British Association of Dermatologists and British Photodermatology Group guidelines for narrowband ultraviolet B phototherapy 2022*

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Accepted for publication
7 May 2021

V.G. and T.C.L. share first authorship.

Produced in 1997 by the British Photodermatology Group and the British Association of Dermatologists (BAD). Reviewed and updated 2004, 2022.

This is an updated guideline prepared for the British Association of Dermatologists (BAD) Clinical Standards Unit, which includes the Therapy & Guidelines subcommittee. Members of the Clinical Standards Unit who have contributed are N.J. Levell (Chair, Therapy & Guidelines subcommittee), B. McDonald (BAD Assistant Honorary Secretary 2019–21), S.L. Chua, A. Daunton, H. Frow, P. Laws, I. Nasr, A. Therianou, M. Hashme (Information Scientist), Z. Kiaee (Guideline Research Fellow), L.S. Exton (Senior Guideline Research Fellow) and M.F. Mohd Mustapa (Director Clinical Standards).

*Plain language summary available online

DOI 10.1111/bjd.21669

Linked Comment: P. Wolf. Br J Dermatol 2022; **187**:285–286.

1. Purpose and scope

The overall objective of the guideline is to provide up-to-date, evidence-based recommendations for the use of narrowband ultraviolet B (NB-UVB) phototherapy in adults, young people and children. The document aims to

- offer an appraisal of all relevant literature up to 18 February 2021, focusing on any key developments;
- address important, practical clinical questions relating to the primary guideline objective;
- provide guideline recommendations and, if appropriate, research recommendations.

The guideline is presented as a detailed review with highlighted recommendations for practical use in the clinic and at home (see Section 3), in addition to an updated patient information leaflet (available on the BAD Skin Health Information website: https://www.skinhealthinfo.org.uk/a-z-conditions-treatments).

2. Methodology

This set of guidelines has been developed using the BAD's recommended methodology.[1] Further information can be found in Appendix T (see Supporting Information) with reference to the AGREE II instrument (www.agreetrust.org)[2] and GRADE (http://www.gradeworkinggroup.org). Recommendations were developed for implementation in the UK National Health Service (NHS).

The Guideline Development Group (GDG) established several clinical questions pertinent to the scope of the guideline

and a set of outcome measures of importance to patients, ranked according to the GRADE methodology (see Section 2.1 and Appendix A; see Supporting Information). The GDG consisted of 10 consultant dermatologists, a medical physicist, a phototherapy nursing sister, three patient representatives and a technical team (consisting of an information scientist, a guideline research fellow and a project manager providing methodological and technical support).

A systematic literature search of the PubMed, MEDLINE, Embase, Cochrane and AMED databases was conducted to identify key articles on NB-UVB to 18 February 2021. The search terms and strategies are detailed in Appendix V (see Supporting Information). Additional references relevant to the topic were also isolated from citations in the reviewed literature and the previous editions of the guidelines.[3,4] Data extraction and critical appraisal, data synthesis, evidence summaries, lists of excluded studies and the PRISMA diagram were prepared by the technical team (Appendixes B–S; see Supporting Information). The overall certainty of the evidence from the included studies was graded according to the GRADE system (high, moderate, low or very low certainty). An additional targeted literature search (for randomized controlled trials and systematic reviews) was conducted on 29 March 2022; no new publications were identified that would have materially affected the recommendations (Appendix V).

The recommendations are based when possible on evidence drawn from systematic reviews of the literature pertaining to the clinical questions identified, following discussions with the entire GDG and factoring in all four factors that would affect its strength rating according to the GRADE approach (i.e. balance between desirable and undesirable effects, overall certainty of the evidence, patient values and preferences, and resource allocation). All GDG members contributed towards drafting and/or reviewing the narratives and information in the guideline and Supporting Information documents. When there was insufficient evidence from the literature, informal consensus was reached based on the specialist clinical experience of the consultants on the GDG.

The Supporting Information contains the summary of findings with forest plots (Appendix B), tables Linking the Evidence To the Recommendations (LETR) (Appendix C), GRADE evidence profiles indicating the overall certainty of the evidence (Appendix D), summaries of the included studies and narrative findings for noncomparative studies (Appendixes E–P), the PRISMA flow diagram (Appendix Q), critical appraisal of the included systematic reviews (Appendix R) and a list of excluded studies (Appendix S). The strength of recommendation is expressed by the wording and symbols shown in Table 1.

2.1 Clinical questions and outcomes

The GDG established two clinical questions pertinent to the scope of the guideline. See Appendix A for the full review protocol.

Review Question 1. In people with skin diseases (*including, but not limited to psoriasis, vitiligo, eczema, hand and foot dermatoses, lichen planus, mycosis fungoides, pityriasis lichenoides, subacute and nodular prurigo, pruritus, chronic spontaneous urticaria, alopecia areata, progressive macular hypomelanosis and morphoea/localized scleroderma*), what are the clinical effectiveness/efficacy, safety and tolerability of NB-UVB phototherapy, as monotherapy or in combination with another treatment, compared with other light-based therapy including the excimer laser and lamp, topical therapy, retinoid therapy, conventional systemic immunosuppression or immunomodulation, biological therapy, placebo, no treatment or NB-UVB in combination with a different treatment?

Review Question 2. In people with photodermatoses (*including polymorphic light eruption, solar urticaria, actinic prurigo, chronic actinic dermatitis, hydroa vacciniforme, erythropoietic protoporphyria and photoaggravated*

Table 1 Strength of recommendation ratings

Strength	Wording	Symbol	Definition
Strong recommendation for the use of an intervention	'Offer' (or similar, e.g. 'use', 'provide', 'take', 'investigate' etc.)	↑↑	Benefits of the intervention outweigh the risks; most patients would choose the intervention while only a small proportion would not; for clinicians, most of their patients would receive the intervention; for policymakers, it would be a useful performance indicator
Weak recommendation for the use of an intervention	'Consider'	↑	Risks and benefits of the intervention are finely balanced; most patients would choose the intervention, but many would not; clinicians would need to consider the pros and cons for the patient in the context of the evidence; for policymakers it would be a poor performance indicator where variability in practice is expected
No recommendation		Θ	Insufficient evidence to support any recommendation
Strong recommendation *against* the use of an intervention	'Do not offer'	↓↓	Risks of the intervention outweigh the benefits; most patients would *not* choose the intervention while only a small proportion would; for clinicians, most of their patients would *not* receive the intervention

eczema), what are the clinical effectiveness/efficacy, safety and tolerability of NB-UVB phototherapy, as monotherapy or in combination with another treatment, used prophylactically and to treat active disease, compared with photoprotective measures including sunscreen, topical and oral corticosteroids, other light-based therapies, systemic immunosuppression, other topical and oral anti-inflammatory/immunomodulator agents, biological therapy, placebo, no treatment or NB-UVB in combination with a different treatment?

Outcomes

The GDG also established a set of outcome measures of importance to patients for each review question. These were agreed by the patient representatives and ranked by them according to the GRADE methodology[5] and data on these extracted from the included studies (Appendixes B–P). Outcomes ranked 7, 8 or 9 are critical for decision making, those ranked 4, 5 or 6 are important but not critical for decision making, and those ranked 1, 2 or 3 not generally important for decision making.

Review question 1: skin diseases

Disease improvement [e.g. ≥ 75% improvement in Psoriasis Area and Severity Index (PASI) or Eczema Area and Severity Index (EASI), or ≥ 50% repigmentation] (9)

Serious adverse events: acute and chronic (9)

Change in psychological wellbeing or quality of life [e.g. Dermatology Life Quality Index (DLQI)] (9)

Disease-specific physician assessment [e.g. PASI, EASI, Severity Weighted Assessment Tool (SWAT), Physician's Global Assessment (PGA)] (8)

Disease-specific patient self-assessment (8)

Sustained clearance and benefit (6)

Treatment tolerability (6)

Reduction of other therapy (6)

Convenience of treatment (5)

Minor adverse events (3)

Review question 2: Photodermatoses

Serious adverse events: acute and chronic (9)

Change in psychological wellbeing or quality of life (e.g. DLQI) (9)

Disease-specific physician assessment (8)

Disease-specific patient self-assessment (8)

Change in sun tolerance (7)

Sustained clearance and benefit (6)

Treatment tolerability (6)

Reduction of other therapy (6)

Convenience of treatment (5)

Minor adverse events (3)

3. Summary of recommendations

The following recommendations and ratings were agreed upon unanimously by the core members of the GDG and patient representatives. For further information on the wording used for recommendations and strength of recommendation ratings see Table 1. The evidence for recommendations is based on the studies as listed (for details and discussion of the evidence see Appendixes B–P).

The clinical efficacy and appropriateness of other treatment modalities should also be considered, taking into account the patient's diagnosis, age and comorbidities, and patient choice.

The GDG is aware of the lack of high-quality evidence for some of these recommendations.

GPP indicates a Good Practice Point: recommendations derived from consensus.

Strong recommendations marked with an asterisk (*) are based on the available evidence, and/or consensus based on specialist experience.

General (applies to all treated conditions)

R1 (GPP) Explain the potential benefits and harms of NB-UVB and provide a patient information leaflet (e.g. https://www.skinhealthinfo.org.uk/a-z-conditions-treatments) to candidates prior to choosing the treatment.

R2 (GPP) All centres should have a phototherapy protocol in place for treatment and to address episodes of symptomatic erythema and other adverse effects.

R3 (↑↑) Carry out minimal erythema dose (MED) testing or test a small area before starting treatment to ascertain a safe starting dose of NB-UVB.

R4 (GPP) All phototherapy devices (including handheld devices) should be evaluated and safety checked by medical physics, and irradiance measurements should be carried out at regular intervals appropriate for the frequency of use.

R5 (GPP) All phototherapy centres should consider providing a home phototherapy service, within an appropriate governance framework and particularly where there is geographical need.

R6 (GPP) Offer skin cancer surveillance at appropriate intervals to people identified as having received more than 500 whole-body NB-UVB treatments, particularly those individuals with other coexisting risk factors for skin cancer.

R7 (↓↓) Do not offer NB-UVB phototherapy to people who are taking ciclosporin, mycophenolate, azathioprine or oral tacrolimus (see contraindications) for their skin disease or other conditions, either as combination therapy or as rescue therapy to control flares.

R8 (GPP) Continue at least daily use of an emollient during a course of NB-UVB to prevent and alleviate skin dryness and pruritus.

R9 (GPP) The use of an emollient should generally be avoided for at least 2 h before NB-UVB, particularly in people with psoriasis, as this may reduce UV transmission in the skin. [However, in people with eczema, consistent treatment of the skin barrier defect outweighs any reduction in UV transmission and these individuals should use emollient following their usual routine (see **R17**).]

Psoriasis

R10 (↑↑) Offer NB-UVB to people with psoriasis who have an inadequate response to topical therapy, or when topical therapy is not suitable, prior to offering systemic immunosuppression or immunomodulation therapies, including psoralen plus ultraviolet A (PUVA).

R11 (↑) Consider adding NB-UVB to a selected systemic psoriasis treatment (i.e. acitretin, methotrexate, fumaric acid esters, apremilast or biologics) as a short-term rescue therapy to control flares, if psoriasis is normally well controlled on these treatments.

R12 (↑) Consider combination therapy of NB-UVB and acitretin in adults and young people with severe chronic psoriasis, but this must be avoided in anyone of childbearing potential.

Vitiligo

R13 (GPP) Inform people with vitiligo who are eligible for NB-UVB of the requirements (depending on local protocols: a pretherapy assessment, medical photographs taken prior to and during follow-ups usually every 3 months, two to three sessions weekly possible for up to 1 year), and the likely response depending on the affected anatomical site (e.g. the face and trunk achieve better repigmentation than acral sites).

R14 (↑↑) Offer NB-UVB (whole body or localized, e.g. home-based handheld) as first-line phototherapy to people with vitiligo who have an inadequate response to topical therapy and/or have **extensive** or **progressive** disease. As a prolonged course is generally required, discuss the risk–benefit ratio, particularly for children.[a] This *may* be combined with a calcineurin antagonist[b] (more evidence for tacrolimus) or intermittent potent topical corticosteroid,[c] on localized sites for a time period appropriate to the body site.

[[a]There is a lack of data on the skin cancer risk for high cumulative exposures in children with less deeply pigmented skin (Fitzpatrick skin types I–III), hence the risk–benefit ratio needs to be carefully considered. [b]Prior to combination NB-UVB and topical tacrolimus treatment, advise patients that there is a theoretical increased risk of skin cancer with this combination of treatment. A shared decision should be made with the person with vitiligo, taking into account other alternatives, the individual's personal and family history of risk of skin cancer and the impact of the vitiligo. [c]There is strong evidence of a limited effect for combination NB-UVB and potent topical corticosteroid, as well as a high risk of loss of response upon stopping treatment. Prior to this combination, consider the risk–benefit ratio of the prolonged use of potent topical corticosteroid.]

R15 (↑) Consider oral steroids (see vitiligo guidelines for specific treatment protocol)[6] in combination with NB-UVB in people with **rapidly progressive vitiligo** to arrest activity of the disease, after careful consideration of risks and benefits.

Eczema

R16 (↑↑) Offer NB-UVB as first-line phototherapy to people with eczema who have an inadequate response to topical therapy alone, prior to offering systemic immunosuppression or immunomodulation therapies, including PUVA.

R17 (GPP) Emollients and, if necessary, short-term intermittent topical corticosteroids should continue to be used during a course of phototherapy for eczema.

R18 (GPP) Stabilize severe, acute flares of eczema prior to commencing NB-UVB therapy by optimizing topical therapy, the use of systemic corticosteroids and/or antibiotics as appropriate.

R19 (GPP) Consider adding NB-UVB to methotrexate or another suitable systemic immunomodulatory medication (avoid with ciclosporin, mycophenolate, azathioprine and tacrolimus) as a short-term rescue therapy to control flares, if eczema is normally well controlled on these treatments.

Palmoplantar dermatoses

R20 (↑) Consider NB-UVB in people with palmoplantar psoriasis who have an inadequate response to topical therapy when PUVA is contraindicated.

R21 (↑) Consider NB-UVB in people with palmoplantar eczema who have an inadequate response to topical therapy when PUVA is contraindicated.

Θ There is insufficient evidence to recommend NB-UVB in people with palmoplantar pustulosis.

Lichen planus

R22 (↑) Consider NB-UVB in people with cutaneous lichen planus who have an inadequate response to topical therapy.

Morphoea (localized scleroderma)

R23 (↑) Consider NB-UVB in people with morphoea (localized scleroderma) when an alternative and more effective phototherapy or systemic therapy is not available or is contraindicated.

Mycosis fungoides

R24 (↑↑) Offer NB-UVB to people with mycosis fungoides for treatment of patches or plaques; however, PUVA is more effective for thicker plaques of mycosis fungoides.

Pityriasis lichenoides

R25 (↑) Consider NB-UVB in people with pityriasis lichenoides chronica (PLC) and pityriasis lichenoides et varioliformis acuta (PLEVA) who have an inadequate response to topical therapy.

Progressive macular hypomelanosis

R26 (↑) Consider NB-UVB in people with progressive macular hypomelanosis.

Subacute and nodular prurigo

R27 (↑) Consider NB-UVB in people with subacute prurigo who have an inadequate response to topical therapy.
R28 (↑) Consider NB-UVB in people with nodular prurigo who have an inadequate response to topical therapy when an alternative and more effective phototherapy is not available or is contraindicated.

Photodermatoses

R29 (↑↑) Offer NB-UVB prophylactic phototherapy to people who are severely affected by polymorphic light eruption and have an inadequate response to photoprotection.
R30 (↑↑) Offer* NB-UVB prophylactic phototherapy as a treatment option to people with erythropoietic protoporphyria.
R31 (↑) Consider NB-UVB prophylactic phototherapy, after photoinvestigation and specific recommendation from a **specialist photobiology centre**, in people with chronic actinic dermatitis who have an inadequate response to photoprotection and topical therapy.

[Current evidence exists mainly for people with Fitzpatrick skin type IV and above combined with the use of emollients and topical or oral corticosteroid.]
R32 (↑) Consider NB-UVB prophylactic phototherapy, after photoinvestigation and advice from a **specialist photobiology centre**, in people with solar urticaria who have an inadequate response to photoprotection and a second-generation H_1-antihistamine at a dose of up to fourfold the licensed dose.
R33 (GPP) Consider NB-UVB prophylactic phototherapy, after photoinvestigation and specific recommendation from a **specialist photobiology centre**, in people who have an inadequate response to photoprotection and topical therapy for the following conditions:

- Actinic prurigo
- Photoaggravated eczema
- Hydroa vacciniforme

Pruritus

R34 (↑↑) Offer NB-UVB to people with pruritus associated with severe kidney disease where other interventions have failed or are not appropriate.
R35 (↑) Consider NB-UVB in people with idiopathic or secondary pruritus (when the underlying cause cannot be corrected), who have an inadequate response to topical therapy.

Chronic urticaria

R36 (↑) Consider NB-UVB in people with chronic spontaneous urticaria. H_1-antihistamines should generally be combined with phototherapy.
R37 (GPP) NB-UVB phototherapy should be discussed with people with chronic spontaneous urticaria who have an inadequate response to other treatments.
R38 (↑) Consider NB-UVB in people with symptomatic dermographism who have an inadequate response to first-line therapy.

H_1-antihistamines should generally be combined with phototherapy.

Insufficient evidence to support any recommendation

Θ There is insufficient evidence to recommend NB-UVB for the treatment of the following conditions (see LETR in Appendix C for a full list):

- Acne
- Acquired perforating dermatosis
- Alopecia areata
- Cutaneous amyloidosis
- Cutaneous plasmacytosis
- Eosinophilic pustular folliculitis
- Erythema annulare centrifugum
- Graft-versus-host disease
- Granuloma annulare
- Hailey–Hailey disease
- Keratosis lichenoides chronica
- Lichen nitidus
- Lichen sclerosus
- Notalgia paraesthetica
- Pigmented purpuric dermatoses
- Pregnancy-induced dermatoses
- Pruritic papular eruption in HIV
- Scleroedema
- Seborrhoeic dermatitis
- Subcorneal pustular dermatosis

List of key future research recommendations

The following list outlines future research recommendations (FRRs).
FRR1 Randomized controlled trials (RCTs) evaluating NB-UVB vs. PUVA for the treatment of people with

- Hyperkeratotic plaque psoriasis
- Lichenified eczema
- Nodular prurigo
- Palmoplantar psoriasis
- Palmoplantar eczema
- Generalized granuloma annulare

FRR2 RCTs evaluating NB-UVB and placebo vs. NB-UVB in combination with acitretin for the treatment of people with psoriasis.
FRR3 RCTs to evaluate NB-UVB, PUVA and UVA1 for people with eczema according to disease pattern, in particular, whether specific phototherapy may be more effective in acute flares of eczema, chronic lichenified eczema or nodular prurigo.

FRR4 Determine the action spectrum for phototherapy in eczema.

FRR5 Determine the safety of prolonged courses of NB-UVB for vitiligo, particularly in children.

FRR6 Large, prospective studies with long-term follow-up of people treated with NB-UVB to establish skin cancer risk correlated with cumulative number, dose, frequency of exposures, age, skin type and ethnicity.

FRR7 Further research into patient and disease characteristics influencing therapeutic response to NB-UVB.

4. Introduction

As far back as 1400 BC, sunlight has been harnessed to treat skin disease,[7] but phototherapy's modern inception began in the 19th century when renowned physician Niels Finsen used UV radiation to treat lupus vulgaris. In 1925, Goeckerman described the benefits of treating psoriasis using UV rays in combination with crude coal tar,[8] but it was not until the 1970s that broadband UVB (BB-UVB) became established as a treatment for inflammatory skin disease. A paradigm shift occurred in 1988 with the introduction of NB-UVB initially to treat psoriasis.[9,10] Parrish and Jaenicke demonstrated that the most effective therapeutic UV wavelength for the treatment of this condition was 313 nm.[11] Fluorescent NB-UVB phototherapy lamps with an emission spectrum that peaks between 310 nm and 311 nm were then originally introduced by Philips, although NB-UVB phototherapy lamps have since been produced by other manufacturers.

UV radiation has been shown to have potent immunomodulatory properties, which involve multiple mechanisms in both the innate and adaptive immune systems. It has a significant immunosuppressive effect on T-cell function and induces antigen-specific tolerance that depends on interactions between antigen-presenting cells, mast cells and keratinocytes.[12] In addition to the immunomodulatory effects of UV, recent studies have demonstrated other key effects of phototherapy to be proapoptotic, antipruritic, antifibrotic and propigmentary, promoting clinical improvement in various skin diseases.[13]

NB-UVB is now the most commonly used type of phototherapy, and numerous studies have demonstrated its effectiveness in the treatment of psoriasis.[14,15] NB-UVB treatment has also become an established treatment for other inflammatory dermatoses such as eczema, as well as for many other conditions including vitiligo, cutaneous T-cell lymphoma and the photodermatoses.[16–18]

4.1 Contraindications

There are a number of absolute contraindications to the use of NB-UVB phototherapy. These include

- Photogenodermatoses (xeroderma pigmentosum, Cockayne syndrome, trichothiodystrophy, Bloom syndrome and Rothmund–Thomson syndrome)
- Disorders with a genetic predisposition to skin cancers (Gorlin syndrome and albinism)
- Concomitant oral immunosuppressive medication, in particular ciclosporin, azathioprine, mycophenolate mofetil and tacrolimus. However, following careful consideration of the risk–benefit ratio, NB-UVB could be used in some people taking specific immunosuppressive medications such as methotrexate or biological therapies
- People medically unfit and unable to safely stand in the whole-body NB-UVB cubicle (e.g. those with severe cardiovascular or respiratory disease, and those with poorly controlled epilepsy)

Relative contraindications

- Hereditary dysplastic naevus syndrome
- Lupus erythematosus
- Previous exposure to arsenic or ionizing radiation
- Past excessive exposure to natural sunlight, sunbeds or phototherapy
- Previous significant use of oral immunosuppressive medication in the form of ciclosporin, azathioprine, mycophenolate mofetil or tacrolimus
- Current premalignant skin lesions
- Current and past history of nonmelanoma skin cancer
- Current and past history of melanoma skin cancer
- Strong family history of skin cancer (melanoma or nonmelanoma) at a young age

NB-UVB phototherapy should generally be avoided in patients with a past personal history of melanoma or with a current melanoma or nonmelanoma skin cancer; however, cases should be assessed on an individual basis and NB-UVB could be considered in those individuals where therapeutic options are limited and the benefit of the treatment outweighs the potential risks.

NB-UVB phototherapy can be given with caution to people with dermatoses that may be photoaggravated, such as dermatomyositis, photoaggravated eczema, Darier disease and transient acantholytic dermatoses, pityriasis rubra pilaris and active herpes simplex. It can be used in people taking potentially photosensitizing medications as long as MED testing is performed before treatment is started.

NB-UVB phototherapy is not contraindicated in childhood (see Section 11), pregnancy or breastfeeding (see Section 10). In addition, there are no risks of treating people with pacemakers *in situ*.

5. Place in the treatment pathway

NB-UVB is usually considered after no response or inadequate response to topical therapy, or if the condition is deemed to be too extensive for topical therapy to treat adequately. It is also a relatively safe and cost-effective second-line option

compared with immunosuppressive, immunomodulating or biological therapies and should be offered before these treatment options.

NB-UVB is generally considered before PUVA for many dermatoses such as psoriasis and eczema due to its better safety profile and relative ease of treatment without the need for oral medication and eye protection following treatment. However, for certain indications, NB-UVB is significantly less effective than PUVA and should be considered only if PUVA is not available. These indications include thicker plaque-stage mycosis fungoides, granuloma annulare, and hand and foot dermatoses. PUVA is still also an important second-line phototherapy for the treatment of many dermatoses, as lack of adequate response to NB-UVB does not predict lack of response to PUVA.[19]

In psoriasis, national UK guidelines (National Institute for Health and Care Excellence – NICE) state that NB-UVB should be offered to people with plaque or guttate-pattern psoriasis that cannot be controlled with topical treatments alone. Systemic treatment should be offered if NB-UVB phototherapy results in an unsatisfactory response or is poorly tolerated, if there is rapid relapse following phototherapy, if access is difficult for logistical reasons, or if the person is at especially high risk of skin cancer.[20]

In eczema, for children under the age of 12 years, national UK guidance (NICE) suggests considering phototherapy or systemic treatments for severe atopic eczema when other management options have failed or are inappropriate, or if there is a significant negative impact on quality of life.[21] For adults with eczema, the NICE guidance does not specifically discuss the use of phototherapy or systemic therapy. In general, UVB phototherapy is recommended after failure of topical therapy, before consideration of systemic or biological therapy.

In vitiligo that has not responded to or is unsuitable for topical therapy, NB-UVB is the first-choice modality of phototherapy, over PUVA, due to higher efficacy and a better safety profile.[6]

6. Improving access

There is increasing evidence for the cost efficacy of NB-UVB phototherapy,[14,22] but convenience and availability remain an issue, and any approach that improves patient access to effective, safe treatment should be a priority.[23–25] One option for improving access is providing home treatment; however, the availability of this form of treatment is currently limited in the UK.[26,27]

In a pragmatic, multicentre, randomized, controlled, noninferiority study comparing home vs. outpatient UVB phototherapy for mild-to-severe psoriasis in the Netherlands (PLUTO), 105 patients were followed up for 1 year after phototherapy. The authors found no significant difference between the efficacy of outpatient and home treatment as assessed by ≥ 50% improvement in PASI or Self-Administered PASI, with no significant differences in adverse effects.[28]

In the UK, two studies in Tayside demonstrated home UVB phototherapy to have similar outcomes to hospital-based phototherapy.[29] The estimated costs to the hospital ranged from £229 to £314 per course (£307 to £422 per effective course for psoriasis), compared with £114 for outpatient therapy (£149 per effective course for psoriasis). However, the total cost to society (hospital and patient costs) is around £410 per course, compared with an estimated £550 for outpatient phototherapy.[30]

Home-based phototherapy may also be considered for people with vitiligo.[31,32] This can be undertaken using either whole-body units or handheld and non-handheld devices for localized areas.[33–36] A prospective study showed no significant difference in repigmentation rates between home-based and hospital-based phototherapy, and only minimal adverse effects and similar health-related quality-of-life scores.[37] A randomized controlled trial of home interventions (HI-Light Vitiligo Trial) found that combination treatment with home-based handheld NB-UVB and potent topical corticosteroid was likely to be superior to potent topical corticosteroid monotherapy in the treatment of localized vitiligo.[38]

It is important to recognize that there are increased safety concerns in the home setting that should be carefully considered. To obtain optimal patient outcomes and ensure robust safety, careful patient selection and training should be ensured, along with remote but close monitoring by experienced phototherapy nurses supported by a hospital-based phototherapy team, which must include medical physics expertise and use a clear governance framework. Recent experience of setting up a new service has been reported,[39] and a useful model for setting up a home phototherapy service is described by Hung *et al.*[40] An alternative way to improve convenience and access to phototherapy services for patients is to enable the patient to self-administer their own treatment in the hospital setting. In a pilot study, 20 selected people with eczema and psoriasis took ownership of treatment by self-administering their UVB phototherapy at hospital. This was safe and effective and enabled them to take greater control of attendance times for UVB phototherapy.[41]

7. Light sources and dosimetry

While fluorescent phototherapy lamps are most commonly used, NB-UVB can be delivered by other sources such as an excimer laser/lamp or filtered broadband lamp (further details in Appendix U; see Supporting Information). Such lamps are generally used for targeted therapy rather than whole-body irradiation.[42–45] Regardless of the method of illumination, accurate dosimetry (measurement) is critical for efficient and safe treatment delivery. Measurement techniques will vary depending on the NB-UVB source, and published guidelines are available.[46,47] It is important that, as part of a quality assurance system, there are regular quality control measurements performed on the cabinet to ensure the accuracy and consistency of the UV dose delivered.[48] Accurate measurement is required for employee safety, in order to compare

anticipated occupational exposure to exposure limit values. This is completed as part of a risk assessment as required by the control of artificial optical radiation at work regulations 2010.[49]

8. Protocols for treatment delivery

Phototherapy protocol variables include initial dose, frequency of treatment, incremental regimen, maximum dose, number of exposures, and potentially a 'tailing-off' period of treatment. There is a lack of good-quality study evidence to guide decision making for many of these variables. Studies in people with psoriasis predominantly with skin phototypes I and II support the need for a test dose on a small area, principally for safety reasons.[50] Routine MED testing will allow identification of people with photosensitivity induced by medication, or previously unrecognized photodermatoses such as chronic actinic dermatitis prior to treatment. This will help prevent sensitive people from burning during treatment and identify whether people require further phototesting.[51,52]

For people with psoriasis, the use of 20% increments has been shown to be only slightly less effective than 40% increments, but importantly it was associated with fewer episodes of symptomatic erythema.[53] Treatment three times weekly is not significantly less effective than five times weekly, and was associated with fewer symptomatic erythema reactions,[54] while treatment twice weekly is as effective as three times weekly, but the duration of treatment is more prolonged.[55] A study from Turkey showed that, for psoriasis, maintenance NB-UVB did not result in longer remission.[56]

There is limited study evidence for specific protocols to treat other conditions. In atopic eczema, a comparative study demonstrated that a low-increment regimen can work as well as higher increments.[57]

Examples of commonly used protocols in the UK are available on the NHS Scotland Photonet website.[58]

It is important that protocols are used only as a guide, as deviation from protocols will be necessary for optimum results in many individual patients. This is particularly the case for conditions other than psoriasis and will vary according to the clinician's individual expertise in treating particular conditions.

9. Adverse effects

NB-UVB is considered a safe treatment modality with a relatively low risk of adverse effects.[59,60]

9.1 Short-term adverse effects

Erythema is the most commonly experienced adverse effect, although its reported rate differs throughout the literature.[61–63] Erythema is usually recorded using a semiquantitative grading system consisting of E0 (no erythema), E1 (barely perceptible asymptomatic), E2 (well defined with mild discomfort), E3 (well defined and painful) and E4 (painful erythema, with bullae). E3 and E4 sunburn-type reactions occur infrequently during courses of phototherapy.[64] The frequency of erythema varies according to body site[65,66] and may increase in the presence of photosensitizing medication.[67] Erythema develops within 3–5 h following exposure to UVB, peaks between 12 and 24 h and resolves by 72 h,[68] although this may vary depending on the intensity of the UV exposure.[69,70]

The risk of phototoxic drug eruptions can be minimized by taking a careful drug history and carrying out MED testing prior to treatment. Individuals also need to be instructed to check with staff before commencing any new medication while receiving phototherapy.

Provocation of photodermatoses. Polymorphic light eruption (PLE) may develop during treatment with NB-UVB. In a retrospective survey, the provocation rate with NB-UVB was 19·5% in 113 patients with PLE, compared with 0·7% in 974 patients with other diagnoses.[71] In the event of flaring, dose reduction and cautious escalation help to lower PLE recurrence. The application of a potent topical steroid to commonly affected sites immediately following each treatment may further reduce the incidence.[72]

To minimize the risk of triggering lupus erythematosus, autoantibody screening should be considered prior to phototherapy in any individual with relevant symptoms or with a known family history of lupus.

The provocation of other previously undiagnosed photodermatoses by NB-UVB, such as chronic actinic dermatitis, can be severe but occurs less frequently. This cannot be consistently predicted from the patient's history, but the presence of a reduced MED should prompt assessment for coexistent photosensitivity prior to treatment.

Reactivation of herpes simplex virus (HSV) and HSV keratitis can occur as a result of NB-UVB treatment.[73,74] In people with a history of HSV infection, the use of prophylactic aciclovir and facial shielding during treatment should be considered.

Pruritus during NB-UVB is commonly reported[61,75] but may arise directly from the underlying disease.[4]

The development of *bullae limited to psoriatic plaques with sparing* of the surrounded nonlesional skin during NB-UVB therapy is a recognized but uncommon complication of therapy. It is hypothesized to reflect the enhanced penetration of UVB through lesional skin due to the reduction in acanthosis and desquamation during treatment.[76,77]

Idiopathic guttate hypomelanosis-like hypopigmented macules and *freckling* have been reported to occur in NB-UVB phototherapy, including in people with cutaneous T-cell lymphoma.[78–80]

9.2 Delayed adverse effects

Photoageing presenting as coarse wrinkling or cutaneous atrophy[81] is a recognized delayed adverse effect of exposure to UVB.[82]

Photocarcinogenesis. The potential risk of skin cancer with PUVA is well established with evidence from both the European and American literature, but the risks with NB-UVB are less clear. Mouse studies indicated that NB-UVB may have a two times higher risk of inducing skin cancer compared with BB-UVB per MED;[9,83–85] however, in clinical practice, the number of

MEDs required for a NB-UVB treatment course is usually less than one-third of that required for BB-UVB, resulting in the overall skin cancer risk probably being lower than that of BB-UVB.[86] This is borne out in clinical studies. A systematic review that included only four studies was unable to identify an increased risk of skin cancer following NB-UVB.[87]

People with vitiligo will usually have prolonged courses and there is only limited evidence to support the long-term safety of high cumulative exposures of NB-UVB in people with vitiligo, although a retrospective study of 15 people with skin types IV–VI receiving between 200 and 600 treatments with a mean follow-up of 83·5 months did not detect any skin cancers.[88] There are special considerations for treatment of children (see Section 11).

The NICE-accredited BAD Service Guidance and Standards for Phototherapy Units 2016[48] currently recommends greater than 500 UVB exposures as the threshold to trigger consideration of skin cancer screening review. It may be appropriate to treat past these arbitrary threshold numbers after clinical assessment by a consultant dermatologist and discussion with the individual patient of the risks and benefits of the various treatment options.

The incidences of genital tumours in men exposed to PUVA and BB-UVB are approximately 16·3 and 4·6 times higher than in the general population, respectively.[89] No evidence exists separately for NB-UVB inducing genital tumours, but it is prudent to cover male genitalia during treatment. There is no standard material used for shielding genitalia, but studies of UV transmittance suggest that darker-coloured materials such as polyester (close weave type and high thread count) offer better protection.[90]

Eye photodamage. Exposure of the eye to NB-UVB can result in acute and chronic photodamage.[91] Photokeratitis[92] and photoconjunctivitis[93] may occur acutely, while chronic exposure is linked to the development of pterygium and cataract formation.[94] For this reason the use of UV-protective goggles is recommended during treatment. Only negligible amounts of UVB are transmitted through the eyelids, and therefore NB-UVB phototherapy can be safely used with the eyes closed in those with eyelid dermatoses, providing eyelid closure is complete and people adhere to this advice.[90,95] For any patient in whom that is not possible, the use of UV-protective contact lenses can be considered. Soft lenses are preferable to gas-permeable ones due to complete coverage of the cornea.[96]

10. Use in pregnancy

Significant reductions in folic acid levels through photodegradation have been reported following high cumulative NB-UVB doses (118 J cm^{-2} following 36 sessions of NB-UVB in the management of psoriasis).[97] Measurement of folic acid levels either with or without supplementation should be considered in women trying to conceive. For women of childbearing age receiving prolonged whole-body NB-UVB courses (e.g. > 30 treatments) folate supplementation should be considered, and the need for supplementation reinforced for those receiving NB-UVB in the first trimester of pregnancy.[98,99]

During pregnancy the use of facial shielding during treatment may help to limit the exacerbation of melasma.

NB-UVB can also be safely used in women who are breastfeeding.

11. Narrowband ultraviolet B phototherapy in children

The general efficacy, tolerability and short-term safety in children have been demonstrated in several retrospective reviews.[100–102]

There is no arbitrary lower age at which children can be treated with NB-UVB, but children would need to be able to be safely left alone in the cabinet for treatment and be capable of complying with all the required safety measures including eye protection requirements; this would generally be around the age of 6 years or above.

Although formal long-term safety data are lacking, the relatively low incidence of skin cancers reported in people treated with NB-UVB in childhood is reassuring. While there is no long-term evidence to show an increased risk of melanoma in those treated with NB-UVB in childhood, overall numbers are small. There is a suggestion of a positive association between childhood sunburn reactions and subsequent risk of melanoma. It is therefore likely to be of increased importance that MED testing is carried out in children before treatment and that consideration is given to choosing treatment protocols that reduce the risk of symptomatic erythemal episodes.

There is a lack of studies on the treatment of vitiligo with NB-UVB in children. As this condition generally requires a prolonged course and sometimes repeated treatments, photocarcinogenesis may be a particular concern. However, a retrospective study using a hospital database has demonstrated safety in terms of skin cancer risk, at least in the medium term for people with skin types IV–VI.[88]

A systematic review of treatment options for childhood psoriasis[103] demonstrates NB-UVB phototherapy to be effective based on data from two open-label studies[104,105] and three retrospective reviews.[101,106,107] This efficacy is also confirmed in a retrospective study.[108]

In atopic eczema, there is good evidence of the efficacy of NB-UVB in children. A number of noncomparative studies that included both children and adults ($n = 296$) looked at NB-UVB as a monotherapy[102,106–114] or in combination with UVA.[101] These agreed that NB-UVB is effective in moderate, severe and chronic atopic dermatitis/eczema. A further study compared the outcome of children with moderate-to-severe eczema treated with NB-UVB to children who had declined this treatment (control group) and showed NB-UVB to be effective.[115] Consequently, the national UK guidance (NICE) suggests considering phototherapy as second-line therapy for children under the age of 12 years with severe atopic eczema.[21]

In the childhood photodermatoses, there is some evidence for the use of NB-UVB in PLE,[72,106,116] although this is less well established than for adults. There are also case series supporting the use of NB-UVB in erythropoietic protoporphyria and to a lesser extent in actinic prurigo and hydroa vacciniforme.[106,117,118]

In MF, there are 28 retrospective case series (n = 600), which included 100 children or young adults (see Appendix J·1·2). These demonstrated NB-UVB as monotherapy or in combination with topical corticosteroids to be an effective treatment option for early-stage MF.

Anxiety about the treatment may be a problem for some children,[106] but this can usually be managed by a clear explanation and a pretreatment visit to the unit. A patient information leaflet specifically for children is also very helpful. Support from the parents is essential and children may be reassured that the phototherapy cabinet is open topped and the child will be able to communicate with the parent standing outside the cabinet during treatment.

12. Safety and governance

Skin sunburn-type reactions secondary to phototherapy are an important cause of litigation and as such clinical governance and safety are of paramount importance.[119,120] In England (2016–2021) there were 25 episodes of litigation related to definite or likely burning from phototherapy out of 327 cases (personal communications from Nick Levell: GIRFT Dermatology lead).

Hospital-based NB-UVB should be administered by a trained phototherapist, who in 2022 will be either a first-level registered nurse or a physiotherapist registered with the Health and Care Professions Council. All staff administering UVB are required to undertake an initial period of supervised training and to be signed off as competent for all relevant areas at the end of this period. All staff should continue to receive annual education and an annual appraisal, and attend a recognized phototherapy update or course every 3 years. Further guidance can be found in the Service Guidance and Standards for Phototherapy Units document.[48]

Patients should be given an education session prior to treatment and should be provided with written patient information leaflets prior to starting their treatment. Educational sessions are typically nurse led but have been shown to be as effective if provided as a patient-specific e-learning session, with the latter showing improved consistency.[121] Patients should sign a consent form to indicate their understanding of side-effects and safety procedures during treatment, such as keeping goggles on and wearing the same clothing during the sessions, where relevant.

Accurate, clear and timely documentation of any patient examination, routine treatment checks, doses given and side-effects observed must be made at each patient visit.

For home phototherapy, careful patient selection is required. Training and ongoing remote supervision and support during the course of treatment by a trained and experienced phototherapist are essential, along with the use of standardized treatment protocols, documentation and appropriate governance frameworks.[26,29,30,40,122]

Unintentional UVB exposure to staff and public should be limited by measures such as curtains around cabinets to control UV scatter from walls and ceilings, and an assessment of environmental scatter should be made in line with The Control of Artificial Optical Radiation at Work Regulations 2010.[49] The safety of the cabinets, their outputs and the local environment is covered separately in the 2015 BAD guidelines on the measurement of UV radiation levels in UV phototherapy.[46]

13. Recommended audit points

The service delivery aspect of phototherapy is covered in depth in the NICE-accredited BAD Service Guidance and Standards for Phototherapy Units 2016.[48] This includes recommendations on referral and patient assessment, consent, staff training, clinical management, equipment, governance and audit.

Recommended audit points are as follows.

In the last 30 consecutive cases of people treated with NB-UVB, is there clear documentation of

1 People with psoriasis
   a having initially demonstrated inadequate response to topical therapy
   b having NB-UVB prior to consideration of systemic immunosuppression or immunomodulation therapies
2 People with eczemas
   a having initially demonstrated inadequate response to topical therapy
   b having NB-UVB prior to consideration of systemic immunosuppression or immunomodulation therapies
   c having continued topical therapy during the course of NB-UVB
   d with severe, acute flares having been stabilized prior to instituting NB-UVB
3 People with vitiligo
   a having initially demonstrated inadequate response to topical therapy
   b having extensive or progressive disease
4 The provision of a patient information leaflet (https://www.skinhealthinfo.org.uk/a-z-conditions-treatments)

The audit recommendation of 30 cases per department is to reduce variation in the results due to a single patient and to allow benchmarking between different units (Appendix W; see Supporting Information).

14. Stakeholder involvement and peer review

The draft document was made available for comments to the BAD membership, the British Photodermatology Group (BPG), the British Dermatological Nursing Group (BDNG), the Primary Care Dermatological Society (PCDS), the British Society for Paediatric Dermatology (BSPD), the British Society for Medical Dermatology (BSMD), the Psoriasis Association (PA), the Psoriasis and Psoriatic Arthritis Alliance (PAPAA), the National Eczema Society (NES), the UK Cutaneous Lupus Group (UKCLG), the Vitiligo Society, Vitiligo Support UK, Lymphoma Action and the British Porphyria Association (BPA). All comments were actively considered by the GDG. Following further review, the finalized version was sent for peer review by the Clinical Standards Unit of the BAD, made up of the Therapy & Guidelines subcommittee, prior to submission for publication.

15. Limitations of the guideline

This document has been prepared on behalf of the BAD and is based on the best data available when the document was prepared. It is recognized that under certain circumstances it may be necessary to deviate from the guidelines and that the results of future studies may require some of the recommendations herein to be changed. Failure to adhere to these guidelines should not necessarily be considered negligent, nor should adherence to these recommendations constitute a defence against a claim of negligence.

16. Plans for guideline revision

The proposed revision for this set of recommendations is scheduled for 2027; where necessary, important interim changes will be updated on the BAD website.

Acknowledgments

We are very grateful to all three patient representatives, including Ms India Angra and Ms Emma Rush, for their input in formulating the clinical questions, ranking of the outcomes, reviewing the evidence and formulating the recommendations, and the Vitiligo Support UK members for their input in ranking the outcomes and providing details of their experiences. We thank Zahra Kiaee (guideline research fellow) for her help with summarizing the papers from the top-up search, as well as all of those who commented on the draft during the consultation period.

Funding sources

None. Development of this guideline was funded independently by the British Association of Dermatologists.

Conflicts of interest

The following interests were declared over the duration of the guideline development: V.G.: past chair of the British Photodermatology Group (nonspecific). R.D.: member of Photonet, the NHS Scotland Managed Clinical Network for UV phototherapy (specific). E.E.: (i) member of Photonet, the NHS Scotland Managed Clinical Network for UV phototherapy (specific); (ii) grant/research support from Blueside Photonics Ltd (nonspecific). A.F.: (i) speaker fees and consultancy – Sanofi (nonspecific); (ii) speaker fees and honoraria – AbbVie, Dermal, Novartis, Sanofi (nonspecific); (iii) travel and course expenses – AbbVie, Almirall, Novartis, Sanofi (nonspecific). S.H.I.: travel expenses and honoraria – Galderma UK (nonspecific). E.R.: Vitiligo Support UK (specific). S.C.W.: (i) treasurer of the British Photodermatology Group (nonspecific); (ii) grants/research support from the British Skin Foundation – Predicting remission outcomes for psoriasis following phototherapy (specific). T.C.L., P.B., H.F., T.G., L.N., H.W., M.H., M.F.M.M. and L.S.E. declare they have no conflicts of interest.

Data availability

The data are available in the Supporting Information.

Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

Appendix A Review protocol.
Appendix B Forest plots.
Appendix C Linking Evidence To Recommendations (LETR).
Appendix D GRADE evidence tables.
Appendix E Psoriasis: summary of included studies.
Appendix F Vitiligo: summary of included studies.
Appendix G Eczema/atopic dermatitis: summary of included studies.
Appendix H Hand and foot dermatoses: summary of included studies.
Appendix I Lichen planus: summary of included studies.
Appendix J Mycosis fungoides/cutaneous T-cell lymphoma: summary of included studies.
Appendix K Pityriasis lichenoides: summary of included studies.
Appendix L Subacute prurigo: summary of included studies.
Appendix M Pruritus: summary of included studies.
Appendix N Chronic spontaneous urticaria: summary of included studies.
Appendix O Other skin diseases excluding photodermatoses: summary of included studies.
Appendix P Photodermatoses: summary of included studies.
Appendix Q PRISMA diagram: study selection.
Appendix R Critical appraisal of included systematic reviews: AMSTAR 2.
Appendix S Papers excluded from quantitative analysis.
Appendix T Methodology.
Appendix U Light sources and dosimetry.
Appendix V Search strategy.
Appendix W Audit standards, data items and data collection methodology.

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