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## Eczema Care Online: development and qualitative optimisation of an online behavioural intervention to support self-management in young people with eczema

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3 **Title: Eczema Care Online: development and qualitative optimisation of an online**  
4 **behavioural intervention to support self-management in young people with eczema**  
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## Abstract

**Objectives:** To describe the development of Eczema Care Online (ECO), an online behaviour change intervention for young people with eczema (Phase 1); and explore and optimise the acceptability of ECO among this target group using think-aloud interviews (Phase 2).

**Methods:** Theory-, evidence-, and person-based approaches to intervention development were used. In Phase 1, a qualitative systematic review and qualitative interviews developed an in-depth understanding of the needs and challenges of young people with eczema. Guiding principles highlighted key intervention design objectives and features to address needs of this target group to maximise user engagement. Behavioural analysis and logic modelling developed ECO's hypothesised programme theory. In Phase 2, qualitative think-aloud interviews were carried out with 28 young people with eczema and the intervention was optimised based on their feedback.

**Results:** The final intervention aimed to reduce eczema severity by supporting treatment use (emollients, topical corticosteroids/topical calcineurin inhibitors), management of irritants/triggers, emotional management; and reducing scratching. Generally, young people expressed positive views of intervention content and design in think-aloud interviews. Quotes and stories from other young people with eczema and ECO's focus on living with eczema (not just topical treatments) were valuable for normalising eczema. Young people believed ECO addressed knowledge gaps they had from childhood and the safety information about topical corticosteroids was reassuring. Negative feedback was used to modify ECO.

**Conclusions:** A prototype of the ECO intervention was developed using rigorous and complementary intervention development approaches. Subsequent think-aloud interviews helped optimise the intervention and demonstrated ECO is likely to be acceptable to this

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2  
3 target group and provided support for our guiding principles including key design objectives  
4  
5 and features to consider when developing interventions for this population. A randomised  
6  
7 controlled trial and process evaluation of the intervention is underway to assess effectiveness  
8  
9 and explore user engagement with the intervention's behavioural goals.  
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## 13 **Article Summary**

### 14 **Strengths and limitations of this study**

- 15  
16 • Our rigorous development using complementary theory-, evidence-, and person-based  
17  
18 approaches to intervention development helped ensure the intervention was  
19  
20 acceptable and engaging to our sample of young people with eczema.  
21  
22
- 23 • Our multidisciplinary intervention development group, including Patient and Public  
24  
25 Involvement, ensured that the content was evidence-based, that advice was feasible,  
26  
27 and that the perspectives of people living with eczema were considered throughout the  
28  
29 whole development process.  
30  
31
- 32 • Although we were able to recruit a good range of ages, genders and eczema severities  
33  
34 for the think-aloud interview study, a large proportion of the sample were university  
35  
36 students, so were likely to have high levels of health and computer literacy.  
37  
38
- 39 • As think-aloud interviews explore participants' immediate reactions to the  
40  
41 intervention, they cannot tell us how people would use the intervention over time or  
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43 explore engagement with the wider behavioural goals.  
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49 **Manuscript word count: 4133**  
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## Introduction

Eczema is a common skin condition that usually begins in childhood,[1] but for many the symptoms (dry, sore, itchy skin) can persist into adolescence and adulthood.[2] Eczema management focuses on identification and avoidance of irritants/triggers that may exacerbate eczema symptoms; the regular use of emollients to restore the skin's barrier function; and topical corticosteroids (or Topical Calcineurin Inhibitors [TCIs] for those with moderate to severe eczema) use to treat flare-ups.[3]

Eczema management can be particularly challenging in adolescence and early adulthood. Young people report a lack of knowledge regarding their eczema and treatments, and advice provided can often conflict with their own eczema experiences and a competing desire to maintain a 'normal' adolescent life.[4–8] These factors may explain why adherence to topical treatments presents challenges for this age group and many report not using their treatments as prescribed.[6]

Systematic reviews of self-management interventions for people with eczema[9,10] identified that, although a few studies evaluated interventions have been developed for parents/carers of children with eczema, only two studies evaluated interventions for children and adolescents.[11,12] Both interventions were delivered face-to-face and only one reported tailoring their intervention to this age group.[11] To address this research gap and the need to improve self-management support for people living with eczema, the Eczema Care Online (ECO) programme aimed to develop two online behavioural interventions: one for young people with eczema (13-25 years) and one for parents and carers of children (0-12 years) with eczema ([www.nottingham.ac.uk/eco](http://www.nottingham.ac.uk/eco)).[13,14]

First, we aimed to describe the development of the ECO intervention for young people with eczema using complementary person-, theory-, and evidence-based approaches (Phase 1).



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3 Guidelines for developing complex interventions emphasise that interventions should be  
4 informed by reviews of the current evidence-base, appropriate theory, and an in-depth  
5 understanding of the context in which the intervention will be implemented.[15] This article  
6 highlights key psychosocial needs of young people with eczema and intervention features to  
7 consider when developing behavioural interventions for this group. Second, we aimed to  
8 carry out think-aloud interviews to explore and optimise the acceptability of the ECO  
9 intervention among young people with eczema (Phase 2).

### 20 **Intervention development methodology**

21 We used theory-, evidence-, and person-based approaches to develop the online  
22 intervention.[16–18] The Person-Based Approach to intervention development uses iterative  
23 qualitative research to understand and accommodate the perspectives of the intervention's  
24 target group.[19]

25 Intervention development was carried out in two phases. In Phase 1, we collated and  
26 synthesised evidence relating to patient behaviours that are likely to reduce eczema severity  
27 and the perspectives of young people with eczema (person- and evidence-based approach).  
28 This evidence guided decisions regarding the intervention's target behaviours and provided  
29 us with an in-depth understanding of the key issues, needs, and behavioural challenges of this  
30 target group. Theory-based approaches (behavioural analysis and logic modelling) were used  
31 to develop and illustrate the intervention's hypothesised programme theory, that is, the  
32 hypothesised mechanisms of action by which the intervention components exerts their  
33 effects.[15,20] In Phase 2, we carried out iterative qualitative think-aloud interviews to gather  
34 user feedback on the intervention prototype and optimise it based on this feedback.[21] The  
35 methods and results for each phase are reported below.

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3 Both phases were guided by a multidisciplinary intervention development group, which  
4  
5 comprised 18 members including Patient and Public Involvement (PPI), dermatologists, a  
6  
7 nurse consultant, researchers with an interest in eczema, GPs, health psychologists, and  
8  
9 experts in intervention development and long-term conditions in adolescents. Through  
10  
11 regular meetings and reviewing documents, this group guided the design of the research,  
12  
13 helped with the interpretation of the research findings, and provided detailed feedback on the  
14  
15 intervention plan, written content, and prototype. The intervention development process is  
16  
17 illustrated in Figure 1. Ethical approval for this research was granted by Wales REC 7 Ethics  
18  
19 Committee (REC 17/WA/0329).  
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### 24 **Patient and Public Involvement**

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26  
27 Two mothers of children and young people with eczema (one of whom had eczema herself)  
28  
29 were part of our multidisciplinary intervention development group. Both were co-applicants  
30  
31 on the research grant application, helping to identify the research topic and develop research  
32  
33 questions. We also sought additional PPI feedback on the intervention content from two  
34  
35 young people with eczema and a panel of PPI contributors with an interest in skin research,  
36  
37 most of whom had experience of eczema, and some were aged 18-25. We discuss the specific  
38  
39 contributions of the PPI to intervention development throughout this manuscript. Two young  
40  
41 people reviewed the study participant information sheet to check comprehension. AR  
42  
43 discussed and provided feedback on our interpretations of the findings and this manuscript.  
44  
45 She continues to help us to disseminate our research findings among her wide-reaching  
46  
47 patient networks and via social media.  
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## 54 **Phase 1: Intervention planning**

### 55 **Phase 1 Methods**

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3 Phase 1 comprised of three steps: (1) Defining the intervention target behaviours; (2)  
4 Collating and synthesising evidence relating to the perspectives of young people with  
5 eczema; and (3) Creating an intervention plan.  
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### 10 *1.1 Defining the intervention target behaviours*

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13 The multidisciplinary intervention development group agreed the intervention's key target  
14 behaviours through consideration of the evidence-base for effective eczema treatments,  
15 clinical guidance on eczema management and recommendations around what would be  
16 feasible and acceptable to implement through an online intervention.[3,22,23]  
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### 23 *1.2 Collating and synthesising evidence relating to the perspectives of young people with* 24 *eczema*

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28 First, we undertook a systematic review and thematic synthesis of the views and experiences  
29 of eczema and/or eczema self-care of people with eczema and parents or carers of children  
30 with eczema.[7] Qualitative studies focusing on the views and experiences of eczema and  
31 eczema treatments, and barriers and facilitators to eczema self-management were included.  
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37 The review identified 39 papers (reporting 32 studies; 9 including young people in the  
38 sample).  
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44 Second, we carried out a secondary analysis of interview data from 25 young people (17-25  
45 years) with eczema.[4,5,24] The data came from the SKINS project, which explored young  
46 people's experiences of living with common skin conditions (eczema, acne, psoriasis,  
47 alopecia). To gather additional views from younger adolescents, the ECO study added to this  
48 data set by carrying out interviews with five young people with eczema aged 13-16 years.  
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54 Both interview studies explored young people's views about eczema treatment and  
55 management, and information and support needs. Interviews were analysed using inductive  
56 thematic analysis.  
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3 The methods and findings of these studies have been described in detail elsewhere.[4,5,7,24]

4  
5 Only key findings relevant to intervention development are summarised in this paper, with  
6  
7 the focus of this paper being on intervention development and the novel findings from Phase  
8

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10 2.

### 11 12 13 *1.3 Developing an intervention plan*

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16 Consistent with the person-based approach, our in-depth understanding of young people with  
17  
18 eczema informed the development of *guiding principles*, which outlined key intervention  
19  
20 objectives and design features that will address these.[19] A list of potential barriers and  
21  
22 facilitators to the target behaviours were also identified from this evidence-base and from  
23  
24 consultation with the multidisciplinary intervention development group and additional PPI  
25  
26 representatives. *A behavioural analysis* outlined the intervention components that were added  
27  
28 to address each of the identified barriers and facilitators for each target behaviour. Consistent  
29  
30 with the approach taken by Band et al. and Greenwell et al.,[17,18] these components were  
31  
32 mapped onto behaviour change theoretical frameworks to describe the planned intervention  
33  
34 content and identify hypothesised mechanisms of action. The Behaviour Change Techniques  
35  
36 Taxonomy classifies intervention content by their behaviour change techniques, the smallest  
37  
38 component for changing behaviour.[25] The Behaviour Change Wheel was used to classify  
39  
40 the source (component of the COM-B model hypothesised to influence behaviour; Capability,  
41  
42 Opportunity, Motivation) and function (e.g. 'Education', 'Persuasion') of each individual or  
43  
44 group of behaviour change techniques.[26] We also mapped the behaviour change techniques  
45  
46 onto their theoretical constructs (e.g. 'Knowledge', 'Skills') using the Theoretical Domains  
47  
48 Framework,[27] which is recommended for use alongside the Behaviour Change Wheel.  
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55 To illustrate key elements of the intervention's programme theory, a *logic model* was  
56  
57 developed to illustrate how the intervention components, theoretical constructs (intervention  
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3 processes), and key behaviours (purported mediators) influence the intervention outcomes  
4  
5 (eczema severity).  
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## 8 **Phase 1 Results**

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#### 10 *1.1 Defining the intervention target behaviours*

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14 The multidisciplinary intervention development group agreed that ECO would aim to reduce  
15  
16 eczema severity by supporting young people with eczema to: (1) Increase their use of  
17  
18 emollients to maintain skin hydration and prevent flare-ups; (2) Improve their use of topical  
19  
20 corticosteroids or topical calcineurin inhibitors through reactive applications of these  
21  
22 treatments in response to flare-ups or, where appropriate, regular intermittent (“weekend”)  
23  
24 preventative applications of topical corticosteroids or topical calcineurin inhibitors if  
25  
26 emollients are insufficient as maintenance therapy; (3) Improve their management of irritants  
27  
28 and triggers; (4) Improve their emotional management; and (5) Reduce scratching. Use of  
29  
30 emollients and topical corticosteroids/topical calcineurin inhibitors were identified as core  
31  
32 behaviours that would likely have the greatest effect on eczema severity. Therefore,  
33  
34 intervention content relating to these behaviours was deemed the most important.  
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#### 40 *1.2 Collating and synthesising evidence relating to the perspectives of young people with* 41 42 *eczema*

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44  
45 The qualitative evidence helped us to develop the following understanding of our target  
46  
47 group. Young people are developing a sense of independent identity and have an increasing  
48  
49 desire for autonomy. Specifically, young people with eczema are keen to take on more  
50  
51 responsibility with their eczema management.[24] However, these young people may feel  
52  
53 apprehensive about their new roles and responsibilities, with some finding interacting with  
54  
55 health professionals and negotiating health care systems daunting.[24] Young people have  
56  
57 gaps in their knowledge of eczema, specifically understanding of the causes/triggers of  
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3 eczema and the rationale behind their treatment (e.g. difference between emollients and  
4 topical corticosteroids/topical calcineurin inhibitors and how to use them).[4,7] Health  
5  
6 professionals do not always revisit such information, assuming that young people were told  
7  
8 this information in childhood.[4,7] In general, young people perceive topical treatments to be  
9  
10 effective, but they also have doubts about their long-term effectiveness, and concerns around  
11  
12 their safety and becoming over-reliant on topical corticosteroids.[7,24] This group perceive  
13  
14 several barriers to applying topical treatments, including using treatments when outside of the  
15  
16 home (e.g. when in class or working in a public-facing job) and cost of treatments.[7,24]  
17  
18 These treatment barriers are not unique to this age group,[7] but are nonetheless important to  
19  
20 address for any eczema behavioural intervention.  
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26  
27 Many young people were told in childhood that they would ‘grow out of’ eczema, but this  
28  
29 information is often at odds with their own experiences.[4] Young people have a desire to ‘fit  
30  
31 in’ with their peers and feel like a ‘normal’ young person.[5] They welcome the opportunity  
32  
33 to share experiences with other young people with eczema to normalise their experience.[5]  
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35

36  
37 The multidisciplinary intervention development group discussed what specific website design  
38  
39 needs young people may have. Usability research has shown that this group are likely to  
40  
41 dislike reading large amounts of text, like concepts to be illustrated visually, and relate to  
42  
43 content created by peers (e.g. stories, images, examples from other young people).[28,29]  
44  
45

46 This evidence was supported by discussions with our young people PPI who also suggested  
47  
48 that young people may prefer videos over reading lots of text and recommended having brief  
49  
50 ‘top tips’ with suggestions from other young people for how they manage eczema. They also  
51  
52 felt that it was important that the intervention was accessible via a mobile device or  
53  
54 computer.  
55  
56

### 57 58 *1.3 Developing an intervention plan* 59 60

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3 We developed a set of guiding principles to address the issues identified in the evidence  
4 synthesis stage (1.2) (Table 1). The behavioural analysis table is presented in Supplementary  
5 Material 1 and the logic model in Figure 2.  
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## 10 **Phase 2: Intervention optimisation**

### 11 **Phase 2 Methods**

#### 12 *2.1 Creating the intervention prototype and videos*

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Creating the intervention prototype was done in several stages. First, guided by our target behaviours, guiding principles and qualitative research, the multidisciplinary intervention development group agreed the topics of the intervention modules and videos. Second, we wrote page content and video scripts, and circulated this to the multidisciplinary intervention development group for comment to ensure it was evidence-based and medically accurate, and the advice was clear and feasible. Positive and negative feedback was entered into the Person-Based Approach Table of Changes,[16] and potential changes were discussed, agreed, and prioritised.

We tested either the video scripts, audio recordings of the scripts, or a storyboard or prototype of the video with young people using think-aloud interviews, and these were also reviewed by a PPI panel. Once the written content and videos were finalised, we created a working prototype of the intervention using the LifeGuide software,[30] which was reviewed by our two young people PPI and further optimised through think-aloud interviews with young people with eczema. The final videos were created by an external video creator.

Table 1 Guiding principles for ECO for young people

User context	Intervention design objectives	Key intervention features
<ul style="list-style-type: none"> <li>Young people (YP) with eczema have an increasing desire for autonomy regarding their eczema management, but may feel apprehensive about their new roles and responsibilities.</li> <li>YP may have gaps in their understanding of eczema.</li> <li>YP may perceive barriers to using topical treatments.</li> </ul>	<p>To support YP to gain autonomy and competence in their eczema management.</p>	<ul style="list-style-type: none"> <li>Ensure YP have a complete understanding of eczema and the rationale behind their treatment.</li> <li>To build YP's self-efficacy for the target behaviours (e.g. information on how to apply treatments, avoid irritants/triggers, reduce scratching).</li> <li>Stories and tips from other YP on what helped them take control of their own eczema and how to overcome barriers to treatments.</li> <li>Use autonomy-promoting language, provide choice wherever possible, and avoid condescending or 'child-like' language/graphics.</li> <li>Provide advice on how to communicate with health professionals and make the most out of appointments.</li> </ul>
<ul style="list-style-type: none"> <li>YP have a desire to live as 'normal' a life as possible.</li> <li>YPs may be told in childhood that they would 'grow out of' eczema, which is at odds with their own experiences.</li> </ul>	<p>To enable YP to maintain a sense of normalcy when managing their eczema</p>	<ul style="list-style-type: none"> <li>Provide age-appropriate advice on living with eczema (e.g. shaving, wearing make-up, and managing eczema at work/university/school).</li> <li>Provide relatable stories and advice from other YP with eczema.</li> <li>Acknowledge that, for some, eczema persists into adolescence and adulthood.</li> <li>Provide images and descriptions of eczema for different skin-types.</li> <li>Avoid providing overly restrictive advice on irritants/triggers, instead offering advice on how to minimise the negative consequences of exposure irritants and triggers or provide alternatives (e.g. using emollients in place of soap).</li> </ul>



<ul style="list-style-type: none"> <li>YPs may have doubts about the long-term effectiveness of topical treatments, and concerns around their safety and becoming over-reliant on topical corticosteroids</li> <li>YP may find topical treatments unpleasant in texture and/or smell and they worried about applying treatments in public in case others 'found out' that they had eczema.</li> </ul>	<p>To build YP's beliefs in the positive effects of their topical treatments</p>	<ul style="list-style-type: none"> <li>Provide information to address topical treatment concerns and barriers, and persuade YPs of the long-term effectiveness of these treatments.</li> </ul>
<ul style="list-style-type: none"> <li>YPs may dislike reading large amounts of text, preferring content that is easy to scan, visual and peer-created.</li> <li>YPs want interventions that are accessible on their smartphones and computers.</li> </ul>	<p>To provide engaging and accessible intervention content</p>	<ul style="list-style-type: none"> <li>Provide interactive content (e.g. quizzes), videos and pictures, and reduce reading burden by keeping the amount of text per page to a minimum.</li> <li>Break the content down into lots of short sections/modules.</li> <li>Intervention to be mobile-friendly.</li> <li>Provide peer-created content (e.g. stories, videos)</li> </ul>

## 2.2 Think-aloud interviews

We carried out 30 think-aloud interviews with 28 young people with eczema (2 people took part in two interviews, viewing a later intervention version) who were purposively sampled based on age, gender and eczema severity (Table 2). Twenty-three of these participants were newly recruited for this study and five participants were from the qualitative study in Phase 1. Participants were recruited via an invitation letter from their GP practice or advertising, opportunistic and snowball sampling of students at the University of Southampton. During the think-aloud interviews, participants were asked to use sections of the intervention while sharing their thoughts and reactions to the content aloud. Interviews were facilitated by a researcher who observed the participant using the intervention and asked prompts when needed to elicit participant reactions.

To maximise participant time during the interviews, participants testing optional modules were sent the core intervention content to look through before the interview and they were asked about it during the interview. Interviews were carried out at participants' preferred location (e.g. at home, the university) and relatives were present for nine interviews.

Interviews lasted 45-90 minutes, took place between October 2018 to April 2019, and were carried out by DG and two medical students (HJ, EW) and one postdoctoral student were trained and supervised by DG and ET (postdoctoral experienced qualitative researchers) (all females). Interviews were audio-recorded and transcribed verbatim.

Optimisation was iterative, moving between data collection, analysis, and intervention modification. We considered data saturation to be reached once no further important changes were required.[16] For each interview, DG completed a feedback table, highlighting positive and negative comments about the intervention, based on the interviewer field notes and listening back to the audio recordings.

Table 2 Think-aloud participant demographics

Variable	Statistic
<b>Age</b>	
Mean (SD)	17.82 (3.41)
Range	13-23
<b>Gender</b>	
Female N (%)	13 (46.43)
Male N (%)	15 (53.57)
<b>Eczema severity (self-defined)*</b>	
Mild N (%)	10 (38.46)
Mild/Moderate N (%)	2 (7.69)
Moderate N (%)	7 (26.92)
Moderate/Severe N (%)	3 (11.54)
Severe N (%)	4 (15.38)

**Key:** \*n=26

MSa and IM read through the transcripts to ensure important issues were captured. The feedback table was reviewed by a sub-group of the intervention development group (KG, IM, MSa, KS, MSt, ET) at weekly meetings. KG transferred negative comments into the Table of Changes and potential changes were agreed and prioritised by this sub-group.[16]

## Phase 2 Results

### 2.1 Creating the intervention prototype and videos

In the final intervention prototype, users first progressed through a brief (nine pages) introductory section containing the key behavioural messages necessary for facilitating a basic understanding of eczema and its management (Supplementary Material 2). Some key behavioural messages were also summarised in short (2 minute) videos (Supplementary Material 3). Users then had the option of completing a simple eczema assessment that provided advice on which of the core treatment modules (emollients or topical

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3 corticosteroids) would be most relevant to them, depending on whether they were currently  
4 experiencing an eczema flare-up (Supplementary Material 4). Users had access to a menu  
5 where they could choose the topic modules that were most relevant to them (Supplementary  
6 Material 5). On each login, users were given suggestions for which modules to look at next,  
7 based on what they had looked at previously.  
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15 A key design feature highlighted in the guiding principles was the use of quotes from other  
16 young people with eczema sharing their experiences of eczema and eczema management  
17 advice (Supplementary Material 4). We also introduced new terminology to help young  
18 people better understand the function of each type of topical treatment and to mirror how this  
19 group already referred to these treatments (e.g. ‘creams’ for all treatments, regardless of  
20 whether they were actually a cream or an ointment). Emollients were termed ‘moisturising  
21 creams’ and topical corticosteroids/topical calcineurin inhibitors were termed ‘flare control  
22 creams’.  
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34 Our multidisciplinary intervention development group and PPI representatives felt that it was  
35 important that the intervention is accessible and relevant to all ethnic groups. Therefore, ECO  
36 provided images and descriptions of eczema for different skin-types and our videos included  
37 cartoon characters from different ethnic groups. The full intervention content is outlined in  
38 Supplementary Material 6 using the TIDieR checklist.[31]  
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## 46 *2.2 Think-aloud interviews*

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49 Generally, young people expressed positive views of the intervention’s content and design.  
50 They found the information and advice clear, easy to follow, helpful, and relatable, and they  
51 liked the videos and brief eczema assessment. Specifically, they found the quotes and advice  
52 from other young people with eczema, and the facts about how common it is to still have  
53 symptoms at their age reassuring, personal, and it made them feel less alone.  
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3 *“I think it's quite comforting to actually know that it's normal for people with eczema.*  
4 *As in like this is, it's not just me, because even though you get told loads of people*  
5 *have eczema, it is just quite nice to be like, 'This is what you're going through, it's*  
6 *okay, this is what you're going to do about it,' and just have the information all*  
7 *there.” (P10, 19-21 years old)*

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15 *“I like this page [content on prevalence of eczema among young people]...it's good to*  
16 *know that, like, I don't know, I always feel quite weird, because I'm 21 and still have*  
17 *eczema, so, it's good to know that.” (P17, 19-21 years old)*

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23 Young people valued that ECO provided advice on living well with eczema, rather than  
24 focusing solely on medical treatments.

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28 *“Sleep problem, emotion, diet and how much you eat - that's good because it's saying*  
29 *that it's not just eczema like using creams, it's also got other stuff, other aspects to it*  
30 *as well...I think you can't just control eczema with creams, you've got to control the*  
31 *whole lot. Yes, this is useful. (P13, 19-21 years old)*

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38 *“In lighter skin eczema may look red, in darker skin eczema may look grey, purple or*  
39 *brown'. I feel like saying that is actually good, because a lot of the time I'm just like,*  
40 *why does my eczema look grey? But I didn't even know that, now I can see that's a*  
41 *common thing in darker skin. I feel like having that is actually really good. (P22, 16-*  
42 *18 years old)*

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50 *“I think that [module on itching] was the most helpful because it said apart from*  
51 *using the creams and things, other things you can do to help you. (P19, 13-15 years*  
52 *old)*

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3 Most young people explained how they learned something new about eczema and its  
4 management from the part of the website they used, with some explaining that ECO helped  
5 addressed the knowledge gaps from childhood.  
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11 *“[ECO is] brilliant. It's given me a lot more information than I've ever had in the*  
12 *past...I've learnt a lot of new things today about eczema that I didn't know over the*  
13 *last 22 years of having eczema, it's amazing!...It's amazing, I love it.” (P9, 22-25*  
14 *years old)*  
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22 *“If I was prescribed stuff by my doctor I would be like, 'Well, it's probably good for*  
23 *me.'...I'd be like why am I even using this and then not bother. I think if you knew that,*  
24 *okay this one's going to stop you itching and reduce soreness then you might be more*  
25 *likely to carry on using it and also, yes if you're someone that doesn't really ask*  
26 *questions it's nice to have a place that will tell you the information anyway without you*  
27 *having to ask someone. (P18, 16-18 years old)*  
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34 Young people also talked about how they found the information about the safety of topical  
35 corticosteroids reassuring:  
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39 *“That's good to know, that it [topical corticosteroids] doesn't affect growth or*  
40 *development...because I've been using it for so many years now. It's always been on*  
41 *my mind, and not being able to find out any information about it, it's worried me...but*  
42 *this helps a lot. It kind of puts your mind at ease, knowing that it doesn't do anything*  
43 *to your growth or development.” (P9, 22-25 years old)*  
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52 The positive feedback provided support for our guiding principles, which emphasised the  
53 importance of maintaining a sense of normalcy when managing eczema, addressing  
54 knowledge gaps to support young people to gain autonomy and competence in eczema  
55 management, and providing engaging and accessible intervention content (Table 1). The  
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3 negative feedback was used to modify the intervention (Table 3 outlines some example  
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5 negative comments and the changes implemented).  
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## 9 **Discussion**

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11 This manuscript provides a description of the rigorous development process for a behavioural  
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13 intervention for young people with eczema; a target group that has been largely ignored in  
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15 eczema research.[7,9,10] It is essential to provide self-management support to this age group  
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17 as they begin to take on a more active role in their eczema management; a role which was  
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19 previously taken on by their families.[6] The person-based approach to intervention  
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21 development allowed us to understand and accommodate the perspectives of young people  
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23 with eczema, resulting in an online intervention that was engaging and acceptable to our  
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25 sample of this target group.[19]  
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30 The behavioural analysis maintained a focus on the behaviours most likely to influence  
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32 eczema severity (topical treatment use, managing irritants/triggers, scratching, emotional  
33  
34 management) and suggested acceptable behaviour change techniques that can help young  
35  
36 people with eczema overcome behavioural barriers relevant to them. Logic modelling offered  
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38 a programme theory that can be tested and refined in future process analyses. Our final  
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40 guiding principles outlined some of the key behavioural issues, intervention design  
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42 objectives, and design features that those developing behavioural interventions for young  
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44 people with eczema, or other long-term conditions, may wish to consider to maximise user  
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46 engagement. The think-aloud interviews provided support for the relevance of these guiding  
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48 principles to this target group and the acceptability of the design features we implemented to  
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50 engage this group. Specifically, the ECO intervention's use of quotes and tips from other  
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52 young people with eczema and its focus on living with eczema (not just topical treatments)  
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54 were valuable for normalising eczema.  
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Table 3 Example issues identified from the think-aloud interviews and the changes implemented to address these

Summary of issue identified	Example quote	Change implemented
Some found the questions in the brief eczema assessment confusing.	<p><i>“Does your skin feel dry? Well, everywhere or in general where you’ve got...eczema? ...I don't know if that's [the question] very clear.” (P12, 22-25 year old)</i></p> <p><i>“Is your skin or redder or darker than usual? ...to me it sounds like ‘is your eczema darker or less dark than your eczema normally is?’, but I think it's a bit ambiguous whether it means that or their usual skin?...you could just say ‘is your eczema red or darker than usual?’” (P18, 16-18 years old)</i></p> <p><i>'Is your skin redder or darker [than usual]?'...maybe it's the 'than usual' bit that needs to be more clearer, because I could interpret that as this being my usual skin, rather than the usual colour of the eczema...maybe, 'Is your eczema redder or darker than usual?' or something (P5, 19-21 years old)</i></p>	The assessment questions were reworded to clarify that we are asking about their eczema at present (rather than in the past) and their eczema skin (rather than skin in general).
The feedback for the brief eczema assessment did not always match their experience (e.g. feedback suggested they may have an eczema flare-up when they didn't).	<p><i>“[Is your skin itchy or sore?] it's not really sore but it is itchy...I can have itchy dry skin but I only have sore skin when it's red and inflamed...[recommended the flare control creams module]... it said that I'm having a flare-up now, but I wouldn't class this as a flare-up. This is kind of just</i></p>	We separately asked whether eczema is ‘itchy’ and ‘sore’ so that people do not receive feedback that they are having a flare-up if they just have itchy and not sore skin. Soften the feedback on current eczema severity to avoid disengaging those who don't agree that they are



Summary of issue identified	Example quote	Change implemented
Some thought the introductory section was too long.	<p><i>my - how my eczema kind of bobbles along, as in my flare-ups would be much more aggressive than what they were suggesting it is.” (P10, 19-21 years old)</i></p> <p><i>“Personally, if I see there's 21 pages, I'm just going to try and get through them.” (P18, 16-18 years old)</i></p>	<p>experiencing an eczema flare-up (‘For most people, this means they are having an eczema flare-up’).</p> <p>Reduce the introductory section significantly with optional click-outs to additional information if needed.</p>
Some young people commented that they already knew a lot of the information as they have had eczema for a long time.	<p><i>“[ECO] was really good...because I've had it for so long I feel like a lot of the information there I've already had drilled into me my whole life, but I feel like for people that either have children with eczema or people with eczema, I don't know, I think it would be really helpful... personally, I would probably want the more information about the lifestyle stuff and diet” (P10, 19-21 years old)</i></p> <p><i>“I think a lot of stuff I probably kind of already knew from having eczema but it's good to get a few things that help yes” (P19, 13-15 years old)</i></p>	<p>Added in a quote from another young person who had eczema for a long time saying how they were surprised that the website contained new helpful tips. Emphasise that the information is based on the most up-to-date research evidence (so they may find new information) and that there is information on ‘living with eczema’ (e.g. diet advice).</p>

The value of behaviour change interventions that make individuals feel they are ‘not alone’ is supported by other qualitative research with people with long-term conditions and parents/carers of children with eczema.[22,32] Although this intervention focused mainly on treatment adherence as this was deemed to have the biggest influence on eczema severity, providing age-appropriate advice and support on how young people can better live with

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2  
3 eczema was valuable for ensuring the content was engaging and relatable to this target group.  
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5 Young people explained how valuable the explanations of eczema and rationale behind the  
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7 topical treatments for addressing gaps in their knowledge, with most participants reporting  
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9 that they learned something new from ECO. This provided further support for the need for  
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11 health services to revisit eczema education with young people, avoiding assumptions that  
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13 they have already been told this information.[4] Online information can be confusing and of  
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15 variable quality,[33,34] therefore, it is important to signpost young people to high quality  
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17 evidence-based online information so they are empowered to take an active role in their own  
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19 healthcare.[35]  
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24 A strength of this research was our rigorous development using complementary theory-,  
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26 evidence-, and person-based approaches to ensure the intervention is acceptable and engaging  
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28 to its target group, as well as effective. Our multidisciplinary intervention development group  
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30 and PPI ensured that the content was evidence-based, that advice was feasible, and that the  
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32 perspectives of people living with eczema were considered throughout the whole  
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34 development process.[36] It was helpful to gain iterative feedback from PPI and young  
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36 people with eczema on early versions of the videos (i.e. scripts, audio recordings of the video  
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38 voiceover, prototype) to ensure that they were as acceptable as possible to the target group  
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40 before it was finalised by the external video creator. One limitation of the think-aloud  
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42 interview study is that a large proportion of the sample were university students, so are likely  
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44 to have high levels of health and computer literacy. Furthermore, as think-aloud interviews  
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46 explore participants' immediate reactions to the intervention, they cannot tell us how people  
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48 would use the intervention over time or explore engagement with the target behaviours.  
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54 In conclusion, the think-aloud interview study demonstrated ECO is likely to be acceptable to  
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56 young people with eczema and provided support for our guiding principles, including key  
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58 design objectives and features to consider when developing interventions for this population.  
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3 A randomised controlled trial of ECO to explore effectiveness and cost-effectiveness is  
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5 underway (ISRCTN79282252).[13] This includes a nested mixed-methods process evaluation  
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7 to explore young people's experiences of using the intervention over time and how the  
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9 intervention was used, and test and further refine the intervention's programme theory. For  
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11 the qualitative interview study, we purposively recruited participants across a range of ages,  
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13 ethnicities, socioeconomic status, eczema severities, and intervention usage. It is important to  
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15 recruit diverse samples to ensure digital interventions do not further facilitate healthcare  
16  
17 inequalities.  
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24  
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26  
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28  
29

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## Competing interests

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## Author Contributions

All authors (except HJ, EW, ELR) designed the study. KG, KS, DG, MSt IM, MSa led the intervention development with input from the other authors. DG, ET, SW, HJ, EW were responsible for recruitment and data collection. KG and DG led on the data analysis, with support from MSa and IM. KG drafted the manuscript, with initial support from DG, MSa and IM. All authors critically reviewed the manuscript, contributing important intellectual content and approved the final manuscript.

## Data sharing statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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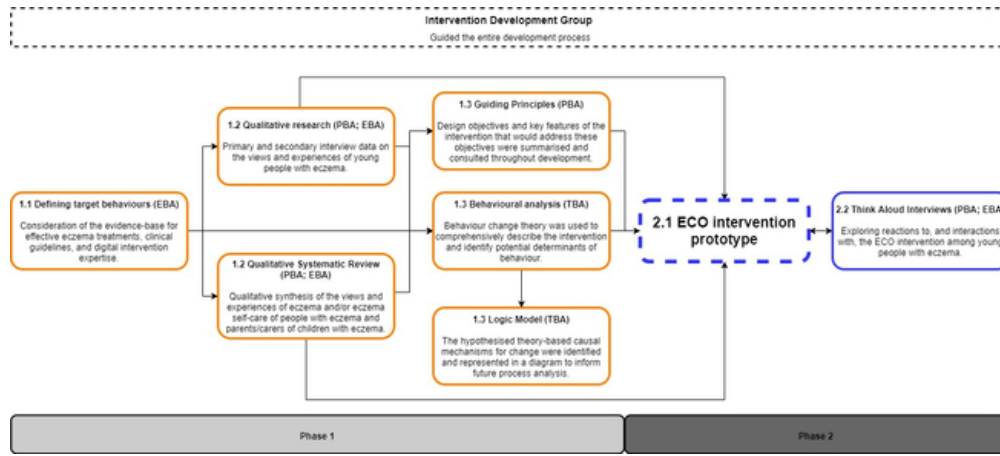


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## 28 **Figure legends**

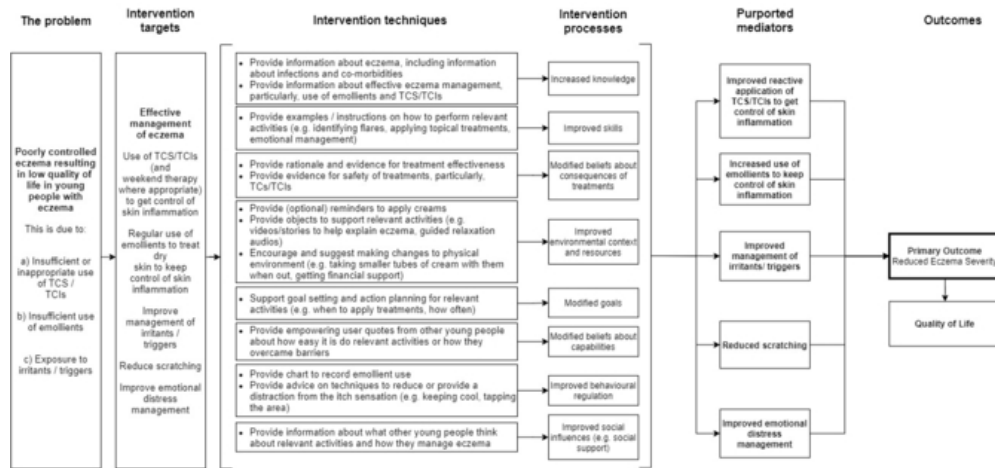
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31 *Figure 1 Intervention development process for ECO intervention. Key: PBA = Person-Based*  
32 *Approach; EBA = Evidence-based approach; TBA = Theory-based approach.*  
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37 *Figure 2 Logic model for Eczema Care Online (ECO) for young people*  
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Intervention development process for ECO intervention. Key: PBA = Person-Based Approach; EBA = Evidence-based approach; TBA = Theory-based approach.

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Logic model for Eczema Care Online (ECO) for young people

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**Supplementary Material 1: Behavioural analysis for the Eczema Care Online (ECO) intervention for young people using the Behaviour Change Wheel (BCW), Theoretical Domains Framework (TDF) and Behaviour Change Techniques Taxonomy (BCTv1)**

**Key:** TCS = Topical Corticosteroids; YP = Young People; EO = Barrier emerged from expert opinion; QSR = Barrier/facilitator emerged from systematic review of qualitative literature with adults with eczema and parents/carers of children with eczema; QI = Barrier/facilitator emerged from qualitative interview research with young people.

Barriers/facilitator to target behaviour	Intervention components	Target construct (BCW)	Theoretical domain (TDF)	Intervention function (BCW)	Behaviour Change Technique (using BCTv1)
<b>Target behaviour: Increased emollient use</b>					
Belief that emollients (in general or a specific brand) <u>do little</u> to control eczema [QSR; QI]  <i>Belief that emollients are useful for preventing dry/cracking skin [QI]</i>	<ul style="list-style-type: none"> <li>Provide persuasive and credible information about the effectiveness of emollients, including scientific evidence, user quotes, and videos</li> <li>Provide rationale for how emollients control eczema</li> </ul>	Psychological capability; Reflective motivation; Social opportunity	Beliefs about consequences; Knowledge; Social Influences	Education; Persuasion; Modelling	5.1 Information about health consequences 6.2 Social comparison 6.3 Information about others' approval 9.1 Credible source
	The 2-week challenge: <ul style="list-style-type: none"> <li>Provide an emollient chart to allow YP to record how their skin is after applying emollients</li> </ul>	Reflective Motivation	Beliefs about consequences	Education; Persuasion	5.1 Information about health consequences 2.4 Self-monitoring of outcomes of behaviour
	<ul style="list-style-type: none"> <li>Provide advice on how to choose an effective emollient (e.g. list of available emollients, disadvantages of using cosmetic moisturisers)</li> </ul>	Psychological capability	Skills	Training	4.1 Instructions on how to perform the behaviour
Concerns about the safety and side effects (e.g. stinging, dependency) of emollients smell, feel, and appearance of emollients [QSR; QI QI]	<ul style="list-style-type: none"> <li>Provide persuasive and credible information about the safety of emollients and risk of side effects (including their flammability), including scientific evidence, user quotes and videos</li> </ul>	Psychological capability; Reflective motivation; Social opportunity	Beliefs about consequences; Knowledge; Social Influences	Education; Persuasion; Modelling	5.1 Information about health consequences 6.2 Social comparison 6.3 Information about others' approval 9.1 Credible source
	<ul style="list-style-type: none"> <li>Provide advice on how to choose the right emollient (e.g. using different emollients at different times of the day, highlighting that different</li> </ul>	Psychological capability	Skills	Training	4.1 Instructions on how to perform the behaviour

Barriers/facilitator to target behaviour	Intervention components	Target construct (BCW)	Theoretical domain (TDF)	Intervention function (BCW)	Behaviour Change Technique (using BCTv1)
	<p>emollients have different constituents, smells, and feel)</p> <ul style="list-style-type: none"> <li>• Provide advice on disguising emollients when around others/away from home (e.g. putting emollient in smaller containers)</li> </ul>				
	<p>The 2-week challenge:</p> <ul style="list-style-type: none"> <li>• Provide an emollient chart to allow YP to record how their skin is each day after applying emollients and how they have found the emollients (e.g. side effects, texture)</li> </ul>	Reflective Motivation	Beliefs about consequences	Education; Persuasion	5.1 Information about health consequences 2.4 Self-monitoring of outcomes of behaviour
Concerns about the psychosocial impact of emollients (e.g. feeling self-conscious) [QSR; QI]	<ul style="list-style-type: none"> <li>• Provide strategies to reduce the psychosocial impact of emollients (e.g. feeling less self-conscious)</li> <li>• Provide quotes from YPs explaining how they overcame some of the psychosocial consequences of emollients</li> </ul>	Psychological capability; Reflective Motivation; Social opportunity	Beliefs about consequences; Beliefs about capabilities; Knowledge; Skills; Social influences	Education; Persuasion; Training; Modelling	5.3 Information about social and environmental consequences 5.6 Information about emotional consequences 6.2 Social comparison 6.3 Information about others' approval 9.1 Credible source
Inconvenience of using emollients when away from home [QSR; QI]	<ul style="list-style-type: none"> <li>• Provide advice on using emollients when away from home (e.g. requesting smaller tubes from health professional)</li> </ul>	Physical Opportunity	Environmental context and resources	Environmental restructuring	12.1 Restructuring the physical environment
Inconvenience of emollients rubbing off (e.g. on clothes and bed sheets) [QSR; QI]	<ul style="list-style-type: none"> <li>• Provide advice on how to choose the right emollient and avoiding them rubbing off (e.g. put on loose clothing, allowing adequate time for absorption, leaving it to dry in a warm room)</li> </ul>	Psychological capability	Skills	Training	4.1 Instructions on how to perform the behaviour

Barriers/facilitator to target behaviour	Intervention components	Target construct (BCW)	Theoretical domain (TDF)	Intervention function (BCW)	Behaviour Change Technique (using BCTv1)
<p>Belief that emollients are time-consuming to apply and to find the right one/competing time pressures [QSR; QI]</p> <p>Forgetting to apply emollients [QI]</p>	<ul style="list-style-type: none"> <li>• Provide information on how to integrate emollient use into everyday life</li> <li>• Reassure YP that applying emollients should not be time-consuming</li> <li>• Advise YP to plan when they will apply their emollients (i.e. ensure they allocate time)</li> </ul>	<p>Psychological capability; Reflective Motivation</p>	<p>Knowledge; Skills; Goals</p>	<p>Education; Training Enablement</p>	<p>1.4 Action planning 4.1 Instructions on how to perform the behaviour 5.3 Information about social and environmental consequences</p>
<p>Forgetting to apply emollients [QI]</p> <p><i>Having an emollient routine [QI]</i></p>	<p>The 2-week challenge:</p> <ul style="list-style-type: none"> <li>• Suggest YP to apply their emollient daily</li> <li>• Suggest YP plan when they will apply their emollients</li> <li>• Suggest YP apply their creams at the same time in the same context each day</li> <li>• Allow YP to choose how many times per day they aim to apply their emollients and suggest they choose a particular time of the day or situation (e.g. after showering) to apply.</li> <li>• Provide an emollient chart to record whether they have used their emollients at their agreed times.</li> </ul>	<p>Reflective motivation; Psychological capability</p>	<p>Goals; Skills; Behavioural regulation</p>	<p>Enablement; Training</p>	<p>1.1 Goal setting (behaviour) 1.4 Action planning 2.3 Self-monitoring of behaviour 8.1 Behavioural practice/rehearsal 8.3 Habit formation</p>
	<ul style="list-style-type: none"> <li>• Allow users to set up regular reminders to apply emollients by email or text messages and decide on the frequency of these reminders</li> <li>• Provide an emollient chart that acts as a reminder by suggesting YP record whether they have used their</li> </ul>	<p>Physical opportunity</p>	<p>Environmental context and resources</p>	<p>Environmental structure</p>	<p>7.1 Prompts/cues</p>

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Barriers/facilitator to target behaviour	Intervention components	Target construct (BCW)	Theoretical domain (TDF)	Intervention function (BCW)	Behaviour Change Technique (using BCTv1)
	emollients at their agreed times [2-week challenge]				
Belief that finding an emollient that works best for you is inconvenient, confusing and time-consuming [QSR; QI]	<ul style="list-style-type: none"> <li>Acknowledge how frustrating and time-consuming this process can be</li> <li>Provide quotes from YP emphasising the importance of finding the right emollient</li> </ul>	Psychological capability; Reflective motivation; Social opportunity	Beliefs about consequences; Beliefs about capabilities; Knowledge; Social Influences	Education; Persuasion; Modelling	5.1 Information about health consequences 6.2 Social comparison 6.3 Information about others' approval 9.1 Credible source
Belief that you don't need to apply the emollient every day or only when you need it/eczema is bad [QI]	<ul style="list-style-type: none"> <li>Provide information on how often to apply emollients and the rationale for doing this</li> </ul>	Psychological capability; Reflective Motivation	Knowledge; Skills	Education; Training	4.1 Instructions on how to perform the behaviour 5.1 Information about health consequences
Lack of skills regarding how to apply emollients/ low self-efficacy [QSR]	<ul style="list-style-type: none"> <li>Provide instructions on how to correctly applying emollients, including how much emollient to apply</li> </ul>	Psychological capability	Skills	Training	4.1 Instructions on how to perform the behaviour
Ran out of emollients [EO]  <i>Stocking up on emollient [QI]</i>	<ul style="list-style-type: none"> <li>Provide advice on how to obtain more emollients/avoid running out</li> </ul>	Physical Opportunity	Environmental context and resources	Environmental structuring	12.5 Adding objects to the environment
Cost of emollients [QI]	<ul style="list-style-type: none"> <li>Provide advice about financial benefits YP can apply for or strategies for reducing the cost of emollients</li> </ul>	Physical Opportunity; Psychological Capability; Reflective Motivation	Environmental context and resources; Knowledge; Beliefs about consequences	Environmental structuring; Education; Persuasion	5.3 Information about social and environmental consequences 12.5 Adding objects to the environment
Difficulties in getting health professionals to	<ul style="list-style-type: none"> <li>Provide advice on how to prepare for appointments with health professionals</li> </ul>	Psychological Capability	Skills	Training	4.1 Instructions on how to perform the behaviour



Barriers/facilitator to target behaviour	Intervention components	Target construct (BCW)	Theoretical domain (TDF)	Intervention function (BCW)	Behaviour Change Technique (using BCTv1)
<p>prescribe different emollients [QI]</p> <p><i>Preparing and researching for consultations [QI]</i></p>					
<b>Target behaviour: Improved use of topical corticosteroids (TCS) or Topical Calcineurin Inhibitors (TCI)</b>					
<p>Belief that TCSs/TCIs are not effective enough for managing flare-ups (e.g. provide only temporary relief before their eczema returned) [QI]</p>	<ul style="list-style-type: none"> <li>• Provide persuasive and credible information about the effectiveness of TCS/TCIs, including scientific evidence, user quotes and videos</li> <li>• Provide rationale for how TCS/TCIs control eczema</li> <li>• Provide advice on whether emollients are also needed</li> </ul>	<p>Psychological capability; Reflective motivation; Social opportunity</p>	<p>Beliefs about consequences; Knowledge; Social Influences</p>	<p>Education; Persuasion; Modelling</p>	<p>5.1 Information about health consequences 6.2 Social comparison 6.3 Information about others' approval 9.1 Credible source</p>
<p>Concerns about the long-term safety of TCSs [QSR; QI; EO]</p>	<ul style="list-style-type: none"> <li>• Provide persuasive and credible information about the safety of TCSs/TCIs (e.g. skin thinning, wrinkling, dependency), including scientific evidence, user quotes and videos</li> </ul>	<p>Psychological capability; Reflective motivation; Social opportunity</p>	<p>Beliefs about consequences; Knowledge; Social Influences</p>	<p>Education; Persuasion; Modelling</p>	<p>5.1 Information about health consequences 6.2 Social comparison 6.3 Information about others' approval 9.1 Credible source</p>
<p>Concerns about the immediate side effects (e.g. stinging) of TCSs/TCIs [QI]</p>	<ul style="list-style-type: none"> <li>• Provide reassuring advice about the temporary nature of side effects (e.g. stinging) and how to choose the right TCS/TCIs (i.e. no side effects)</li> </ul>	<p>Psychological capability; Reflective motivation;</p>	<p>Skills; Beliefs about consequences; Knowledge</p>	<p>Education; Persuasion; Training</p>	<p>4.1 Instructions on how to perform the behaviour 5.1 Information about health consequences</p>
<p>Uncertainty regarding when to start and finish TCSs/TCIs [QI]</p>	<ul style="list-style-type: none"> <li>• Provide information on when to apply TCSs/TCIs and for how long</li> </ul>	<p>Psychological capability</p>	<p>Skills</p>	<p>Training</p>	<p>4.1 Instructions on how to perform the behaviour</p>

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Barriers/facilitator to target behaviour	Intervention components	Target construct (BCW)	Theoretical domain (TDF)	Intervention function (BCW)	Behaviour Change Technique (using BCTv1)
Lack of skills regarding how to apply TCSs/TCIs / low self-efficacy [EO]	<ul style="list-style-type: none"> <li>Provide instructions on how to correctly apply TCSs/TCIs, including how much to apply</li> </ul>	Psychological capability	Skills	Training	4.1 Instructions on how to perform the behaviour
Belief that using more TCS than prescribed will conceal their eczema or make their eczema flare-up pass quicker [QI]	<ul style="list-style-type: none"> <li>Provide information on how much TCS/TCIs to apply</li> </ul>	Psychological capability	Skills	Training	4.1 Instructions on how to perform the behaviour
Uncertainty regarding the difference between steroids [QI]	<ul style="list-style-type: none"> <li>Provide information on what type of steroids are available and which ones they should use on different body parts and why</li> </ul>	Psychological capability	Skills	Training	4.1 Instructions on how to perform the behaviour
Ran out of TCS/TCIs /not being able to get hold of their preferred TCS (e.g. out of stock) [QI]  <i>Stocking up on TCS/TCIs [QI]</i>	<ul style="list-style-type: none"> <li>Provide information on how to obtain more TCS/TCIs and avoid running out</li> </ul>	Physical Opportunity	Environmental context and resources	Environmental structuring	12.5 Adding objects to the environment
Belief that health professionals (including pharmacists) are reluctant or hesitant to prescribe TCSs/the right potency [QI]	<ul style="list-style-type: none"> <li>Provide advice on how to talk to health professionals</li> <li>Provide advice on how to choose an effective TC/TCIs S (e.g. list of available TCSs/TCIs)</li> </ul>	Psychological capability	Skills	Training	4.1 Instructions on how to perform the behaviour

Barriers/facilitator to target behaviour	Intervention components	Target construct (BCW)	Theoretical domain (TDF)	Intervention function (BCW)	Behaviour Change Technique (using BCTv1)
	<ul style="list-style-type: none"> <li>Provide explanation of how the health professional decides on the TCS/TCI prescription</li> </ul>				
Cost of TCSs/TCIs [QI]	<ul style="list-style-type: none"> <li>Provide advice about financial benefits YP can apply for or strategies for reducing the cost of TCSs/TCIs</li> </ul>	Psychological capability; Reflective motivation	Beliefs about consequences; Knowledge	Education; Persuasion	5.3 Information about social and environmental consequences
<b>Target behaviour: Management of irritants and triggers</b>					
Lack of knowledge regarding common irritants and triggers [EO]	<ul style="list-style-type: none"> <li>Provide information on common irritants and triggers</li> <li>Provide information on misconceptions (e.g. food allergies)</li> </ul>	Psychological capability; Reflective Motivation	Beliefs about consequences; Knowledge; Skills	Education; Persuasion; Training	4.1 Instructions on how to perform the behaviour 5.1 Information about health consequences
Belief that you can't avoid some triggers (e.g. stress)/Belief that the benefits of avoidance (e.g. avoiding a brief flare-up) do not outweigh the costs (e.g. not being able to go swimming) [QI]	<ul style="list-style-type: none"> <li>Where appropriate, provide advice on how to minimise the effects of irritants/triggers (e.g. apply emollients before and/or afterwards)</li> <li>Where appropriate, provide advice on how to avoid or reduce contact with certain irritants/triggers (e.g. soaps, high temperatures, sweat), including when away from home</li> </ul>	Psychological capability; Reflective Motivation	Beliefs about consequences; Knowledge; Skills	Education; Persuasion; Training	4.1 Instructions on how to perform the behaviour 5.1 Information about health consequences

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Barriers/facilitator to target behaviour	Intervention components	Target construct (BCW)	Theoretical domain (TDF)	Intervention function (BCW)	Behaviour Change Technique (using BCTv1)
<b>Target behaviour: Reduce scratching</b>					
Belief that scratching is not that bad [EO]	<ul style="list-style-type: none"> <li>Explain itch-scratch cycle and that scratching makes itch/eczema worse</li> </ul>	Psychological capability; Reflective Motivation	Beliefs about consequences; Knowledge	Education; Persuasion	5.1 Information about health consequences 5.6 Information about emotional consequences
Feeling of itchiness and desire for instant relief [QI]  <i>Wearing appropriate clothes [QI]; Keeping cool [QI]; Emollient use [QI]; Antihistamine [QI]; Tapping [QI]; Keeping nails short/wear gloves [QI]</i>	<ul style="list-style-type: none"> <li>Provide information on the factors that make scratching more likely (e.g. hot temperature, lack of sleep)</li> <li>Provide advice on reducing itchiness (e.g. keeping cool, emollient use, tapping the area, clench fist, wearing clothes with long arms and legs, put emollient in fridge to keep cool).</li> <li>Provide advice on sleep management.</li> <li>Provide techniques to prevent the negative consequences of scratching (e.g. keep nails short, wear gloves) and how to deal with the annoyance of others telling them to stop scratching (e.g. ask people to suggest things they can do, like tap skin, instead).</li> </ul>	Physical Capability; Psychological Capability	Environmental context and resources; Skills; Behavioural Regulation	Training; Education; Enablement; Environmental restructuring	4.1 Information on how to perform a behaviour 4.2 Information about antecedents 12.3 Avoidance/reducing exposure to cues for behaviour 12.5 Adding objects to the environment 12.6 Body changes
Scratching is a habit [QI]  <i>Distraction techniques [QI]</i>	<ul style="list-style-type: none"> <li>Provide techniques to raise awareness of scratching (e.g. record instances of scratching)</li> <li>Provide techniques to stop scratching (e.g. distraction, relaxation techniques, replace scratching with an alternative behaviour such as clenching fists).</li> </ul>	Psychological Capability; Automatic Motivation; Physical Opportunity	Environmental context and resources; Skills; Behavioural Regulation	Training; Enablement; Environmental restructuring	2.3 Self-monitoring of behaviour 4.1 Information on how to perform a behaviour 8.2 Behaviour substitution 8.4 Habit reversal 12.4 Distraction 12.5 Adding objects to the environment
<b>Target behaviour: Engaging in emotional management techniques</b>					

Barriers/facilitator to target behaviour	Intervention components	Target construct (BCW)	Theoretical domain (TDF)	Intervention function (BCW)	Behaviour Change Technique (using BCTv1)
Belief that emotional management techniques will <u>do little</u> to control their eczema or help with difficult emotions [EO]/ Belief that stress (e.g. during exam time) can't be avoided [QI]	<ul style="list-style-type: none"> <li>Explain the necessity of emotional management techniques for promoting engagement with the other behaviours and provide evidence that they are effective for dealing with difficult emotions</li> <li>Provide user quotes demonstrating how emotional management techniques helped other users to take control of their eczema</li> </ul>	Psychological capability; Reflective Motivation	Beliefs about consequences; Knowledge	Education; Persuasion	5.1 Information about health consequences 5.6 Information about emotional consequences
<i>Belief that emotions affect eczema [QI]</i>	<ul style="list-style-type: none"> <li>Provide user quotes demonstrating how emotional management techniques helped other users to take control of their eczema</li> </ul>	Psychological capability; Reflective motivation; Social opportunity	Beliefs about consequences; Knowledge; Social Influences	Education; Persuasion; Modelling	5.1 Information about health consequences 6.2 Social comparison 6.3 Information about others' approval 9.1 Credible source
Lack of understanding regarding how to do the emotional management techniques [EO]	<ul style="list-style-type: none"> <li>Provide guidance on how to do the emotional management techniques</li> <li>Provide guided audio recordings of emotional management exercises</li> </ul>	Psychological capability	Skills	Training	4.1 Instructions on how to perform the behaviour
Lack of confidence in ability to practice emotional management techniques [EO]	<ul style="list-style-type: none"> <li>Provide YP quotes demonstrating how easy it was for other users to practice the emotional management techniques</li> </ul>	Psychological capability; Reflective motivation; Social opportunity	Beliefs about consequences; Beliefs about capabilities; Knowledge; Social Influences	Education; Persuasion; Modelling	6.2 Social comparison 6.3 Information about others' approval 9.1 Credible source

Supplementary Material 2: Screenshot of page in introductory module providing key behavioural messages on topical treatments



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Introduction

← Back Getting control and keeping control of eczema Next →

What are flare control creams and moisturising creams? Page 6/9

<p><b>Get control</b> <b>Flare control creams (usually steroid creams)</b></p> <p>These creams are used to <b>get control</b> of eczema. They are:</p> <ul style="list-style-type: none"> <li>• Used to treat sore and itchy skin</li> <li>• Normally prescribed and are usually steroid creams (topical corticosteroids). Sometimes they are TCIs (Topical Calcineurin Inhibitors)</li> </ul> <p>Most people with eczema will need to use flare control creams at some point. <b>This will be during flare-ups, usually for a few days or weeks until the eczema is under control.</b></p>	<p><b>Keep control</b> <b>Moisturising creams (emollients)</b></p> <p>These creams are used to <b>keep control</b> of eczema. They help to:</p> <ul style="list-style-type: none"> <li>• Stop eczema flare-ups by keeping out things that may irritate the skin</li> <li>• Make the skin soft by locking water in the skin</li> <li>• Stop itching</li> <li>• Reduce soreness</li> </ul> <p><b>Most people with eczema will need to use moisturising creams every day.</b></p>
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Supplementary Material 3: Screenshot of video explaining how eczema affects the skin barrier to provide a better understanding of eczema and a rationale for how topical treatments work



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**Introduction**

← Back **What is Eczema?** Next →

Page 4/9

**The skin barrier and eczema**

Our skin is a natural barrier that stops things from getting into our bodies and keeps water in the skin. **In someone with eczema, this skin barrier works less well.** It lets moisture out, making the skin dry.


It also lets in things that irritate the skin, such as soap and washing up liquid. This can cause the skin to react, making it itchy and sore.

**Watch this video to find out more about the skin barrier in people with eczema.**

Back [Click here for a text explanation of the video.](#) Next

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3 **Supplementary Material 4: Screenshot of simple eczema assessment and subsequent**  
4 **feedback on which of the core treatment modules (emollients or topical corticosteroids)**  
5 **would be most relevant depending on whether they were currently experiencing an**  
6 **eczema flare-up**  
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13 **Introduction**

14 ← Back **Getting control and keeping control of eczema**

15  
16 **Answer these questions for suggestions on where to go next...**  
17 This may help you choose the right creams for the current condition of your skin. You can also go to  
18 'menu' if you would now like to browse the whole website.

19  
20 **At the moment:**

21 1. Is your eczema itchy? Yes  No


22 2. Do you have patches of dry skin? Yes  No

23 3. Is your eczema sore? Yes  No

24 4. Is your eczema redder or darker than usual? Yes  No

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37 **Introduction**

38 ← Back **Getting control and keeping control of eczema**

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41 **What should I do now?**  
42 You have told us that your eczema is redder or darker than usual, and sore. For most people, this  
43 means they are having an eczema flare-up.

44 **You might want to have a look at the section on 'flare control creams'.** It would be good to look  
45 at this section first to find out what you can do to get control of your eczema. **You could then**  
46 **have a look at the section on 'moisturising creams'.** This section will help you keep control of your  
47 eczema in the long-term.

48 **You will find the most up-to-date information about how best to use flare control creams and**  
49 **moisturising creams in these sections.** Many people who have been dealing with eczema for  
50 many years told us that they still found out new things in these sections!

51 Or click on 'menu' to go straight to the menu of different topics.

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**Supplementary Material 5: Screenshot of page explaining the menu of different information topics and quotes from other young people with eczema**

**Eczema Care Online**  
Self-help toolkit

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**Introduction**

← Back **What is Eczema Care Online?** Next →

**What happens next?** Page 2/9  
The next few pages will give you key information about eczema and the best way to treat it.

**Menu of Topics**

**Eczema Care Online**  
Self-help toolkit

To log out, please close ALL browser windows

Home | How control eczema | Moisturizing creams | **What can make eczema worse?** | Living well with eczema | More about treatments

← Back Menu of topics

Once you have seen the introduction, our menu of topics will appear at the top of your screen and you will be able to browse the whole website.

**ECO quotes**

Throughout ECO there will be quotes based on the tips and experiences that young people have shared with us. These have been checked by people with eczema to make sure they will be useful for you.

*"I've been dealing with eczema for years and thought I knew it all, and was really surprised by the helpful new tips I found"*  
Jordan

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## Supplementary Material 6: Description of Eczema Care Online (ECO) for Young

### People in accordance with the Template for Intervention Description and Replication

#### (TIDieR) checklist

- 1. BRIEF NAME: Eczema Care Online (ECO) for Young People
- 2. WHY: Online interventions could potentially be used to support young people with eczema; however, research developing such interventions has been limited and systematic reviews show the need for systematically developed evidence-based interventions to support self-management of eczema.
- 3 & 4. WHAT (materials and procedures): ECO for Young People is an online behavioural intervention for young people with eczema aged 13-25 years with mild to severe eczema. It aims to reduce eczema severity, targeting 5 key behaviours: (1) Increase their use of emollients to maintain skin hydration and prevent flare-ups; (2) Improve their use of TCS or TCIs through reactive applications of these treatments in response to flare-ups or, where appropriate, regular intermittent (“weekend”) preventative applications of TCS/TCI if emollients are insufficient as maintenance therapy; (3) Improve their management of irritants and triggers; (4) Improve their emotional management; and (5) Reduce scratching. See the table below for an overview of the modules included in ECO for Young People. For more detail about specific intervention techniques, see the behavioural analysis in Supplementary Material 1.

**Table 1: Overview of the key intervention components of ECO for Young People**

Menu	Modules	Description
Home Page	N/A	<ul style="list-style-type: none"> <li>• Signposting to key modules that young people haven’t accessed yet</li> <li>• Quick links to interactive content e.g. videos</li> </ul>
Flare control creams	<ul style="list-style-type: none"> <li>• Flare control cream video</li> <li>• What are they?</li> <li>• Are they safe?</li> <li>• Common questions</li> <li>• When and how do I use them?</li> <li>• How can I find the right cream?</li> <li>• Golden rules</li> </ul>	<ul style="list-style-type: none"> <li>• Evidence-based education and messages to increase motivation and competence to use topical corticosteroids (TCS), including; evidence of safety and support for skills development e.g. videos/photos showing use of TCS</li> </ul>
Moisturising creams	<ul style="list-style-type: none"> <li>• Moisturising creams video</li> <li>• What are they and how to they help?</li> <li>• Are they safe?</li> </ul>	<ul style="list-style-type: none"> <li>• Evidence-based education and messages to increase motivation and competence to use emollients, including; evidence of safety and</li> </ul>

	<ul style="list-style-type: none"> <li>• Common Concerns</li> <li>• When and how do I use them?</li> <li>• How do I find the right cream?</li> <li>• Take the two-week challenge</li> <li>• Golden rules</li> </ul>	support for skills development e.g. videos/photos showing how to use emollients
What can make eczema worse	<ul style="list-style-type: none"> <li>• Living with eczema video</li> <li>• Bathing, showering, and washing clothes</li> <li>• Cosmetics, make-up and shaving</li> <li>• Diet and allergies</li> <li>• Weather and holidays</li> <li>• Swimming and physical activity</li> </ul>	<ul style="list-style-type: none"> <li>• Evidence-based education and messages to increase motivation and competence in identifying key eczema triggers and managing them, including practical tips</li> </ul>
Living well with eczema	<ul style="list-style-type: none"> <li>• Beat the itch</li> <li>• Sleep</li> <li>• Stress and eczema</li> <li>• Studying and work</li> <li>• Eczema and money</li> </ul>	<ul style="list-style-type: none"> <li>• Evidence-based education and messages to increase motivation and competence to manage some of the symptoms and psychosocial impacts of eczema e.g. itching and scratching, disturbed sleep, stress, including techniques to manage them</li> </ul>
More about treatments	<ul style="list-style-type: none"> <li>• Talking to health professionals</li> <li>• Infections</li> <li>• Topical Calcineurin Inhibitors</li> <li>• Other treatments</li> <li>• Other resources</li> </ul>	<ul style="list-style-type: none"> <li>• Evidence-based education and messages to increase motivation and competence to manage other aspects of treatments e.g. consulting with health professionals and other treatments</li> </ul>

- 5. WHO PROVIDED: ECO for Young People is provided direct to patients via their GP surgeries.
- 6. HOW: ECO for Young People is entirely online, although users are encouraged to contact their GP, pharmacist or nurse, for example, to obtain or change their treatments, or to treat potential infections.
- 7. WHERE: ECO for Young People is intended for any young person (aged 13-25) with mild to severe eczema. It can be implemented in primary or secondary care. The intervention is online and designed to be accessed using computers, tablets and phones via a web-browser.
- 8. WHEN and HOW MUCH: For the randomised controlled trial study, young people are given access to the intervention if their GP identifies that they have eczema that has required treatment in the last 12 months. Once registered young people can use the online intervention as much or as little as they like.

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- 9. TAILORING: Young people have access to all the modules on ECO, however the website uses signposting based on four questions about the current state of their eczema. They will then be recommended either the module on emollients or flare control creams module depending on whether it appears they are currently experiencing an eczema flare-up. Key modules will also be recommended, one or two at a time, on the intervention home page if they haven't been viewed yet. These modules/menus are: 1) moisturising creams; 2) flare control creams, 3) bathing, showering and washing clothes; 4) beat the itch, 5) stress and eczema.
  - 10. MODIFICATIONS: An additional email was circulated in response to COVID-19 that provided further advice about handwashing.
  - 11. HOW WELL: The intervention is currently being tested in a randomised control trial with young people with eczema (ISRCTN79282252). Information about the results of the randomised controlled trial, including both quantitative and qualitative data, will be presented in future publications.

**COREQ checklist**

No	Item	Guide questions/description	Comments	Location in manuscript
<b>Domain 1: Research team and reflexivity</b>				
<i>Personal Characteristics</i>				
1.	Interviewer/facilitator	Which author/s conducted the interview or focus group?	DG, HJ, EW	Methods Section 2.2
2.	Credentials	What were the researcher's credentials? <i>E.g. PhD, MD</i>	Postdoctoral experienced qualitative researcher (DG) and two medical students (HJ, EW) supervised by DG and another postdoctoral researcher (ET)	Methods Section 2.2
3.	Occupation	What was their occupation at the time of the study?	See above	Methods Section 2.2
4.	Gender	Was the researcher male or female?	All female	Methods Section 2.2
5.	Experience and training	What experience or training did the researcher have?	See No 2	Methods Section 2.2
<i>Relationship with participants</i>				
6.	Relationship established	Was a relationship established prior to study commencement?	Some of the participants were known to the two medical student interviewers (HJ, EW).	-
7.	Participant knowledge of the interviewer	What did the participants know about the researcher? <i>e.g. personal goals, reasons for doing the research</i>	Participants were told that the interviews were to help improve the ECO intervention.	-
8.	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? <i>e.g. Bias, assumptions, reasons and interests in the research topic</i>	One of the interviewers was involved in intervention development (DG), which could be a potential source of bias.	-
<b>Domain 2: study design</b>				
<i>Theoretical framework</i>				
9.	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? <i>e.g. grounded theory, discourse analysis, ethnography,</i>	Person-based approach to intervention development	Intervention development methodology section

No	Item	Guide questions/description	Comments	Location in manuscript
		<i>phenomenology, content analysis</i>		
<i>Participant selection</i>				
10.	Sampling	How were participants selected? e.g. <i>purposive, convenience, consecutive, snowball</i>	Purposive, opportunistic, and snowballing sampling	Methods Section 2.2
11.	Method of approach	How were participants approached? e.g. <i>face-to-face, telephone, mail, email</i>	Invitation letter from their GP practice or advertising, opportunistic and snowball sampling of students at the University of Southampton.	Methods Section 2.2
12.	Sample size	How many participants were in the study?	28	Methods Section 2.2
13.	Non-participation	How many people refused to participate or dropped out? Reasons?	Data not collected	-
<i>Setting</i>				
14.	Setting of data collection	Where was the data collected? e.g. <i>home, clinic, workplace</i>	At participants' homes or at a location of the participants' choice (e.g. at the university).	Methods Section 2.2
15.	Presence of non-participants	Was anyone else present besides the participants and researchers?	A family member was present for 9 of the interviews.	Methods Section 2.2
16.	Description of sample	What are the important characteristics of the sample? e.g. <i>demographic data, date</i>	Demographic information can be found in Table 2. Interviews were carried out during October 2018 to April 2019.	Methods Section 2.2
<i>Data collection</i>				
17.	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Interview question guide not applicable for think aloud research	-
18.	Repeat interviews	Were repeat interviews carried out? If yes, how many?	Yes, 2 people took part in two interviews	Methods Section 2.2
19.	Audio/visual recording	Did the research use audio or visual recording to collect the data?	Audio recording.	Methods Section 2.2
20.	Field notes	Were field notes made during and/or after the	Field notes were made after all interviews.	Methods Section 2.2

No	Item	Guide questions/description	Comments	Location in manuscript
		interview or focus group?		
21.	Duration	What was the duration of the interviews or focus group?	45-90 minutes	Methods Section 2.2
22.	Data saturation	Was data saturation discussed?	We considered data saturation to be reached once no further important changes were required	Methods Section 2.2
23.	Transcripts returned	Were transcripts returned to participants for comment and/or correction?	No	-
<b>Domain 3: analysis and findings</b>				
<i>Data analysis</i>				
24.	Number of data coders	How many data coders coded the data?	Two (KG & DG), with input from 5 other researchers	Methods Section 2.2
25.	Description of the coding tree	Did authors provide a description of the coding tree?	No	-
26.	Derivation of themes	Were themes identified in advance or derived from the data?	Not applicable.	-
27.	Software	What software, if applicable, was used to manage the data?	Microsoft excel was used for Table of changes	-
28.	Participant checking	Did participants provide feedback on the findings?	No	-
<i>Reporting</i>				
29.	Participant checking	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. <i>participant number</i>	Participant quotations are presented and each quotation is identified by a pseudonym and their gender and age is noted.	Results Section 2.2
30.	Data and findings consistent	Was there consistency between the data presented and the findings?	Yes	Results Section 2.2
31.	Clarity of major themes	Were major themes clearly presented in the findings?	Not applicable.	-
32.	Clarity of minor themes	Is there a description of diverse cases or	Not applicable.	-

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No	Item	Guide questions/description	Comments	Location in manuscript
		discussion of minor themes?		

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# BMJ Open

## Eczema Care Online: development and qualitative optimisation of an online behavioural intervention to support self-management in young people with eczema

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Secondary Subject Heading:	Qualitative research, Paediatrics, General practice / Family practice
Keywords:	Eczema < DERMATOLOGY, QUALITATIVE RESEARCH, Paediatric dermatology < DERMATOLOGY, PRIMARY CARE



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3 **Title: Eczema Care Online: development and qualitative optimisation of an online**  
4 **behavioural intervention to support self-management in young people with eczema**  
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## Abstract

**Objectives:** To describe the development of Eczema Care Online (ECO), an online behaviour change intervention for young people with eczema (Phase 1); and explore and optimise the acceptability of ECO among this target group using think-aloud interviews (Phase 2).

**Methods:** Theory-, evidence-, and person-based approaches to intervention development were used. In Phase 1, a qualitative systematic review and qualitative interviews developed an in-depth understanding of the needs and challenges of young people with eczema. Guiding principles highlighted key intervention design objectives and features to address needs of this target group to maximise user engagement. Behavioural analysis and logic modelling developed ECO's hypothesised programme theory. In Phase 2, qualitative think-aloud interviews were carried out with 28 young people with eczema and the intervention was optimised based on their feedback.

**Results:** The final intervention aimed to reduce eczema severity by supporting treatment use (emollients, topical corticosteroids/topical calcineurin inhibitors), management of irritants/triggers, emotional management; and reducing scratching. Generally, young people expressed positive views of intervention content and design in think-aloud interviews. Quotes and stories from other young people with eczema and ECO's focus on living with eczema (not just topical treatments) were valuable for normalising eczema. Young people believed ECO addressed knowledge gaps they had from childhood and the safety information about topical corticosteroids was reassuring. Negative feedback was used to modify ECO.

**Conclusions:** A prototype of the ECO intervention was developed using rigorous and complementary intervention development approaches. Subsequent think-aloud interviews helped optimise the intervention and demonstrated ECO is likely to be acceptable to this

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3 target group and provided support for our guiding principles including key design objectives  
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5 and features to consider when developing interventions for this population. A randomised  
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7 controlled trial and process evaluation of the intervention is underway to assess effectiveness  
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10 and explore user engagement with the intervention's behavioural goals.  
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## 13 **Article Summary**

### 14 **Strengths and limitations of this study**

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19 • Our rigorous development using complementary theory-, evidence-, and person-based  
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21 approaches to intervention development helped ensure the intervention was  
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23 acceptable and engaging to our sample of young people with eczema.  
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- 26 • Our multidisciplinary intervention development group, including Patient and Public  
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28 Involvement, ensured that the content was evidence-based, that advice was feasible,  
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30 and that the perspectives of people living with eczema were considered throughout the  
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32 whole development process.  
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- 35 • Although we were able to recruit a good range of ages, genders and eczema severities  
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37 for the think-aloud interview study, a large proportion of the sample were university  
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39 students, so were likely to have high levels of health and computer literacy.  
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- 42 • As think-aloud interviews explore participants' immediate reactions to the  
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44 intervention, they cannot tell us how people would use the intervention over time or  
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46 explore engagement with the wider behavioural goals.  
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## Introduction

Atopic eczema (syn. atopic dermatitis) is the most common type of dermatitis/eczematous inflammation and will be referred to from here on as just “eczema” in accordance with the nomenclature of the World Allergy Organisation.[1] Eczema is a common skin condition that usually begins in childhood,[2] but for many the symptoms (dry, sore, itchy skin) can persist into adolescence and adulthood.[3]. Eczema management focuses on identification and avoidance of irritants/triggers that may exacerbate eczema symptoms; regular use of emollients to restore skin barrier function; and topical corticosteroids or topical calcineurin inhibitors (TCIs) to treat flare-ups.[4]

Eczema management can be particularly challenging in adolescence and early adulthood. Young people report a lack of knowledge regarding their eczema and treatments, and advice provided can often conflict with their own eczema experiences and a competing desire to maintain a ‘normal’ adolescent life.[5–9] These factors may explain why adherence to topical treatments presents challenges for this age group and many report not using their treatments as prescribed.[7]

Systematic reviews of self-management interventions for people with eczema[10,11] identified that, although a few studies evaluated interventions have been developed for parents/carers of children with eczema, only two studies evaluated interventions for children and adolescents.[12,13] Both interventions were delivered face-to-face and only one reported tailoring their intervention to this age group.[12] To address this research gap and the need to improve self-management support for people living with eczema, the Eczema Care Online (ECO) programme aimed to develop two online behavioural interventions: one for young people with eczema (13-25 years) and one for parents and carers of children (0-12 years) with eczema ([www.nottingham.ac.uk/eco](http://www.nottingham.ac.uk/eco)).[14,15]

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3 First, we aimed to describe the development of the ECO intervention for young people with  
4 eczema (Phase 1). Second, we aimed to explore and optimise the acceptability of the ECO  
5 intervention among young people with eczema (Phase 2). This article highlights key  
6 psychosocial needs of young people with eczema and intervention features to consider when  
7 developing behavioural interventions for this group.  
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## 16 **Intervention development methodology**

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18 We used theory-, evidence-, and person-based approaches to develop the online  
19 intervention.[16–18] Guidelines for developing complex interventions emphasise that  
20 interventions should be informed by reviews of the current evidence-base, appropriate theory,  
21 and an in-depth understanding of the context in which the intervention will be  
22 implemented.[19] The Person-Based Approach to intervention development uses iterative  
23 qualitative research to understand and accommodate the perspectives of the intervention's  
24 target group.[20]  
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35 Intervention development was carried out in two phases. In Phase 1, we collated and  
36 synthesised evidence relating to patient behaviours that are likely to reduce eczema severity  
37 and the perspectives of young people with eczema (person- and evidence-based approach).  
38 This evidence guided decisions regarding the intervention's target behaviours and provided  
39 us with an in-depth understanding of the key issues, needs, and behavioural challenges of this  
40 target group. Theory-based approaches (behavioural analysis and logic modelling) were used  
41 to develop and illustrate the intervention's hypothesised programme theory, that is, the  
42 hypothesised mechanisms of action by which the intervention components exerts their  
43 effects.[19,21] In Phase 2, we carried out iterative qualitative think-aloud interviews to gather  
44 user feedback on the intervention prototype and optimise it based on this feedback.[22] The  
45 methods and results for each phase are reported below.  
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3 Both phases were guided by a multidisciplinary intervention development group, which  
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5 comprised 18 members including Patient and Public Involvement (PPI), dermatologists, a  
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7 nurse consultant, researchers with an interest in eczema, GPs, health psychologists, and  
8  
9 experts in intervention development, writing patient-friendly health information, and long-  
10  
11 term conditions in adolescents. Through regular meetings and reviewing documents, this  
12  
13 group guided the design of the research, helped with the interpretation of the research  
14  
15 findings, and provided detailed feedback on the intervention plans, written content, website  
16  
17 design, and prototypes for both online interventions (young people and parents and carers of  
18  
19 children with eczema). The intervention development process is illustrated in Figure 1.  
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24 Ethical approval for this research was granted by Wales REC 7 Ethics Committee (REC  
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26 17/WA/0329).  
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### 29 **Patient and Public Involvement**

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32 Two mothers of children and young people with eczema (one of whom had eczema herself  
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34 and helps run an eczema support group [AR]) were part of our multidisciplinary intervention  
35  
36 development group. Both were co-applicants on the research grant application, helping to  
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38 identify the research topic and develop research questions. We also sought additional PPI  
39  
40 feedback on the intervention content and design from two young people with eczema and a  
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42 panel of PPI contributors with an interest in skin research, most of whom had experience of  
43  
44 eczema, and some were aged 18-25. We discuss the specific contributions of the PPI to  
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46 intervention development throughout this manuscript. Two young people reviewed the study  
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48 participant information sheet to check comprehension. One PPI member (AR) discussed and  
49  
50 provided feedback on our interpretations of the findings and this manuscript. She continues to  
51  
52 help us to disseminate our research findings among her wide-reaching patient networks and  
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54 via social media.  
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## Phase 1: Intervention planning

### Phase 1 Methods

Phase 1 comprised of three steps: (1) Defining the intervention target behaviours; (2) Collating and synthesising evidence relating to the perspectives of young people with eczema; and (3) Creating an intervention plan.

#### *1.1 Defining the intervention target behaviours*

The multidisciplinary intervention development group agreed the intervention's key target behaviours through consideration of the evidence-base for effective eczema treatments, clinical guidance on eczema management and recommendations around what would be feasible and acceptable to implement through an online intervention.[4,23,24]

#### *1.2 Collating and synthesising evidence relating to the perspectives of young people with eczema*

First, we undertook a systematic review and thematic synthesis of the views and experiences of eczema and/or eczema self-care of people with eczema and parents or carers of children with eczema.[8] Qualitative studies focusing on the views and experiences of eczema and eczema treatments, and barriers and facilitators to eczema self-management were included. The review identified 39 papers (reporting 32 studies; 9 including young people in the sample).

Second, we carried out a secondary analysis of interview data from 25 young people (17-25 years) with eczema.[5,6,25] The data came from the SKINS project, which explored young people's experiences of living with common skin conditions (eczema, acne, psoriasis, alopecia). To gather additional views from younger adolescents, the ECO study added to this data set by carrying out interviews with five young people with eczema aged 13-16 years.

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3 Both interview studies explored young people's views about eczema treatment and  
4 management, and information and support needs. Interviews were analysed using inductive  
5 thematic analysis.  
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10 The methods and findings of these studies have been described in detail elsewhere.[5,6,8,25]

11 Only key findings relevant to intervention development are summarised in this paper, with  
12 the focus of this paper being on intervention development and the novel findings from Phase  
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### 20 *1.3 Developing an intervention plan*

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22 Consistent with the person-based approach, our in-depth understanding of young people with  
23 eczema informed the development of *guiding principles*, which outlined key intervention  
24 objectives and design features that will address these.[20] A list of potential barriers and  
25 facilitators to the target behaviours were also identified from this evidence-base and from  
26 consultation with the multidisciplinary intervention development group and additional PPI  
27 representatives. A *behavioural analysis* outlined the intervention components that were added  
28 to address each of the identified barriers and facilitators for each target behaviour. Consistent  
29 with the approach taken by Band et al. and Greenwell et al.,[17,18] these components were  
30 mapped onto behaviour change theoretical frameworks to describe the planned intervention  
31 content and identify hypothesised mechanisms of action. The Behaviour Change Techniques  
32 Taxonomy classifies intervention content by their behaviour change techniques, the smallest  
33 component for changing behaviour.[26] The Behaviour Change Wheel was used to classify  
34 the source (component of the COM-B model hypothesised to influence behaviour; Capability,  
35 Opportunity, Motivation) and function (e.g. 'Education', 'Persuasion') of each individual or  
36 group of behaviour change techniques.[27] We also mapped the behaviour change techniques  
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3 onto their theoretical constructs (e.g. ‘Knowledge’, ‘Skills’) using the Theoretical Domains  
4 Framework,[28] which is recommended for use alongside the Behaviour Change Wheel.  
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8 To illustrate key elements of the intervention’s programme theory, a *logic model* was  
9 developed to illustrate how the intervention components, theoretical constructs (intervention  
10 processes), and key behaviours (purported mediators) influence the intervention outcomes  
11 (eczema severity).  
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## 17 **Phase 1 Results**

### 18 *1.1 Defining the intervention target behaviours*

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21 The multidisciplinary intervention development group agreed that ECO would aim to reduce  
22 eczema severity by supporting young people with eczema to: (1) Increase their use of  
23 emollients to maintain skin hydration and prevent flare-ups; (2) Improve their use of topical  
24 corticosteroids or topical calcineurin inhibitors through reactive applications of these  
25 treatments in response to flare-ups or, where appropriate, regular intermittent (“weekend”)  
26 preventative applications of topical corticosteroids or topical calcineurin inhibitors if  
27 emollients are insufficient as maintenance therapy; (3) Improve their management of irritants  
28 and triggers; (4) Improve their emotional management; and (5) Reduce scratching. Use of  
29 emollients and topical corticosteroids/topical calcineurin inhibitors were identified as core  
30 behaviours that would likely have the greatest effect on eczema severity. Therefore,  
31 intervention content relating to these behaviours was deemed the most important.  
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### 50 *1.2 Collating and synthesising evidence relating to the perspectives of young people with* 51 *eczema*

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55 The qualitative evidence helped us to develop the following understanding of our target  
56 group. Young people are developing a sense of independent identity and, specifically, young  
57 people with eczema are keen to take on more responsibility with their eczema  
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3 management.[25] However, these young people may find their new roles and responsibilities,  
4  
5 such as interacting with health professionals and negotiating health care systems,  
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7 daunting.[25] Young people do not have a comprehensive understanding of eczema,  
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9 specifically some have little knowledge of the causes/triggers of eczema and the rationale  
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11 behind their treatment (e.g. difference between emollients and topical corticosteroids/topical  
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13 calcineurin inhibitors and how to use them).[5,8] Health professionals do not always revisit  
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15 such information, assuming that young people were told this information in childhood.[5,8]  
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17 In general, young people perceive topical treatments to be effective, but they also have doubts  
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19 about their long-term effectiveness, and concerns around their safety and becoming over-  
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21 reliant on topical corticosteroids.[8,25] This group report several perceived barriers to  
22  
23 applying topical treatments, including using treatments when outside of the home (e.g. when  
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25 in class or working in a public-facing job) and cost of treatments.[8,25] These treatment  
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27 barriers are not unique to this age group,[8] but are nonetheless important to address for any  
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29 eczema behavioural intervention.  
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36 Many young people were told in childhood that they would ‘grow out of’ eczema, but this  
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38 information is often at odds with their own experiences.[5] Young people have a desire to ‘fit  
39  
40 in’ with their peers and feel like a ‘normal’ young person.[6] They welcome the opportunity  
41  
42 to share experiences with other young people with eczema to normalise their experience.[6]  
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46 The multidisciplinary intervention development group discussed what specific website design  
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48 needs young people may have. Usability research has shown that this group are likely to  
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50 dislike reading large amounts of text, like concepts to be illustrated visually, and relate to  
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52 content created by peers (e.g. stories, images, examples from other young people).[29,30]  
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54 This evidence was supported by discussions with our young people PPI who also suggested  
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56 that young people may prefer videos over reading lots of text and recommended having brief  
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58 ‘top tips’ with suggestions from other young people for how they manage eczema. They also  
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3 felt that it was important that the intervention could be accessed via a mobile device or  
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5 computer.  
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### 8 *1.3 Developing an intervention plan*

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11 We developed a set of guiding principles to address the issues identified in the evidence  
12  
13 synthesis stage (1.2) (Table 1). The behavioural analysis table is presented in Supplementary  
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15 Material 1 and the logic model in Figure 2.  
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## 18 **Phase 2: Intervention optimisation**

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### 20 **Phase 2 Methods**

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#### 22 *2.1 Creating the intervention prototype and videos*

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27 Creating the intervention prototype was done in several stages. First, guided by our target  
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29 behaviours, guiding principles and qualitative research, the multidisciplinary intervention  
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31 development group agreed the topics of the intervention modules and videos. Second, we  
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33 wrote page content and video scripts, and circulated this to the multidisciplinary intervention  
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35 development group for comment to ensure it was evidence-based and medically accurate, and  
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37 the advice was clear and feasible. Positive and negative feedback was entered into the  
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39 Person-Based Approach Table of Changes,[16] and potential changes were discussed, agreed,  
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41 and prioritised.  
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47 We tested either the video scripts, audio recordings of the scripts, or a storyboard or  
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49 prototype of the video with young people using think-aloud interviews, and these were also  
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51 reviewed by a PPI panel. Once the written content and videos were finalised, we created a  
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53 working prototype of the intervention using the LifeGuide software,[31] which was reviewed  
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55 by our two young people PPI and further optimised through think-aloud interviews with  
56  
57 young people with eczema. The final videos were created by an external video creator.  
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Table 1 Guiding principles for ECO for young people

User context	Intervention design objectives	Key intervention features
<ul style="list-style-type: none"> <li>Young people (YP) with eczema have an increasing desire for autonomy regarding their eczema management, but may feel apprehensive about their new roles and responsibilities.</li> <li>YP may have gaps in their understanding of eczema.</li> <li>YP may perceive barriers to using topical treatments.</li> </ul>	<p>To support YP to gain autonomy and competence in their eczema management.</p>	<ul style="list-style-type: none"> <li>Ensure YP have a complete understanding of eczema and the rationale behind their treatment.</li> <li>To build YP's self-efficacy for the target behaviours (e.g. information on how to apply treatments, avoid irritants/triggers, reduce scratching).</li> <li>Stories and tips from other YP on what helped them take control of their own eczema and how to overcome barriers to treatments.</li> <li>Use autonomy-promoting language, provide choice wherever possible, and avoid condescending or 'child-like' language/graphics.</li> <li>Provide advice on how to communicate with health professionals and make the most out of appointments.</li> </ul>
<ul style="list-style-type: none"> <li>YP have a desire to live as 'normal' a life as possible.</li> <li>YPs receive unhelpful messages that eczema is solely a childhood illness</li> </ul>	<p>To enable YP to maintain a sense of normalcy when managing their eczema</p>	<ul style="list-style-type: none"> <li>Provide age-appropriate advice on living with eczema (e.g. shaving, wearing make-up, and managing eczema at work/university/school).</li> <li>Provide relatable stories and advice from other YP with eczema.</li> <li>Acknowledge that, for some, eczema persists into adolescence and adulthood.</li> <li>Provide images and descriptions of eczema for different skin-types.</li> <li>Avoid providing overly restrictive advice on irritants/triggers, instead offering advice on how to minimise the negative consequences of exposure irritants and triggers or provide alternatives (e.g. using emollients in place of soap).</li> </ul>

<ul style="list-style-type: none"> <li>• YPs may have doubts and safety concerns about topical treatments.</li> <li>• YP may find topical treatments unpleasant in texture and/or smell and they worried about applying treatments in public in case others ‘found out’ that they had eczema.</li> </ul>	<p>To build YP’s beliefs in the positive effects of their topical treatments</p>	<ul style="list-style-type: none"> <li>• Provide information to address topical treatment concerns and barriers, and persuade YPs of the long-term effectiveness of these treatments.</li> </ul>
<ul style="list-style-type: none"> <li>• YPs prefer content that is easy to scan, visual, and peer-created.</li> <li>• YPs want interventions that are accessible on their mobile devices and computers.</li> </ul>	<p>To provide engaging and accessible intervention content</p>	<ul style="list-style-type: none"> <li>• Provide interactive content (e.g. quizzes), videos and pictures, and reduce reading burden by keeping the amount of text per page to a minimum.</li> <li>• Break the content down into lots of short sections/modules.</li> <li>• Intervention to be mobile-friendly.</li> <li>• Provide peer-created content (e.g. stories, videos)</li> </ul>



## 2.2 Think-aloud interviews

We carried out 30 think-aloud interviews with 28 young people with eczema (2 people took part in two interviews, viewing a later intervention version) who were purposively sampled based on age, gender, and eczema severity (Table 2). Twenty-three of these participants were newly recruited for this study and five participants were from the qualitative study in Phase 1. Participants were recruited via an invitation letter from their GP practice (n=20) or advertising, opportunistic and snowball sampling of students at the University of Southampton (n=8). During the think-aloud interviews, participants were asked to use sections of the intervention while sharing their thoughts and reactions to the content and design aloud. Interviews were facilitated by a researcher who observed the participant using the intervention and asked prompts when needed to elicit participant reactions. At the end of the think-aloud interview, participants were asked some open-ended questions to elicit their general views of the intervention content and design and how it compares to other websites they have used.

To maximise participant time during the interviews, participants testing optional modules were sent the core intervention content to look through before the interview and they were asked about it during the interview. Interviews were carried out at participants' preferred location (e.g. at home, the university) and relatives were present for nine interviews.

Interviews lasted 45-90 minutes, took place between October 2018 to April 2019, and were carried out by DG and two medical students (HJ, EW) and one postdoctoral student were trained and supervised by DG and ET (postdoctoral experienced qualitative researchers) (all females). Interviews were audio-recorded and transcribed verbatim.

Optimisation was iterative, moving between data collection, analysis, and intervention modification. We considered data saturation to be reached once no further important changes

were required.[16] For each interview, DG completed a feedback table, highlighting positive and negative comments about the intervention, based on the interviewer field notes and listening back to the audio recordings.

*Table 2 Think-aloud participant demographics*

<b>Variable</b>	<b>Statistic</b>
<b>Age</b>	
Mean (SD)	17.82 (3.41)
Range	13-23
<b>Gender</b>	
Female N (%)	13 (46.43)
Male N (%)	15 (53.57)
<b>Eczema severity (self-defined)*</b>	
Mild N (%)	10 (38.46)
Mild/Moderate N (%)	2 (7.69)
Moderate N (%)	7 (26.92)
Moderate/Severe N (%)	3 (11.54)
Severe N (%)	4 (15.38)

**Key:** \*n=26

MSa and IM read through the transcripts to ensure important issues were captured. The feedback table was reviewed by a sub-group of the intervention development group (KG, IM, MSa, KS, MSt, ET) at weekly meetings. KG transferred negative comments into the Table of Changes and potential changes were agreed and prioritised by this sub-group.[16]

## **Phase 2 Results**

### *2.1 Creating the intervention prototype and videos*

As the primary focus of the intervention was educational, a website that was also accessible via a mobile device was deemed the most appropriate delivery format. In the final intervention prototype, users first progressed through a brief (nine pages) introductory section

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2  
3 containing the key behavioural messages necessary for facilitating a basic understanding of  
4 eczema and its management (Supplementary Material 2). Some key behavioural messages  
5  
6 were also summarised in short (2 minute) videos (Supplementary Material 3). Users then had  
7  
8 the option of completing a simple eczema assessment that provided advice on which of the  
9  
10 core treatment modules (emollients or topical corticosteroids) would be most relevant to  
11  
12 them, depending on whether they were currently experiencing an eczema flare-up  
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14 (Supplementary Material 4). Users had access to a menu where they could choose the topic  
15  
16 modules that were most relevant to them (Supplementary Material 5). On each login, users  
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18 were given suggestions for which modules to look at next, based on what they had looked at  
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20 previously. Users could choose to have additional behaviour change content delivered by  
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22 email or SMS text messages.  
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29 A key design feature highlighted in the guiding principles was the use of quotes from other  
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31 young people with eczema sharing their experiences of eczema and eczema management  
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33 advice (Supplementary Material 4). We also introduced new terminology to help young  
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35 people better understand the function of each type of topical treatment and to mirror how this  
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37 group already referred to these treatments (e.g. 'creams' for all treatments, regardless of  
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39 whether they were actually a cream or an ointment). Emollients were termed 'moisturising  
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41 creams' and topical corticosteroids/topical calcineurin inhibitors were termed 'flare control  
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43 creams'.  
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48 Our multidisciplinary intervention development group and PPI representatives felt that it was  
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50 important that the intervention is accessible and relevant to all ethnic groups. Therefore, ECO  
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52 provided images and descriptions of eczema for different skin-types and our videos included  
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54 cartoon characters from different ethnic groups. The full intervention content is outlined in  
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56 Supplementary Material 6 using the TIDieR checklist.[32]  
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## 2.2 Think-aloud interviews

Generally, young people expressed positive views of the intervention's content and design. They found the information and advice clear, easy to follow, helpful, and relatable, and they liked the videos and brief eczema assessment. Specifically, they found the quotes and advice from other young people with eczema, and the facts about how common it is to still have symptoms at their age reassuring, personal, and it made them feel less alone.

*"I think it's quite comforting to actually know that it's normal for people with eczema. As in like this is, it's not just me, because even though you get told loads of people have eczema, it is just quite nice to be like, 'This is what you're going through, it's okay, this is what you're going to do about it,' and just have the information all there." (P10, 19-21 years old)*

*"I like this page [content on prevalence of eczema among young people]...it's good to know that, like, I don't know, I always feel quite weird, because I'm 21 and still have eczema, so, it's good to know that." (P17, 19-21 years old)*

Young people valued that ECO provided advice on living well with eczema, rather than focusing solely on medical treatments.

*"Sleep problem, emotion, diet and how much you eat - that's good because it's saying that it's not just eczema like using creams, it's also got other stuff, other aspects to it as well...I think you can't just control eczema with creams, you've got to control the whole lot. Yes, this is useful. (P13, 19-21 years old)*

*"In lighter skin eczema may look red, in darker skin eczema may look grey, purple or brown'. I feel like saying that is actually good, because a lot of the time I'm just like, why does my eczema look grey? But I didn't even know that, now I can see that's a*

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2  
3 *common thing in darker skin. I feel like having that is actually really good. (P22, 16-*  
4  
5 *18 years old)*

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7  
8 *“I think that [module on itching] was the most helpful because it said apart from*  
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10 *using the creams and things, other things you can do to help you. (P19, 13-15 years*  
11  
12 *old)*

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16 Most young people explained how they learned something new about eczema and its  
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18 management from the part of the website they used, with some explaining that ECO helped  
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20 addressed the knowledge gaps from childhood.  
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24 *“[ECO is] brilliant. It's given me a lot more information than I've ever had in the*  
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26 *past...I've learnt a lot of new things today about eczema that I didn't know over the*  
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28 *last 22 years of having eczema, it's amazing!...It's amazing, I love it.” (P9, 22-25*  
29  
30 *years old)*

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35 *“If I was prescribed stuff by my doctor I would be like, 'Well, it's probably good for*  
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37 *me.'...I'd be like why am I even using this and then not bother. I think if you knew that,*  
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39 *okay this one's going to stop you itching and reduce soreness then you might be more*  
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41 *likely to carry on using it and also, yes if you're someone that doesn't really ask*  
42  
43 *questions it's nice to have a place that will tell you the information anyway without you*  
44  
45 *having to ask someone. (P18, 16-18 years old)*

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47 Young people also talked about how they found the information about the safety of topical  
48  
49 corticosteroids reassuring:  
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51  
52 *“That's good to know, that it [topical corticosteroids] doesn't affect growth or*  
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54 *development...because I've been using it for so many years now. It's always been on*  
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56 *my mind, and not being able to find out any information about it, it's worried me...but*  
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3 *this helps a lot. It kind of puts your mind at ease, knowing that it doesn't do anything*  
4 *to your growth or development.” (P9, 22-25 years old)*  
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8 The positive feedback provided support for our guiding principles, which emphasised the  
9 importance of maintaining a sense of normalcy when managing eczema, addressing  
10 knowledge gaps to support young people to gain autonomy and competence in eczema  
11 management, and providing engaging and accessible intervention content (Table 1). The  
12 negative feedback was used to modify the intervention (Table 3 outlines some example  
13 negative comments and the changes implemented).  
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## 23 **Discussion**

24 This manuscript provides a description of the rigorous development process for a behavioural  
25 intervention for young people with eczema; a target group that has been largely ignored in  
26 eczema research.[8,10,11] It is essential to provide self-management support to this age  
27 group as they begin to take on a more active role in their eczema management; a role which  
28 was previously taken on by their families.[7] The person-based approach to intervention  
29 development allowed us to understand and accommodate the perspectives of young people  
30 with eczema, resulting in an online intervention that was engaging and acceptable to our  
31 sample of this target group.[20]  
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45 The behavioural analysis maintained a focus on the behaviours most likely to influence  
46 eczema severity (topical treatment use, managing irritants/triggers, scratching, emotional  
47 management) and suggested acceptable behaviour change techniques that can help young  
48 people with eczema overcome behavioural barriers relevant to them. Logic modelling offered  
49 a programme theory that can be tested and refined in future process analyses. Our final  
50 guiding principles outlined some of the key behavioural issues, intervention design  
51 objectives, and design features that those developing behavioural interventions for young  
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3 people with eczema, or other long-term conditions, may wish to consider to maximise user  
4 engagement. The think-aloud interviews provided support for the relevance of these guiding  
5 principles to this target group and the acceptability of the design features we implemented to  
6 engage this group. Specifically, the ECO intervention's use of quotes and tips from other  
7 young people with eczema and its focus on living with eczema (not just topical treatments)  
8 were valuable for normalising eczema.  
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17 *Table 3 Example issues identified from the think-aloud interviews and the changes*  
18 *implemented to address these*  
19

Summary of issue identified	Example quote	Change implemented
Some found the questions in the brief eczema assessment confusing.	<p data-bbox="608 831 970 1048"> <i>"Does your skin feel dry?" Well, everywhere or in general where you've got...eczema? ...I don't know if that's [the question] very clear." (P12, 22-25 year old)</i> </p> <p data-bbox="608 1126 979 1563"> <i>"Is your skin or redder or darker than usual?'...to me it sounds like 'is your eczema darker or less dark than your eczema normally is?', but I think it's a bit ambiguous whether it means that or their usual skin?...you could just say 'is your eczema red or darker than usual?'" (P18, 16-18 years old)</i> </p> <p data-bbox="608 1603 970 2038"> <i>'Is your skin redder or darker [than usual]?'...maybe it's the 'than usual' bit that needs to be more clearer, because I could interpret that as this being my usual skin, rather than the usual colour of the eczema...maybe, 'Is your eczema redder or darker than usual?' or something (P5, 19-21 years old)</i> </p>	The assessment questions were reworded to clarify that we are asking about their eczema at present (rather than in the past) and their eczema skin (rather than skin in general).



Summary of issue identified	Example quote	Change implemented
<p>The feedback for the brief eczema assessment did not always match their experience (e.g. feedback suggested they may have an eczema flare-up when they didn't).</p>	<p><i>"[Is your skin itchy or sore?] it's not really sore but it is itchy...I can have itchy dry skin but I only have sore skin when it's red and inflamed...[recommended the flare control creams module]... it said that I'm having a flare-up now, but I wouldn't class this as a flare-up. This is kind of just my - how my eczema kind of bobbles along, as in my flare-ups would be much more aggressive than what they were suggesting it is."</i> (P10, 19-21 years old)</p>	<p>We separately asked whether eczema is 'itchy' and 'sore' so that people do not receive feedback that they are having a flare-up if they just have itchy and not sore skin. Soften the feedback on current eczema severity to avoid disengaging those who don't agree that they are experiencing an eczema flare-up ('For most people, this means they are having an eczema flare-up').</p>
<p>Some thought the introductory section was too long.</p>	<p><i>"Personally, if I see there's 21 pages, I'm just going to try and get through them."</i> (P18, 16-18 years old)</p>	<p>Reduce the introductory section significantly with optional click-outs to additional information if needed.</p>
<p>Some young people commented that they already knew a lot of the information as they have had eczema for a long time.</p>	<p><i>"[ECO] was really good...because I've had it for so long I feel like a lot of the information there I've already had drilled into me my whole life, but I feel like for people that either have children with eczema or people with eczema, I don't know, I think it would be really helpful... personally, I would probably want the more information about the lifestyle stuff and diet"</i> (P10, 19-21 years old)</p>	<p>Added in a quote from another young person who had eczema for a long time saying how they were surprised that the website contained new helpful tips. Emphasise that the information is based on the most up-to-date research evidence (so they may find new information) and that there is information on 'living with eczema' (e.g. diet advice).</p>
	<p><i>"I think a lot of stuff I probably kind of already knew from having eczema but it's good to get a few things that help yes"</i> (P19, 13-15 years old)</p>	

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3 The value of behaviour change interventions that make individuals feel they are ‘not alone’ is  
4 supported by other qualitative research with people with long-term conditions and  
5  
6 parents/carers of children with eczema.[23,33] Although this intervention focused mainly on  
7  
8 treatment adherence as this was deemed to have the biggest influence on eczema severity,  
9  
10 providing age-appropriate advice and support on how young people can better live with  
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12 eczema was valuable for ensuring the content was engaging and relatable to this target group.  
13  
14 Young people explained how valuable the explanations of eczema and rationale behind the  
15  
16 topical treatments for addressing gaps in their knowledge, with most participants reporting  
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18 that they learned something new from ECO. This provided further support for the need for  
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20 health services to revisit eczema education with young people, avoiding assumptions that  
21  
22 they have already been told this information.[5] Online information can be confusing and of  
23  
24 variable quality,[34,35] therefore, it is important to signpost young people to high quality  
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26 evidence-based online information so they are empowered to take an active role in their own  
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28 healthcare.[36]

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36 A strength of this research was our rigorous development using complementary theory-,  
37  
38 evidence-, and person-based approaches to ensure the intervention is acceptable and engaging  
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40 to its target group. Our multidisciplinary intervention development group and PPI ensured  
41  
42 that the content was evidence-based, that advice was feasible, and that the perspectives of  
43  
44 people living with eczema were considered throughout the whole development process.[37] It  
45  
46 was helpful to gain iterative feedback from PPI and young people with eczema on early  
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48 versions of the videos (i.e. scripts, audio recordings of the video voiceover, prototype) to  
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50 ensure that they were as acceptable as possible to the target group before it was finalised by  
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52 the external video creator. One limitation of the think-aloud interview study is that we did not  
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54 collect information on participant ethnicity, socioeconomic status, or educational level. It will  
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56 be important to purposively sample based on these demographics in future evaluations of this  
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3 intervention to ensure it is engaging and effective for all participant groups and ensure digital  
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5 interventions do not further facilitate healthcare inequalities. Furthermore, as think-aloud  
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7 interviews explore participants' immediate reactions to the intervention, they cannot tell us  
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9 how people would use the intervention over time or explore engagement with the target  
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11 behaviours.  
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15 In conclusion, the think-aloud interview study demonstrated ECO is likely to be acceptable to  
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17 young people with eczema and provided support for our guiding principles, including key  
18  
19 design objectives and features to consider when developing interventions for this population.  
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21 A randomised controlled trial of ECO to explore effectiveness and cost-effectiveness is  
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23 underway (ISRCTN79282252).[14] This includes a nested mixed-methods process evaluation  
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25 to explore young people's experiences of using the intervention over time and how the  
26  
27 intervention was used, and test and further refine the intervention's programme theory. For  
28  
29 the qualitative interview study, we purposively recruited participants across a range of ages,  
30  
31 ethnicities, socioeconomic status, eczema severities, and intervention usage.  
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19  
20  
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23  
24 industry funding. The other authors have no competing interests to declare.  
25  
26

### 27 **Author Contributions**

28  
29 KG, DG, KS, MSt, ET, MJR, AR, JC, SL, SML, FC, SW, HCW, KST, LY, MSa and IM  
30  
31 designed the study. KG, KS, DG, MSt, IM, MSa led the intervention development with input  
32  
33  
34 from ET, MJR, AR, JC, SL, SML, FC, ELR, SW, HJ, EW, HCW, KST, LY, MSa and IM.  
35  
36  
37 DG, ET, SW, HJ, EW were responsible for recruitment and data collection. KG and DG led  
38  
39 on the data analysis, with support from MSa and IM. KG drafted the manuscript, with initial  
40  
41  
42 support from DG, MSa and IM. All authors critically reviewed the manuscript, contributing  
43  
44  
45 important intellectual content and approved the final manuscript.  
46  
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### 48 **Data sharing statement**

49  
50 The data that support the findings of this study are available from the corresponding author  
51  
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53 upon reasonable request.  
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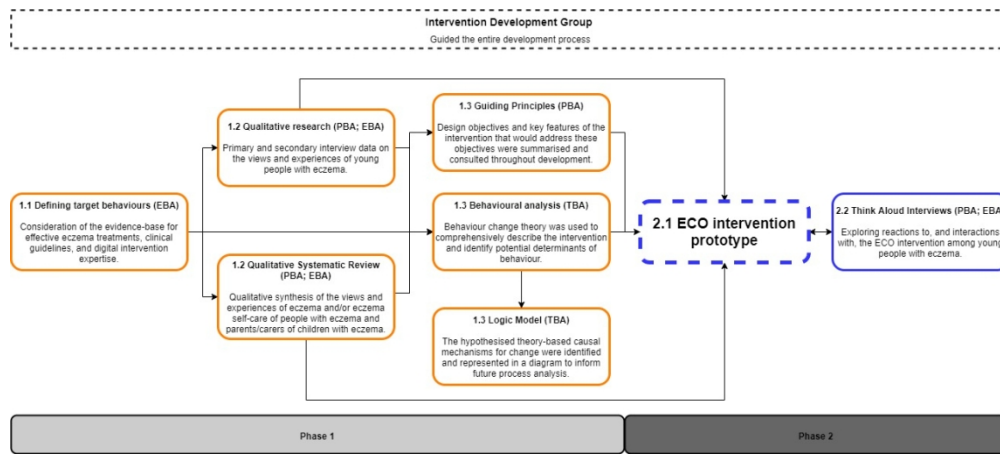
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## Figure legends

*Figure 1 Intervention development process for ECO intervention. Key: PBA = Person-Based Approach; EBA = Evidence-based approach; TBA = Theory-based approach.*

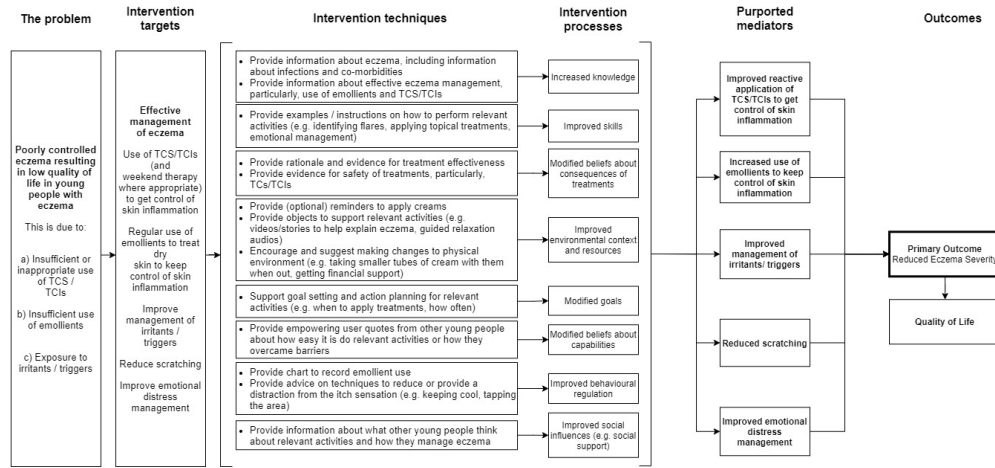
*Figure 2 Logic model for Eczema Care Online (ECO) for young people*

For peer review only



Intervention development process for ECO intervention. Key: PBA = Person-Based Approach; EBA = Evidence-based approach; TBA = Theory-based approach.

55x24mm (600 x 600 DPI)



Logic model for Eczema Care Online (ECO) for young people

57x26mm (600 x 600 DPI)

### Supplementary Material 1: Behavioural analysis for the Eczema Care Online (ECO) intervention for young people using the Behaviour Change Wheel (BCW), Theoretical Domains Framework (TDF) and Behaviour Change Techniques Taxonomy (BCTv1)

**Key:** TCS = Topical Corticosteroids; YP = Young People; EO = Barrier emerged from expert opinion; QSR = Barrier/facilitator emerged from systematic review of qualitative literature with adults with eczema and parents/carers of children with eczema; QI = Barrier/facilitator emerged from qualitative interview research with young people.

Barriers/facilitator to target behaviour	Intervention components	Target construct (BCW)	Theoretical domain (TDF)	Intervention function (BCW)	Behaviour Change Technique (using BCTv1)
<b>Target behaviour: Increased emollient use</b>					
Belief that emollients (in general or a specific brand) <u>do little</u> to control eczema [QSR; QI]	<ul style="list-style-type: none"> <li>Provide persuasive and credible information about the effectiveness of emollients, including scientific evidence, user quotes, and videos</li> <li>Provide rationale for how emollients control eczema</li> </ul>	Psychological capability; Reflective motivation; Social opportunity	Beliefs about consequences; Knowledge; Social Influences	Education; Persuasion; Modelling	5.1 Information about health consequences 6.2 Social comparison 6.3 Information about others' approval 9.1 Credible source
<i>Belief that emollients are useful for preventing dry/cracking skin</i> [QI]	The 2-week challenge: <ul style="list-style-type: none"> <li>Provide an emollient chart to allow YP to record how their skin is after applying emollients</li> </ul>	Reflective Motivation	Beliefs about consequences	Education; Persuasion	5.1 Information about health consequences 2.4 Self-monitoring of outcomes of behaviour
	<ul style="list-style-type: none"> <li>Provide advice on how to choose an effective emollient (e.g. list of available emollients, disadvantages of using cosmetic moisturisers)</li> </ul>	Psychological capability	Skills	Training	4.1 Instructions on how to perform the behaviour
Concerns about the safety and side effects (e.g. stinging, dependency) of emollients smell, feel, and appearance of emollients [QSR; QI]	<ul style="list-style-type: none"> <li>Provide persuasive and credible information about the safety of emollients and risk of side effects (including their flammability), including scientific evidence, user quotes and videos</li> <li>Provide advice on how to choose the right emollient (e.g. using different emollients at different times of the day, highlighting that different</li> </ul>	Psychological capability; Reflective motivation; Social opportunity	Beliefs about consequences; Knowledge; Social Influences	Education; Persuasion; Modelling	5.1 Information about health consequences 6.2 Social comparison 6.3 Information about others' approval 9.1 Credible source
		Psychological capability	Skills	Training	4.1 Instructions on how to perform the behaviour

Barriers/facilitator to target behaviour	Intervention components	Target construct (BCW)	Theoretical domain (TDF)	Intervention function (BCW)	Behaviour Change Technique (using BCTv1)
	emollients have different constituents, smells, and feel) <ul style="list-style-type: none"> <li>• Provide advice on disguising emollients when around others/away from home (e.g. putting emollient in smaller containers)</li> </ul>				
	The 2-week challenge: <ul style="list-style-type: none"> <li>• Provide an emollient chart to allow YP to record how their skin is each day after applying emollients and how they have found the emollients (e.g. side effects, texture)</li> </ul>	Reflective Motivation	Beliefs about consequences	Education; Persuasion	5.1 Information about health consequences 2.4 Self-monitoring of outcomes of behaviour
Concerns about the psychosocial impact of emollients (e.g. feeling self-conscious) [QSR; QI]	<ul style="list-style-type: none"> <li>• Provide strategies to reduce the psychosocial impact of emollients (e.g. feeling less self-conscious)</li> <li>• Provide quotes from YPs explaining how they overcame some of the psychosocial consequences of emollients</li> </ul>	Psychological capability; Reflective Motivation; Social opportunity	Beliefs about consequences; Beliefs about capabilities; Knowledge; Skills; Social influences	Education; Persuasion; Training; Modelling	5.3 Information about social and environmental consequences 5.6 Information about emotional consequences 6.2 Social comparison 6.3 Information about others' approval 9.1 Credible source
Inconvenience of using emollients when away from home [QSR; QI]	<ul style="list-style-type: none"> <li>• Provide advice on using emollients when away from home (e.g. requesting smaller tubes from health professional)</li> </ul>	Physical Opportunity	Environmental context and resources	Environmental restructuring	12.1 Restructuring the physical environment
Inconvenience of emollients rubbing off (e.g. on clothes and bed sheets) [QSR; QI]	<ul style="list-style-type: none"> <li>• Provide advice on how to choose the right emollient and avoiding them rubbing off (e.g. put on loose clothing, allowing adequate time for absorption, leaving it to dry in a warm room)</li> </ul>	Psychological capability	Skills	Training	4.1 Instructions on how to perform the behaviour

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Barriers/facilitator to target behaviour	Intervention components	Target construct (BCW)	Theoretical domain (TDF)	Intervention function (BCW)	Behaviour Change Technique (using BCTv1)
<p>Belief that emollients are time-consuming to apply and to find the right one/competing time pressures [QSR; QI]</p> <p>Forgetting to apply emollients [QI]</p>	<ul style="list-style-type: none"> <li>• Provide information on how to integrate emollient use into everyday life</li> <li>• Reassure YP that applying emollients should not be time-consuming</li> <li>• Advise YP to plan when they will apply their emollients (i.e. ensure they allocate time)</li> </ul>	<p>Psychological capability; Reflective Motivation</p>	<p>Knowledge; Skills; Goals</p>	<p>Education; Training Enablement</p>	<p>1.4 Action planning 4.1 Instructions on how to perform the behaviour 5.3 Information about social and environmental consequences</p>
<p>Forgetting to apply emollients [QI]</p> <p><i>Having an emollient routine [QI]</i></p>	<p>The 2-week challenge:</p> <ul style="list-style-type: none"> <li>• Suggest YP to apply their emollient daily</li> <li>• Suggest YP plan when they will apply their emollients</li> <li>• Suggest YP apply their creams at the same time in the same context each day</li> <li>• Allow YP to choose how many times per day they aim to apply their emollients and suggest they choose a particular time of the day or situation (e.g. after showering) to apply.</li> <li>• Provide an emollient chart to record whether they have used their emollients at their agreed times.</li> </ul>	<p>Reflective motivation; Psychological capability</p>	<p>Goals; Skills; Behavioural regulation</p>	<p>Enablement; Training</p>	<p>1.1 Goal setting (behaviour) 1.4 Action planning 2.3 Self-monitoring of behaviour 8.1 Behavioural practice/rehearsal 8.3 Habit formation</p>
	<ul style="list-style-type: none"> <li>• Allow users to set up regular reminders to apply emollients by email or text messages and decide on the frequency of these reminders</li> <li>• Provide an emollient chart that acts as a reminder by suggesting YP record whether they have used their</li> </ul>	<p>Physical opportunity</p>	<p>Environmental context and resources</p>	<p>Environmental structure</p>	<p>7.1 Prompts/cues</p>

Barriers/facilitator to target behaviour	Intervention components	Target construct (BCW)	Theoretical domain (TDF)	Intervention function (BCW)	Behaviour Change Technique (using BCTv1)
	emollients at their agreed times [2-week challenge]				
Belief that finding an emollient that works best for you is inconvenient, confusing and time-consuming [QSR; QI]	<ul style="list-style-type: none"> <li>Acknowledge how frustrating and time-consuming this process can be</li> <li>Provide quotes from YP emphasising the importance of finding the right emollient</li> </ul>	Psychological capability; Reflective motivation; Social opportunity	Beliefs about consequences; Beliefs about capabilities; Knowledge; Social Influences	Education; Persuasion; Modelling	5.1 Information about health consequences 6.2 Social comparison 6.3 Information about others' approval 9.1 Credible source
Belief that you don't need to apply the emollient every day or only when you need it/eczema is bad [QI]	<ul style="list-style-type: none"> <li>Provide information on how often to apply emollients and the rationale for doing this</li> </ul>	Psychological capability; Reflective Motivation	Knowledge; Skills	Education; Training	4.1 Instructions on how to perform the behaviour 5.1 Information about health consequences
Lack of skills regarding how to apply emollients/ low self-efficacy [QSR]	<ul style="list-style-type: none"> <li>Provide instructions on how to correctly applying emollients, including how much emollient to apply</li> </ul>	Psychological capability	Skills	Training	4.1 Instructions on how to perform the behaviour
Ran out of emollients [EO]  <i>Stocking up on emollient [QI]</i>	<ul style="list-style-type: none"> <li>Provide advice on how to obtain more emollients/avoid running out</li> </ul>	Physical Opportunity	Environmental context and resources	Environmental structuring	12.5 Adding objects to the environment
Cost of emollients [QI]	<ul style="list-style-type: none"> <li>Provide advice about financial benefits YP can apply for or strategies for reducing the cost of emollients</li> </ul>	Physical Opportunity; Psychological Capability; Reflective Motivation	Environmental context and resources; Knowledge; Beliefs about consequences	Environmental structuring; Education; Persuasion	5.3 Information about social and environmental consequences 12.5 Adding objects to the environment
Difficulties in getting health professionals to	<ul style="list-style-type: none"> <li>Provide advice on how to prepare for appointments with health professionals</li> </ul>	Psychological Capability	Skills	Training	4.1 Instructions on how to perform the behaviour

Barriers/facilitator to target behaviour	Intervention components	Target construct (BCW)	Theoretical domain (TDF)	Intervention function (BCW)	Behaviour Change Technique (using BCTv1)
prescribe different emollients [QI]  <i>Preparing and researching for consultations [QI]</i>					
<b>Target behaviour: Improved use of topical corticosteroids (TCS) or Topical Calcineurin Inhibitors (TCI)</b>					
Belief that TCSs/TCIs are not effective enough for managing flare-ups (e.g. provide only temporary relief before their eczema returned) [QI]	<ul style="list-style-type: none"> <li>• Provide persuasive and credible information about the effectiveness of TCS/TCIs, including scientific evidence, user quotes and videos</li> <li>• Provide rationale for how TCS/TCIs control eczema</li> <li>• Provide advice on whether emollients are also needed</li> </ul>	Psychological capability; Reflective motivation; Social opportunity	Beliefs about consequences; Knowledge; Social Influences	Education; Persuasion; Modelling	5.1 Information about health consequences 6.2 Social comparison 6.3 Information about others' approval 9.1 Credible source
	<ul style="list-style-type: none"> <li>• Provide advice on how to choose an effective TCS/TCIs</li> </ul>	Psychological capability	Skills	Training	4.1 Instructions on how to perform the behaviour
Concerns about the long-term safety of TCSs [QSR; QI; EO]	<ul style="list-style-type: none"> <li>• Provide persuasive and credible information about the safety of TCSs/TCIs (e.g. skin thinning, wrinkling, dependency), including scientific evidence, user quotes and videos</li> </ul>	Psychological capability; Reflective motivation; Social opportunity	Beliefs about consequences; Knowledge; Social Influences	Education; Persuasion; Modelling	5.1 Information about health consequences 6.2 Social comparison 6.3 Information about others' approval 9.1 Credible source
Concerns about the immediate side effects (e.g. stinging) of TCSs/TCIs [QI]	<ul style="list-style-type: none"> <li>• Provide reassuring advice about the temporary nature of side effects (e.g. stinging) and how to choose the right TCS/TCIs (i.e. no side effects)</li> </ul>	Psychological capability; Reflective motivation;	Skills; Beliefs about consequences; Knowledge	Education; Persuasion; Training	4.1 Instructions on how to perform the behaviour 5.1 Information about health consequences
Uncertainty regarding when to start and finish TCSs/TCIs [QI]	<ul style="list-style-type: none"> <li>• Provide information on when to apply TCSs/TCIs and for how long</li> </ul>	Psychological capability	Skills	Training	4.1 Instructions on how to perform the behaviour

Barriers/facilitator to target behaviour	Intervention components	Target construct (BCW)	Theoretical domain (TDF)	Intervention function (BCW)	Behaviour Change Technique (using BCTv1)
Lack of skills regarding how to apply TCSs/TCIs / low self-efficacy [EO]	<ul style="list-style-type: none"> <li>Provide instructions on how to correctly apply TCSs/TCIs, including how much to apply</li> </ul>	Psychological capability	Skills	Training	4.1 Instructions on how to perform the behaviour
Belief that using more TCS than prescribed will conceal their eczema or make their eczema flare-up pass quicker [QI]	<ul style="list-style-type: none"> <li>Provide information on how much TCS/TCIs to apply</li> </ul>	Psychological capability	Skills	Training	4.1 Instructions on how to perform the behaviour
Uncertainty regarding the difference between steroids [QI]	<ul style="list-style-type: none"> <li>Provide information on what type of steroids are available and which ones they should use on different body parts and why</li> </ul>	Psychological capability	Skills	Training	4.1 Instructions on how to perform the behaviour
Ran out of TCS/TCIs /not being able to get hold of their preferred TCS (e.g. out of stock) [QI]  <i>Stocking up on TCS/TCIs [QI]</i>	<ul style="list-style-type: none"> <li>Provide information on how to obtain more TCS/TCIs and avoid running out</li> </ul>	Physical Opportunity	Environmental context and resources	Environmental structuring	12.5 Adding objects to the environment
Belief that health professionals (including pharmacists) are reluctant or hesitant to prescribe TCSs/the right potency [QI]	<ul style="list-style-type: none"> <li>Provide advice on how to talk to health professionals</li> <li>Provide advice on how to choose an effective TC/TCIs S (e.g. list of available TCSs/TCIs)</li> </ul>	Psychological capability	Skills	Training	4.1 Instructions on how to perform the behaviour

Barriers/facilitator to target behaviour	Intervention components	Target construct (BCW)	Theoretical domain (TDF)	Intervention function (BCW)	Behaviour Change Technique (using BCTv1)
	<ul style="list-style-type: none"> <li>Provide explanation of how the health professional decides on the TCS/TCI prescription</li> </ul>				
Cost of TCSs/TCIs [QI]	<ul style="list-style-type: none"> <li>Provide advice about financial benefits YP can apply for or strategies for reducing the cost of TCSs/TCIs</li> </ul>	Psychological capability; Reflective motivation	Beliefs about consequences; Knowledge	Education; Persuasion	5.3 Information about social and environmental consequences
<b>Target behaviour: Management of irritants and triggers</b>					
Lack of knowledge regarding common irritants and triggers [EO]	<ul style="list-style-type: none"> <li>Provide information on common irritants and triggers</li> <li>Provide information on misconceptions (e.g. food allergies)</li> </ul>	Psychological capability; Reflective Motivation	Beliefs about consequences; Knowledge; Skills	Education; Persuasion; Training	4.1 Instructions on how to perform the behaviour 5.1 Information about health consequences
Belief that you can't avoid some triggers (e.g. stress)/Belief that the benefits of avoidance (e.g. avoiding a brief flare-up) do not outweigh the costs (e.g. not being able to go swimming) [QI]	<ul style="list-style-type: none"> <li>Where appropriate, provide advice on how to minimise the effects of irritants/triggers (e.g. apply emollients before and/or afterwards)</li> <li>Where appropriate, provide advice on how to avoid or reduce contact with certain irritants/triggers (e.g. soaps, high temperatures, sweat), including when away from home</li> </ul>	Psychological capability; Reflective Motivation	Beliefs about consequences; Knowledge; Skills	Education; Persuasion; Training	4.1 Instructions on how to perform the behaviour 5.1 Information about health consequences

Barriers/facilitator to target behaviour	Intervention components	Target construct (BCW)	Theoretical domain (TDF)	Intervention function (BCW)	Behaviour Change Technique (using BCTv1)
<b>Target behaviour: Reduce scratching</b>					
Belief that scratching is not that bad [EO]	<ul style="list-style-type: none"> <li>Explain itch-scratch cycle and that scratching makes itch/eczema worse</li> </ul>	Psychological capability; Reflective Motivation	Beliefs about consequences; Knowledge	Education; Persuasion	5.1 Information about health consequences 5.6 Information about emotional consequences
Feeling of itchiness and desire for instant relief [QI]  <i>Wearing appropriate clothes [QI]; Keeping cool [QI]; Emollient use [QI]; Antihistamine [QI]; Tapping [QI]; Keeping nails short/wear gloves [QI]</i>	<ul style="list-style-type: none"> <li>Provide information on the factors that make scratching more likely (e.g. hot temperature, lack of sleep)</li> <li>Provide advice on reducing itchiness (e.g. keeping cool, emollient use, tapping the area, clench fist, wearing clothes with long arms and legs, put emollient in fridge to keep cool).</li> <li>Provide advice on sleep management.</li> <li>Provide techniques to prevent the negative consequences of scratching (e.g. keep nails short, wear gloves) and how to deal with the annoyance of others telling them to stop scratching (e.g. ask people to suggest things they can do, like tap skin, instead).</li> </ul>	Physical Capability; Psychological Capability	Environmental context and resources; Skills; Behavioural Regulation	Training; Education; Enablement; Environmental restructuring	4.1 Information on how to perform a behaviour 4.2 Information about antecedents 12.3 Avoidance/reducing exposure to cues for behaviour 12.5 Adding objects to the environment 12.6 Body changes
Scratching is a habit [QI]  <i>Distraction techniques [QI]</i>	<ul style="list-style-type: none"> <li>Provide techniques to raise awareness of scratching (e.g. record instances of scratching)</li> <li>Provide techniques to stop scratching (e.g. distraction, relaxation techniques, replace scratching with an alternative behaviour such as clenching fists).</li> </ul>	Psychological Capability; Automatic Motivation; Physical Opportunity	Environmental context and resources; Skills; Behavioural Regulation	Training; Enablement; Environmental restructuring	2.3 Self-monitoring of behaviour 4.1 Information on how to perform a behaviour 8.2 Behaviour substitution 8.4 Habit reversal 12.4 Distraction 12.5 Adding objects to the environment
<b>Target behaviour: Engaging in emotional management techniques</b>					



Barriers/facilitator to target behaviour	Intervention components	Target construct (BCW)	Theoretical domain (TDF)	Intervention function (BCW)	Behaviour Change Technique (using BCTv1)
Belief that emotional management techniques will <u>do little</u> to control their eczema or help with difficult emotions [EO]/ Belief that stress (e.g. during exam time) can't be avoided [QI]	<ul style="list-style-type: none"> <li>Explain the necessity of emotional management techniques for promoting engagement with the other behaviours and provide evidence that they are effective for dealing with difficult emotions</li> <li>Provide user quotes demonstrating how emotional management techniques helped other users to take control of their eczema</li> </ul>	Psychological capability; Reflective Motivation	Beliefs about consequences; Knowledge	Education; Persuasion	5.1 Information about health consequences 5.6 Information about emotional consequences
<i>Belief that emotions affect eczema [QI]</i>	<ul style="list-style-type: none"> <li>Provide user quotes demonstrating how emotional management techniques helped other users to take control of their eczema</li> </ul>	Psychological capability; Reflective motivation; Social opportunity	Beliefs about consequences; Knowledge; Social Influences	Education; Persuasion; Modelling	5.1 Information about health consequences 6.2 Social comparison 6.3 Information about others' approval 9.1 Credible source
Lack of understanding regarding how to do the emotional management techniques [EO]	<ul style="list-style-type: none"> <li>Provide guidance on how to do the emotional management techniques</li> <li>Provide guided audio recordings of emotional management exercises</li> </ul>	Psychological capability	Skills	Training	4.1 Instructions on how to perform the behaviour
Lack of confidence in ability to practice emotional management techniques [EO]	<ul style="list-style-type: none"> <li>Provide YP quotes demonstrating how easy it was for other users to practice the emotional management techniques</li> </ul>	Psychological capability; Reflective motivation; Social opportunity	Beliefs about consequences; Beliefs about capabilities; Knowledge; Social Influences	Education; Persuasion; Modelling	6.2 Social comparison 6.3 Information about others' approval 9.1 Credible source



Supplementary Material 2: Screenshot of page in introductory module providing key behavioural messages on topical treatments



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Introduction

← Back Getting control and keeping control of eczema Next →

What are flare control creams and moisturising creams? Page 6/9

<p><b>Get control</b></p> <p><b>Flare control creams (usually steroid creams)</b></p> <p>These creams are used to <b>get control</b> of eczema. They are:</p> <ul style="list-style-type: none"> <li>• Used to treat sore and itchy skin</li> <li>• Normally prescribed and are usually steroid creams (topical corticosteroids). Sometimes they are TCIs (Topical Calcineurin Inhibitors)</li> </ul> <p>Most people with eczema will need to use flare control creams at some point. <b>This will be during flare-ups, usually for a few days or weeks until the eczema is under control.</b></p>	<p><b>Keep control</b></p> <p><b>Moisturising creams (emollients)</b></p> <p>These creams are used to <b>keep control</b> of eczema. They help to:</p> <ul style="list-style-type: none"> <li>• Stop eczema flare-ups by keeping out things that may irritate the skin</li> <li>• Make the skin soft by locking water in the skin</li> <li>• Stop itching</li> <li>• Reduce soreness</li> </ul> <p><b>Most people with eczema will need to use moisturising creams every day.</b></p>
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Back Next

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1  
2  
3 **Supplementary Material 3: Screenshot of video explaining how eczema affects the skin**  
4 **barrier to provide a better understanding of eczema and a rationale for how topical**  
5 **treatments work**  
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14 Introduction

15 ← Back What is Eczema? Next →

16 Page 4/9

17

18

19 **The skin barrier and eczema**

20 Our skin is a natural barrier that stops things

21 from getting into our bodies and keeps water

22 in the skin. **In someone with eczema, this skin**

23 **barrier works less well.** It lets moisture out,

24 making the skin dry.

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26 It also lets in things that irritate the skin, such

27 as soap and washing up liquid. This can

28 cause the skin to react, making it itchy and

29 sore.

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31 **Watch this video to find out more about the skin**

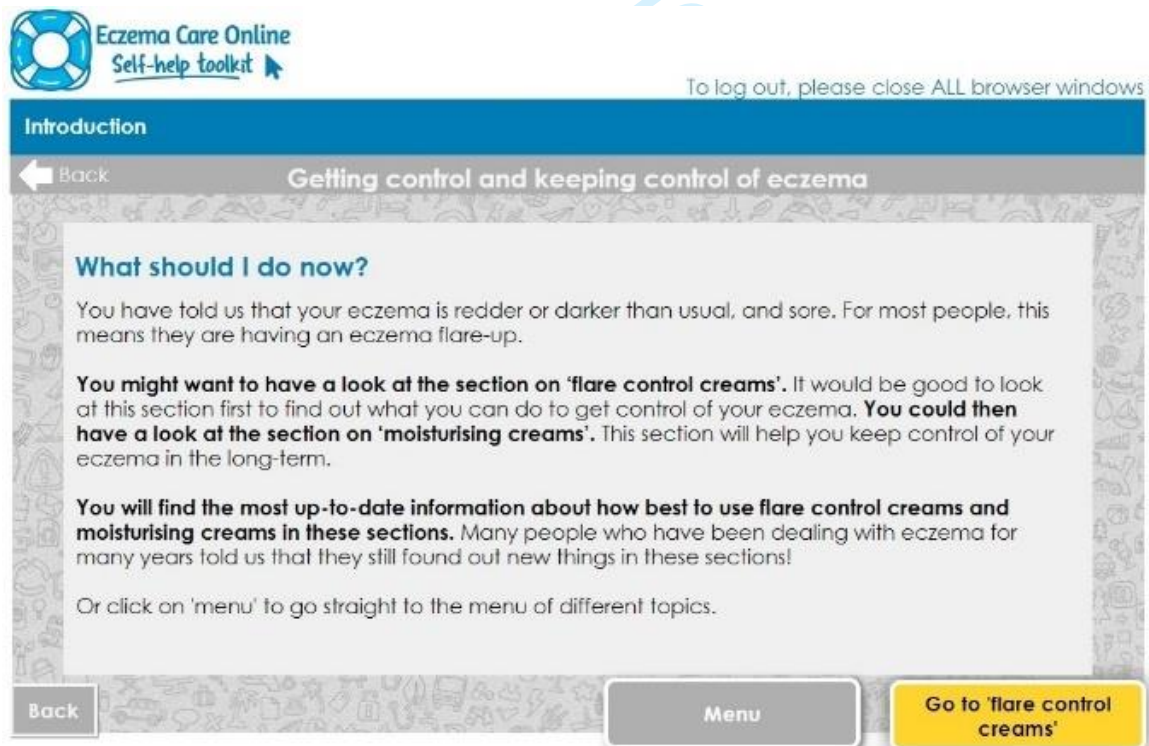
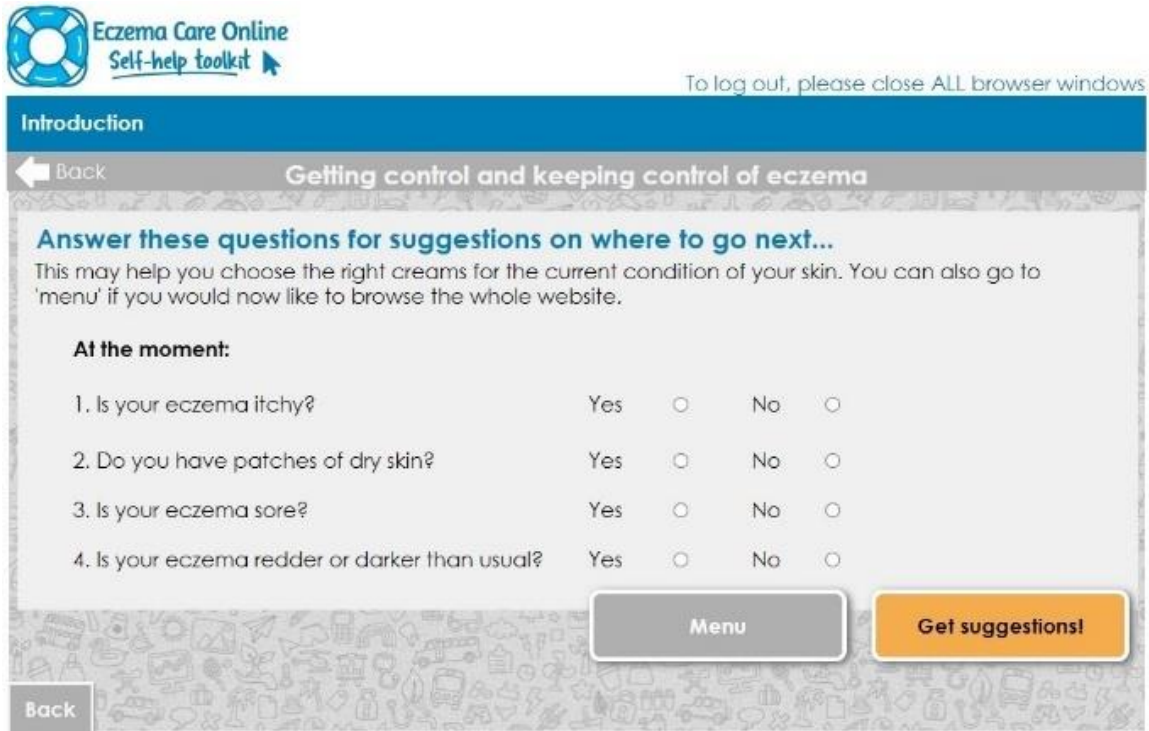
32 **barrier in people with eczema.**

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34 Back Click [here](#) for a text explanation of the video. Next

A screenshot of a video player. The video shows a cartoon character with a red body and a white face, standing behind a brick wall. The wall has a large hole in the center. The background is a blue sky with a white cloud and a yellow sun. The video player interface shows a play button, a progress bar at 0:59 / 2:14, and volume and full-screen icons.

**Supplementary Material 4: Screenshot of simple eczema assessment and subsequent feedback on which of the core treatment modules (emollients or topical corticosteroids) would be most relevant depending on whether they were currently experiencing an eczema flare-up**



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3 **Supplementary Material 5: Screenshot of page explaining the menu of different**  
4 **information topics and quotes from other young people with eczema**  
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12 **Introduction**

13 ← Back **What is Eczema Care Online?** Next →

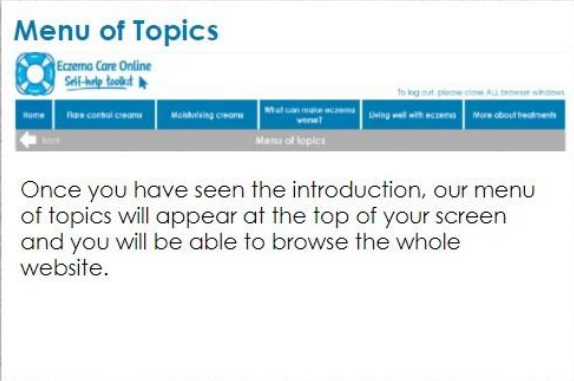
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15 **What happens next?** Page 2/9

16 The next few pages will give you key information about eczema and the best way to treat it.

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18 **Menu of Topics**



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24 Once you have seen the introduction, our menu of topics will appear at the top of your screen and you will be able to browse the whole website.

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33 **ECO quotes**

34 Throughout ECO there will be quotes based on the tips and experiences that young people have shared with us. These have been checked by people with eczema to make sure they will be useful for you.

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“I've been dealing with eczema for years and thought I knew it all, and was really surprised by the helpful new tips I found”  
*Jordan*”

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## Supplementary Material 6: Description of Eczema Care Online (ECO) for Young

### People in accordance with the Template for Intervention Description and Replication

#### (TIDieR) checklist

- 1. BRIEF NAME: Eczema Care Online (ECO) for Young People
- 2. WHY: Online interventions could potentially be used to support young people with eczema; however, research developing such interventions has been limited and systematic reviews show the need for systematically developed evidence-based interventions to support self-management of eczema.
- 3 & 4. WHAT (materials and procedures): ECO for Young People is an online behavioural intervention for young people with eczema aged 13-25 years with mild to severe eczema. It aims to reduce eczema severity, targeting 5 key behaviours: (1) Increase their use of emollients to maintain skin hydration and prevent flare-ups; (2) Improve their use of TCS or TCIs through reactive applications of these treatments in response to flare-ups or, where appropriate, regular intermittent (“weekend”) preventative applications of TCS/TCI if emollients are insufficient as maintenance therapy; (3) Improve their management of irritants and triggers; (4) Improve their emotional management; and (5) Reduce scratching. See the table below for an overview of the modules included in ECO for Young People. For more detail about specific intervention techniques, see the behavioural analysis in Supplementary Material 1.

**Table 1: Overview of the key intervention components of ECO for Young People**

Menu	Modules	Description
Home Page	N/A	<ul style="list-style-type: none"> <li>• Signposting to key modules that young people haven’t accessed yet</li> <li>• Quick links to interactive content e.g. videos</li> </ul>
Flare control creams	<ul style="list-style-type: none"> <li>• Flare control cream video</li> <li>• What are they?</li> <li>• Are they safe?</li> <li>• Common questions</li> <li>• When and how do I use them?</li> <li>• How can I find the right cream?</li> <li>• Golden rules</li> </ul>	<ul style="list-style-type: none"> <li>• Evidence-based education and messages to increase motivation and competence to use topical corticosteroids (TCS), including; evidence of safety and support for skills development e.g. videos/photos showing use of TCS</li> </ul>
Moisturising creams	<ul style="list-style-type: none"> <li>• Moisturising creams video</li> <li>• What are they and how to they help?</li> <li>• Are they safe?</li> </ul>	<ul style="list-style-type: none"> <li>• Evidence-based education and messages to increase motivation and competence to use emollients, including; evidence of safety and</li> </ul>

	<ul style="list-style-type: none"> <li>• Common Concerns</li> <li>• When and how do I use them?</li> <li>• How do I find the right cream?</li> <li>• Take the two-week challenge</li> <li>• Golden rules</li> </ul>	support for skills development e.g. videos/photos showing how to use emollients
What can make eczema worse	<ul style="list-style-type: none"> <li>• Living with eczema video</li> <li>• Bathing, showering, and washing clothes</li> <li>• Cosmetics, make-up and shaving</li> <li>• Diet and allergies</li> <li>• Weather and holidays</li> <li>• Swimming and physical activity</li> </ul>	<ul style="list-style-type: none"> <li>• Evidence-based education and messages to increase motivation and competence in identifying key eczema triggers and managing them, including practical tips</li> </ul>
Living well with eczema	<ul style="list-style-type: none"> <li>• Beat the itch</li> <li>• Sleep</li> <li>• Stress and eczema</li> <li>• Studying and work</li> <li>• Eczema and money</li> </ul>	<ul style="list-style-type: none"> <li>• Evidence-based education and messages to increase motivation and competence to manage some of the symptoms and psychosocial impacts of eczema e.g. itching and scratching, disturbed sleep, stress, including techniques to manage them</li> </ul>
More about treatments	<ul style="list-style-type: none"> <li>• Talking to health professionals</li> <li>• Infections</li> <li>• Topical Calcineurin Inhibitors</li> <li>• Other treatments</li> <li>• Other resources</li> </ul>	<ul style="list-style-type: none"> <li>• Evidence-based education and messages to increase motivation and competence to manage other aspects of treatments e.g. consulting with health professionals and other treatments</li> </ul>

- 5. WHO PROVIDED: ECO for Young People is provided direct to patients via their GP surgeries.
- 6. HOW: ECO for Young People is entirely online, although users are encouraged to contact their GP, pharmacist or nurse, for example, to obtain or change their treatments, or to treat potential infections.
- 7. WHERE: ECO for Young People is intended for any young person (aged 13-25) with mild to severe eczema. It can be implemented in primary or secondary care. The intervention is online and designed to be accessed using computers, tablets and phones via a web-browser.
- 8. WHEN and HOW MUCH: For the randomised controlled trial study, young people are given access to the intervention if their GP identifies that they have eczema that has required treatment in the last 12 months. Once registered young people can use the online intervention as much or as little as they like.

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- 9. TAILORING: Young people have access to all the modules on ECO, however the website uses signposting based on four questions about the current state of their eczema. They will then be recommended either the module on emollients or flare control creams module depending on whether it appears they are currently experiencing an eczema flare-up. Key modules will also be recommended, one or two at a time, on the intervention home page if they haven't been viewed yet. These modules/menus are: 1) moisturising creams; 2) flare control creams, 3) bathing, showering and washing clothes; 4) beat the itch, 5) stress and eczema.
  - 10. MODIFICATIONS: An additional email was circulated in response to COVID-19 that provided further advice about handwashing.
  - 11. HOW WELL: The intervention is currently being tested in a randomised control trial with young people with eczema (ISRCTN79282252). Information about the results of the randomised controlled trial, including both quantitative and qualitative data, will be presented in future publications.

**COREQ checklist**

No	Item	Guide questions/description	Comments	Location in manuscript
<b>Domain 1: Research team and reflexivity</b>				
<i>Personal Characteristics</i>				
1.	Interviewer/facilitator	Which author/s conducted the interview or focus group?	DG, HJ, EW	Methods Section 2.2
2.	Credentials	What were the researcher's credentials? <i>E.g. PhD, MD</i>	Postdoctoral experienced qualitative researcher (DG) and two medical students (HJ, EW) supervised by DG and another postdoctoral researcher (ET)	Methods Section 2.2
3.	Occupation	What was their occupation at the time of the study?	See above	Methods Section 2.2
4.	Gender	Was the researcher male or female?	All female	Methods Section 2.2
5.	Experience and training	What experience or training did the researcher have?	See No 2	Methods Section 2.2
<i>Relationship with participants</i>				
6.	Relationship established	Was a relationship established prior to study commencement?	Some of the participants were known to the two medical student interviewers (HJ, EW).	-
7.	Participant knowledge of the interviewer	What did the participants know about the researcher? <i>e.g. personal goals, reasons for doing the research</i>	Participants were told that the interviews were to help improve the ECO intervention.	-
8.	Interviewer characteristics	What characteristics were reported about the interviewer/facilitator? <i>e.g. Bias, assumptions, reasons and interests in the research topic</i>	One of the interviewers was involved in intervention development (DG), which could be a potential source of bias.	-
<b>Domain 2: study design</b>				
<i>Theoretical framework</i>				
9.	Methodological orientation and Theory	What methodological orientation was stated to underpin the study? <i>e.g. grounded theory, discourse analysis, ethnography,</i>	Person-based approach to intervention development	Intervention development methodology section



No	Item	Guide questions/description	Comments	Location in manuscript
		<i>phenomenology, content analysis</i>		
<i>Participant selection</i>				
10.	Sampling	How were participants selected? e.g. <i>purposive, convenience, consecutive, snowball</i>	Purposive, opportunistic, and snowballing sampling	Methods Section 2.2
11.	Method of approach	How were participants approached? e.g. <i>face-to-face, telephone, mail, email</i>	Invitation letter from their GP practice or advertising, opportunistic and snowball sampling of students at the University of Southampton.	Methods Section 2.2
12.	Sample size	How many participants were in the study?	28	Methods Section 2.2
13.	Non-participation	How many people refused to participate or dropped out? Reasons?	Data not collected	-
<i>Setting</i>				
14.	Setting of data collection	Where was the data collected? e.g. <i>home, clinic, workplace</i>	At participants' homes or at a location of the participants' choice (e.g. at the university).	Methods Section 2.2
15.	Presence of non-participants	Was anyone else present besides the participants and researchers?	A family member was present for 9 of the interviews.	Methods Section 2.2
16.	Description of sample	What are the important characteristics of the sample? e.g. <i>demographic data, date</i>	Demographic information can be found in Table 2. Interviews were carried out during October 2018 to April 2019.	Methods Section 2.2
<i>Data collection</i>				
17.	Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Interview question guide not applicable for think aloud research	-
18.	Repeat interviews	Were repeat interviews carried out? If yes, how many?	Yes, 2 people took part in two interviews	Methods Section 2.2
19.	Audio/visual recording	Did the research use audio or visual recording to collect the data?	Audio recording.	Methods Section 2.2
20.	Field notes	Were field notes made during and/or after the	Field notes were made after all interviews.	Methods Section 2.2

No	Item	Guide questions/description	Comments	Location in manuscript
		interview or focus group?		
21.	Duration	What was the duration of the interviews or focus group?	45-90 minutes	Methods Section 2.2
22.	Data saturation	Was data saturation discussed?	We considered data saturation to be reached once no further important changes were required	Methods Section 2.2
23.	Transcripts returned	Were transcripts returned to participants for comment and/or correction?	No	-
<b>Domain 3: analysis and findings</b>				
<i>Data analysis</i>				
24.	Number of data coders	How many data coders coded the data?	Two (KG & DG), with input from 5 other researchers	Methods Section 2.2
25.	Description of the coding tree	Did authors provide a description of the coding tree?	No	-
26.	Derivation of themes	Were themes identified in advance or derived from the data?	Not applicable.	-
27.	Software	What software, if applicable, was used to manage the data?	Microsoft excel was used for Table of changes	-
28.	Participant checking	Did participants provide feedback on the findings?	No	-
<i>Reporting</i>				
29.	Participant checking	Were participant quotations presented to illustrate the themes / findings? Was each quotation identified? e.g. <i>participant number</i>	Participant quotations are presented and each quotation is identified by a pseudonym and their gender and age is noted.	Results Section 2.2
30.	Data and findings consistent	Was there consistency between the data presented and the findings?	Yes	Results Section 2.2
31.	Clarity of major themes	Were major themes clearly presented in the findings?	Not applicable.	-
32.	Clarity of minor themes	Is there a description of diverse cases or	Not applicable.	-

No	Item	Guide questions/description	Comments	Location in manuscript
		discussion of minor themes?		

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