelheim, Bristol Myers Squibb, Celgene, Cipher, Dermavant, Eli Lilly, Fresnius Kabi, Galderma, GlaxoSmithKline, Incyte Corporation, Innovaderm, Intega Skin, Janssen, Kyowa Kirin, La Roche Posay, LEO Pharma, L'Oréal, Medexus, MedX, Merck, Novartis, P&G, Pediapharm, Pfizer, Regeneron, Roche, Sanofi Genzyme, Sandoz, Sentrex, Sun Pharma, TEVA, Tribute, UCB, Valeant, Viatris, and Volo Health; and has served as a principal investigator for AbbVie, Acelyrin, Akros, Altius, Amgen, Aralez, Arcutis, Avillion, Bausch Health, Bayer, Boehringer Ingelheim, Bristol Myers Squibb, Celgene, Celltrion, Cipher, Concert, Dermavant, Devonian, Eli Lilly, Evelo, Galderma, GlaxoSmithKline, Incyte Corporation, Innovaderm, Intega Skin, Janssen, Kyowa Kirin, La Roche Posay, LEO Pharma, L'Oréal, Medexus, MedX, Merck, MoonLake, Novartis, P&G, Pediapharm, Pfizer, Regeneron, Roche, Sanofi Genzyme, Sandoz, Sentrex, Sun Pharma, TEVA, Tribute, UCB, Valeant, Viatris, and Volo Health. Kim A. Papp has received honoraria and/or grants as a consultant, speaker, investigator, or scientific officer from AbbVie, Acelyrin, Akros, Alumis, Amgen, Arcutis, Bausch Health/Valeant, Boehringer Ingelheim, Bristol Myers Squibb, Can-Fite Biopharma, Celltrion, Concert Pharmaceuticals, Dermavant, Dermira, DICE Pharmaceuticals, DICE Therapeutics, Eli Lilly and Company, Evelo Biosciences, Forbion, Galderma, Horizon Therapeutics, Incyte Corporation, Janssen, Kymab, Kyowa Hakko Kirin, LEO Pharma, Meiji Seika Pharma, Mitsubishi Pharma, Nimbus Therapeutics, Novartis, Pfizer, Reistone, Sanofi-Aventis/Genzyme, Sandoz, Sun Pharma, Takeda, Tarsus Pharmaceuticals, UCB Pharma, and Zai Lab. Jensen Yeung has served as a consultant, investigator, or speaker or received honoraria from AbbVie, Amgen, Acrutis, Apogee, Bausch Health, Boehringer Ingelheim, Bristol Myers Squibb, Celltrion, Fresenius Kabi, Galderma, Incyte Corporation, JAMP Pharma, Janssen, LEO Pharma, Lilly, Novartis, Pfizer, Regeneron, Sanofi Genzyme, Sun Pharma, Takeda, and UCB. Melinda J. Gooderham has served as a principal investigator for AbbVie, Alumis, Amgen, AnaptysBio, Apogee, Arcutis, Aristea, Aslan, Bausch Health, Boehringer Ingelheim International GmbH, Bristol Myers Squibb, Cara Therapeutics, Coherus Biosciences, Dermira, Eli Lilly, Galderma SA, GlaxoSmithKline, Incyte Corporation, InMagene, JAMP, Janssen, LEO Pharma, MedImmune, Meiji, MoonLake, Nektar Therapeutics, Nimbus, Novartis, Pfizer, Regeneron, Sanofi Genzyme, Sun Pharma, Takeda Pharmaceutical Company, Tarsus, UCB, Ventyx, and Vyne; a consultant for AbbVie, Amgen, Apogee, Aslan, Bausch Health, Boehringer Ingelheim International GmbH, Eli Lilly, Janssen, Novartis Pharmaceuticals, Sanofi Genzyme, Sun Pharma, and UCB; an advisory board member for AbbVie, Amgen, Apogee, Arena Pharmaceuticals, Asana BioSciences, Aslan, Bausch Health, Boehringer Ingelheim International GmbH, Eli Lilly, Galderma SA, Incyte Corporation, Janssen, LEO Pharma, Novartis, Pfizer, Regeneron, Sanofi

Genzyme, Sun Pharma, UCB, and Union; and a paid speaker for AbbVie, Amgen, Bausch Health, Bristol Myers Squibb, Boehringer Ingelheim International GmbH, Eli Lilly, Galderma SA, Janssen, JAMP, LEO Pharma, L'Oréal, Novartis, Pfizer, Regeneron, Sanofi Genzyme, Sun Pharma, and UCB.

Ethical approval. This article is based on previously conducted studies and does not contain any new studies with human participants or animals performed by any of the authors.

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REFERENCES

- Sandoval-Cruz M, Garcia-Carrasco M, Sanchez-Porras R, Mendoza-Pinto C, Jimenez-Hernandez M, Munguia-Realpozo P, et al. Immunopathogenesis of vitiligo. Autoimmun Rev. 2011;10(12):762–5.
- 2. Bergqvist C, Ezzedine K. Vitiligo: a review. Dermatology. 2020;236(6):571–92.
- Ezzedine K, Eleftheriadou V, Jones H, Bibeau K, Kuo FI, Sturm D, et al. Psychosocial effects of vitiligo: a systematic literature review. Am J Clin Dermatol. 2021;22(6):757–74.
- 4. Thompson AR, Clarke SA, Newell RJ, Gawkrodger DJ, Appearance Research Collaboration.

Vitiligo linked to stigmatization in British South Asian women: a qualitative study of the experiences of living with vitiligo. Br J Dermatol. 2010;163(3):481–6.

- 5. Zeidler C, Pereira MP, Huet F, Misery L, Steinbrink K, Stander S. Pruritus in autoimmune and inflammatory dermatoses. Front Immunol. 2019;10:1303.
- 6. Ezzedine K, Sheth V, Rodrigues M, Eleftheriadou V, Harris JE, Hamzavi IH, et al. Vitiligo is not a cosmetic disease. J Am Acad Dermatol. 2015;73(5):883–5.
- Teasdale E, Muller I, Abdullah Sani A, Thomas KS, Stuart B, Santer M. Views and experiences of seeking information and help for vitiligo: a qualitative study of written accounts. BMJ Open. 2018;8(1): e018652.
- 8. Hamzavi IH, Bibeau K, Grimes P, Harris JE, van Geel N, Parsad D, et al. Exploring the natural and treatment history of vitiligo: patient and healthcare professional perceptions from the global VAL-IANT study. Br J Dermatol. 2023;189(5):569–77.
- 9. Seneschal J, Speeckaert R, Taieb A, Wolkerstorfer A, Passeron T, Pandya AG, et al. Worldwide expert recommendations for the diagnosis and management of vitiligo: position statement from the International Vitiligo Task Force-part 2: specific treatment recommendations. J Eur Acad Dermatol Venereol. 2023;37(11):2185–95.
- Eleftheriadou V, Atkar R, Batchelor J, McDonald B, Novakovic L, Patel J, et al. British Association of Dermatologists guidelines for the management of people with vitiligo 2021. Br J Dermatol. 2022;186(1):18–29.
- 11. Perez-Bootello J, Cova-Martin R, Naharro-Rodriguez J, Segurado-Miravalles G. Vitiligo: pathogenesis and new and emerging treatments. Int J Mol Sci. 2023;24(24):17306.
- 12. Iwanowski T, Kolkowski K, Nowicki RJ, Sokolowska-Wojdylo M. Etiopathogenesis and emerging methods for treatment of vitiligo. Int J Mol Sci. 2023;24(11):9749.
- 13. Incyte Corporation and Innomar Strategies. Opzelura[®] (ruxolitinib cream). Product Monograph. Oakville: 2024.
- 14. Incyte Corporation. Opzelura[®] (ruxolitinib cream). Full Prescribing Information. Wilmington, DE: Incyte Corporation: 2024.
- 15. Incyte Biosciences U.K. Ltd. Opzelura[®] (ruxolitinib cream). Summary of Product Characteristics. Leatherhead, UK: 2023.

- 1366
- Incyte Biosciences Distribution BV. Opzelura[®] (ruxolitinib cream). Summary of Product Characteristics. Amsterdam, Netherlands: 2023.
- 17. ClinicalTrials.gov. NCT06118411. https://clini caltrials.gov/study/NCT06118411. Accessed 20 Jan 2025.
- ClinicalTrials.gov. NCT06163326. https://clini caltrials.gov/study/NCT06163326. Accessed 20 Jan 2025.
- 19. ClinicalTrials.gov. NCT06113445. https://clini caltrials.gov/study/NCT06113445. Accessed 30 Jan 2025.
- 20. Sitek JC, Loeb M, Ronnevig JR. Narrowband UVB therapy for vitiligo: does the repigmentation last? J Eur Acad Dermatol Venereol. 2007;21(7):891–6.
- 21. Ezzedine K, Lim HW, Suzuki T, Katayama I, Hamzavi I, Lan CC, et al. Revised classification/ nomenclature of vitiligo and related issues: the Vitiligo Global Issues Consensus Conference. Pigment Cell Melanoma Res. 2012;25(3):E1-13.
- 22. Pala V, Ribero S, Quaglino P, Mastorino L. Updates on potential therapeutic approaches for vitiligo: Janus kinase inhibitors and biologics. J Clin Med. 2023;12(23):7486.
- 23. Bibeau K, Pandya AG, Ezzedine K, Jones H, Gao J, Lindley A, et al. Vitiligo prevalence and quality of life among adults in Europe, Japan and the USA. J Eur Acad Dermatol Venereol. 2022;36(10):1831–44.
- 24. Krüger C, Schallreuter KU. A review of the worldwide prevalence of vitiligo in children/adolescents and adults. Int J Dermatol. 2012;51(10):1206–12.
- 25. Lilly E, Lu PD, Borovicka JH, Victorson D, Kwasny MJ, West DP, et al. Development and validation of a vitiligo-specific quality-of-life instrument (VitiQoL). J Am Acad Dermatol. 2013;69(1):e11–8.
- 26. Vachiramon V, Onprasert W, Harnchoowong S, Chanprapaph K. Prevalence and clinical characteristics of itch in vitiligo and its clinical significance. Biomed Res Int. 2017;2017:5617838.
- 27. Silverberg JI, Silverberg NB. Association between vitiligo extent and distribution and quality-of-life impairment. JAMA Dermatol. 2013;149(2):159–64.
- Picardo M, Huggins RH, Jones H, Marino R, Ogunsola M, Seneschal J. The humanistic burden of vitiligo: a systematic literature review of quality-of-life outcomes. J Eur Acad Dermatol Venereol. 2022;36(9):1507–23.

- 29. Amer AA, Gao XH. Quality of life in patients with vitiligo: an analysis of the dermatology life quality index outcome over the past two decades. Int J Dermatol. 2016;55(6):608–14.
- 30. Bibeau K, Ezzedine K, Harris JE, van Geel N, Grimes P, Parsad D, et al. Mental health and psychosocial quality-of-life burden among patients with vitiligo: findings from the global VALIANT study. JAMA Dermatol. 2023;159(10):1124–8.
- 31. Catucci Boza J, Giongo N, Machado P, Horn R, Fabbrin A, Cestari T. Quality of life impairment in children and adults with vitiligo: a cross-sectional study based on dermatology-specific and diseasespecific quality of life instruments. Dermatology. 2016;232(5):619–25.
- 32. Rios-Duarte JA, Sanchez-Zapata MJ, Silverberg JI. Association of vitiligo with multiple cutaneous and extra-cutaneous autoimmune diseases: a nationwide cross-sectional study. Arch Dermatol Res. 2023;315(9):2597–603.
- 33. Desai S, McCormick E, Sodha P, Friedman A. Shining a light on vitiligo and associated comorbidities: what is the evidence? J Drugs Dermatol. 2023;22(4):428–30.
- 34. Laberge G, Mailloux CM, Gowan K, Holland P, Bennett DC, Fain PR, et al. Early disease onset and increased risk of other autoimmune diseases in familial generalized vitiligo. Pigment Cell Res. 2005;18(4):300–5.
- 35. Do Bu EA, Santos VMD, Lima KS, Pereira CR, Alexandre MES, Bezerra V. Neuroticism, stress, and rumination in anxiety and depression of people with vitiligo: an explanatory model. Acta Psychol (Amst). 2022;227:103613.
- Liu J, Tang R, Xiao Y, Luo M, Shi Y, Deng Q, et al. Meta-analytic review of high anxiety comorbidity among patients with vitiligo. Biomed Res Int. 2021;2021:6663646.
- 37. Lai YC, Yew YW, Kennedy C, Schwartz RA. Vitiligo and depression: a systematic review and metaanalysis of observational studies. Br J Dermatol. 2017;177(3):708–18.
- Osinubi O, Grainge MJ, Hong L, Ahmed A, Batchelor JM, Grindlay D, et al. The prevalence of psychological comorbidity in people with vitiligo: a systematic review and meta-analysis. Br J Dermatol. 2018;178(4):863–78.
- 39. Wang G, Qiu D, Yang H, Liu W. The prevalence and odds of depression in patients with vitiligo: a meta-analysis. J Eur Acad Dermatol Venereol. 2018;32(8):1343–51.

- 40. Nathalie J, Chang J, Ezzedine K, Rodrigues M. Health-related quality of life in paediatric patients with vitiligo: a systematic review and meta-analysis. J Eur Acad Dermatol Venereol. 2021;35(11):e755–6.
- 41. Amer AA, McHepange UO, Gao XH, Hong Y, Qi R, Wu Y, et al. Hidden victims of childhood vitiligo: impact on parents' mental health and quality of life. Acta Derm Venereol. 2015;95(3):322–5.
- 42. van Geel N, Speeckaert R, Taieb A, Ezzedine K, Lim HW, Pandya AG, et al. Worldwide expert recommendations for the diagnosis and management of vitiligo: position statement from the International Vitiligo Task Force part 1: towards a new management algorithm. J Eur Acad Dermatol Venereol. 2023;37(11):2173–84.
- 43. Hamzavi I, Jain H, McLean D, Shapiro J, Zeng H, Lui H. Parametric modeling of narrowband UV-B phototherapy for vitiligo using a novel quantitative tool: the Vitiligo Area Scoring Index. Arch Dermatol. 2004;140(6):677–83.
- 44. van Geel N, Lommerts J, Bekkenk M, Wolkerstorfer A, Prinsen CAC, Eleftheriadou V, et al. Development and validation of the Vitiligo Extent Score (VES): an international collaborative initiative. J Investig Dermatol. 2016;136(5):978–84.
- 45. van Geel N, Wolkerstorfer A, Lommerts JE, Ezzedine K, Eleftheriadou V, Hamzavi I, et al. Validation study of the Vitiligo Extent Score-plus. J Am Acad Dermatol. 2018;78(5):1013–5.
- 46. Krishna GS, Ramam M, Mehta M, Sreenivas V, Sharma VK, Khandpur S. Vitiligo impact scale: an instrument to assess the psychosocial burden of vitiligo. Indian J Dermatol Venereol Leprol. 2013;79(2):205–10.
- 47. Salzes C, Abadie S, Seneschal J, Whitton M, Meurant JM, Jouary T, et al. The Vitiligo Impact Patient Scale (VIPs): development and validation of a vitiligo burden assessment tool. J Investig Dermatol. 2016;136(1):52–8.
- Batchelor JM, Tan W, Tour S, Yong A, Montgomery AA, Thomas KS. Validation of the Vitiligo Noticeability Scale: a patient-reported outcome measure of vitiligo treatment success. Br J Dermatol. 2016;174(2):386–94.
- 49. Uitentuis SE, Heilmann MN, Verdaasdonk RM, Bae JM, Luiten RM, Wolkerstorfer A, et al. Ultraviolet photography in vitiligo: image quality, validity and reliability. J Eur Acad Dermatol Venereol. 2020;34(7):1590–4.
- 50. Finlay AY, Khan GK. Dermatology Life Quality Index (DLQI)—a simple practical

measure for routine clinical use. Clin Exp Dermatol. 1994;19(3):210–6.

- 51. Lewis-Jones MS, Finlay AY. The Children's Dermatology Life Quality Index (CDLQI): initial validation and practical use. Br J Dermatol. 1995;132(6):942–9.
- 52. Pathak GN, Chandy RJ, Naini V, Feldman SR, Rao BK. Quality of life assessments utilized in vitiligo clinical trials. Dermatol Ther. 2023;2023:9948769.
- 53. Gan EY, Eleftheriadou V, Esmat S, Hamzavi I, Passeron T, Bohm M, et al. Repigmentation in vitiligo: position paper of the Vitiligo Global Issues Consensus Conference. Pigment Cell Melanoma Res. 2017;30(1):28–40.
- van Geel N, Speeckaert R, Taieb A, Picardo M, Bohm M, Gawkrodger DJ, et al. Koebner's phenomenon in vitiligo: European position paper. Pigment Cell Melanoma Res. 2011;24(3):564–73.
- 55. Bassiouny D, Hegazy R, Esmat S, Gawdat HI, Ahmed Ezzat M, Tawfik HA, et al. Cosmetic camouflage as an adjuvant to vitiligo therapies: effect on quality of life. J Cosmet Dermatol. 2021;20(1):159–65.
- Poondru S, Kundu RV. Use of camouflage in vitiligo: a cross-sectional survey. J Cosmet Dermatol. 2023;22(12):3524–6.
- 57. Dutta RR, Kumar T, Ingole N. Diet and vitiligo: the story so far. Cureus. 2022;14(8): e28516.
- Cunningham KN, Rosmarin D. Vitiligo treatments: review of current therapeutic modalities and JAK inhibitors. Am J Clin Dermatol. 2023;24(2):165–86.
- 59. Khalili M, Amiri R, Mohammadi S, Iranmanesh B, Aflatoonian M. Efficacy and safety of traditional and surgical treatment modalities in segmental vitiligo: a review article. J Cosmet Dermatol. 2022;21(6):2360–73.
- 60. Strehl C, Ehlers L, Gaber T, Buttgereit F. Glucocorticoids-all-rounders tackling the versatile players of the immune system. Front Immunol. 2019;10:1744.
- 61. Nicolaidou E, Antoniou C, Stratigos AJ, Stefanaki C, Katsambas AD. Efficacy, predictors of response, and long-term follow-up in patients with vitiligo treated with narrowband UVB phototherapy. J Am Acad Dermatol. 2007;56(2):274–8.
- 62. Harris J, Papp K, Forman SB, Zdybski J, Pandya AG, Seneschal J et al. Relapse and maintenance of clinical response in the randomized withdrawal arm of the TRUE-V long term extension phase 3

study of ruxolitinib cream in vitiligo. Presented at American Academy of Dermatology (AAD) Annual Meeting; 2023 March 17–21; New Orleans, LA.

- 63. Cavalie M, Ezzedine K, Fontas E, Montaudie H, Castela E, Bahadoran P, et al. Maintenance therapy of adult vitiligo with 0.1% tacrolimus ointment: a randomized, double blind, placebo-controlled study. J Investig Dermatol. 2015;135(4):970–4.
- 64. Quintás-Cardama A, Vaddi K, Liu P, Manshouri T, Li J, Scherle PA, et al. Preclinical characterization of the selective JAK1/2 inhibitor INCB018424: therapeutic implications for the treatment of myeloproliferative neoplasms. Blood. 2010;115(15):3109–17.
- 65. Rosmarin D, Passeron T, Pandya AG, Grimes P, Harris JE, Desai SR, et al. Two phase 3, randomized, controlled trials of ruxolitinib cream for vitiligo. N Engl J Med. 2022;387(16):1445–55.
- 66. McElroy J, Casquejo RJ, Yu H, Torsiello J, Sangha AM, Buhs LP. Understanding the mechanism of disease of vitiligo and the impact on clinical management. J Dermatol Physician Assist. 2025;19(1):28–35.
- 67. Pandya AG, Harris JE, Lebwohl M, Hamzavi IH, Butler K, Kuo FI, et al. Addition of narrowband UVB phototherapy to ruxolitinib cream in patients with vitiligo. J Investig Dermatol. 2022;142(12):3352–5 (e4).
- 68. Astellas Pharma US Inc. Protopic[®] (tacrolimus). Full Prescribing Information. Deerfield: 2011.
- 69. Stinco G, Trevisan G, Buligan C, Gregoraci G, De Marchi S, di Meo N, et al. Narrow band-ultraviolet B versus clobetasol propionate foam in the treatment of vitiligo: a retrospective study. Dermatol Ther (Heidelb). 2013;3(1):95–105.
- Udompataikul M, Boonsupthip P, Siriwattanagate R. Effectiveness of 0.1% topical tacrolimus in adult and children patients with vitiligo. J Dermatol. 2011;38(6):536–40.
- Berbert Ferreira S, Berbert Ferreira R, Neves Neto AC, Assef SMC, Scheinberg M. Topical tofacitinib: a Janus kinase inhibitor for the treatment of vitiligo in an adolescent patient. Case Rep Dermatol. 2021;13(1):190–4.
- Majid I. Does topical tacrolimus ointment enhance the efficacy of narrowband ultraviolet B therapy in vitiligo? A left-right comparison study. Photodermatol Photoimmunol Photomed. 2010;26(5):230–4.
- 73. Akdeniz N, Yavuz IH, Gunes Bilgili S, Ozaydin Yavuz G, Calka O. Comparison of efficacy of

narrow band UVB therapies with UVB alone, in combination with calcipotriol, and with betamethasone and calcipotriol in vitiligo. J Dermatolog Treat. 2014;25(3):196–9.

- 74. Bhatnagar A, Kanwar AJ, Parsad D, De D. Comparison of systemic PUVA and NB-UVB in the treatment of vitiligo: an open prospective study. J Eur Acad Dermatol Venereol. 2007;21(5):638–42.
- 75. Hearn RM, Kerr AC, Rahim KF, Ferguson J, Dawe RS. Incidence of skin cancers in 3867 patients treated with narrow-band ultraviolet B photo-therapy. Br J Dermatol. 2008;159(4):931–5.
- 76. Kanwar AJ, Dogra S. Narrow-band UVB for the treatment of generalized vitiligo in children. Clin Exp Dermatol. 2005;30(4):332–6.
- 77. Tien Guan ST, Theng C, Chang A. Randomized, parallel group trial comparing home-based phototherapy with institution-based 308 excimer lamp for the treatment of focal vitiligo vulgaris. J Am Acad Dermatol. 2015;72(4):733–5.
- Mohammad TF, Silpa-Archa N, Griffith JL, Lim HW, Hamzavi IH. Home phototherapy in vitiligo. Photodermatol Photoimmunol Photomed. 2017;33(5):241–52.
- 79. Scarlett WL. Ultraviolet radiation: sun exposure, tanning beds, and vitamin D levels. What you need to know and how to decrease the risk of skin cancer. J Am Osteopath Assoc. 2003;103(8):371–5.
- 80. Kanwar AJ, Mahajan R, Parsad D. Low-dose oral mini-pulse dexamethasone therapy in progressive unstable vitiligo. J Cutan Med Surg. 2013;17(4):259–68.
- 81. Mehta H, Kumar S, Parsad D, Bishnoi A, Vinay K, Kumaran MS. Oral cyclosporine is effective in stabilizing active vitiligo: results of a randomized controlled trial. Dermatol Ther. 2021;34(5): e15033.
- 82. Speeckaert R, van Geel N. The real-life efficacy of methotrexate in vitiligo: a retrospective study and literature review. J Eur Acad Dermatol Venereol. 2023;37(11):2267–9.
- 83. Guyon M, Merhi R, Andreu N, Boniface K, Seneschal J. Efficacy and safety of the combination of steroid pulse therapy with methotrexate for vitiligo: a pilot retrospective case series. J Eur Acad Dermatol Venereol. 2023;37(11):2264–6.
- Khodadadi L, Shafieyan S, Sotoudeh M, Dizaj AV, Shahverdi A, Aghdami N, et al. Intraepidermal injection of dissociated epidermal cell suspension improves vitiligo. Arch Dermatol Res. 2010;302(8):593–9.

- 85. Hartmann A, Broecker EB, Hamm H. Repigmentation of skin and hairs in stable vitiligo by transplantation of autologous melanocytes in fibrin suspension. J Eur Acad Dermatol Venereol. 2008;22(5):624–6.
- Budania A, Parsad D, Kanwar AJ, Dogra S. Comparison between autologous noncultured epidermal cell suspension and suction blister epidermal grafting in stable vitiligo: a randomized study. Br J Dermatol. 2012;167(6):1295–301.
- 87. Dillon AB, Sideris A, Hadi A, Elbuluk N. Advances in vitiligo: an update on medical and surgical treatments. J Clin Aesthet Dermatol. 2017;10(1):15–28.
- 88. van den Boorn JG, Picavet DI, van Swieten PF, van Veen HA, Konijnenberg D, van Veelen PA, et al. Skin-depigmenting agent monobenzone

induces potent T-cell autoimmunity toward pigmented cells by tyrosinase haptenation and melanosome autophagy. J Investig Dermatol. 2011;131(6):1240–51.

- 89. van Geel N, Depaepe L, Speeckaert R. Laser (755 nm) and cryotherapy as depigmentation treatments for vitiligo: a comparative study. J Eur Acad Dermatol Venereol. 2015;29(6):1121–7.
- 90. Majid I, Imran S. Depigmentation therapy with Q-switched Nd: YAG laser in universal vitiligo. J Cutan Aesthet Surg. 2013;6(2):93–6.
- 91. Taneja N, Sreenivas V, Sahni K, Gupta V, Ramam M. A cross-sectional study of spontaneous repigmentation in vitiligo. Indian J Dermatol Venereol Leprol. 2020;86(3):240–50.