

E-health in caring for patients with atopic dermatitis: a randomized controlled cost-effectiveness study of internet-guided monitoring and online self-management training

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Summary

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Conflicts of interest

None declared.

This study is registered in the Dutch trial register, NTR number 612.

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Background The Dermatology Department of the University Medical Centre Utrecht, the Netherlands, developed an e-health portal for patients with atopic dermatitis (AD), consisting of e-consultation, a patient-tailored website, monitoring and self-management training.

Objectives To determine the cost-effectiveness of individualized e-health compared with usual face-to-face care for children and adults with AD.

Methods A randomized controlled cost-effectiveness study from a societal perspective in adults and parents of children with moderate AD. Outcomes were quality of life, severity of AD, itching and direct and indirect costs. Data were collected at baseline and at 3 and 12 months after randomization. Linear mixed models were used to analyse clinical outcomes. After multiple imputation of missing data, costs and differences in costs were calculated over a period of 1 year.

Results In total, 199 patients were included. There were no significant differences in disease-specific quality of life, severity of AD and intensity of itching between both groups at the three time points. The difference in direct costs between the intervention and control groups was €24 [95% confidence interval (CI) -360 to 383], whereas this difference was -€618 (95% CI -2502 to 1143) for indirect costs. Overall, individual e-health was expected to save €594 (95% CI -2545 to 1227) per patient in the first year of treatment, mainly through a reduction in work absenteeism. Uncertainty analyses revealed that the probability of e-health reducing costs was estimated to be $\geq 73\%$.

Conclusions E-health during follow-up of patients with AD is, after initial diagnosis and treatment during face-to-face contact, just as effective as usual face-to-face care with regard to quality of life and severity of disease. However, when costs are considered, e-health is likely to result in substantial cost savings. Therefore, e-health is a valuable service for patients with AD.

Atopic dermatitis (AD) is a chronic inflammatory pruritic skin disease, with periods of exacerbations and remissions. The overall prevalence of AD in the Netherlands has been estimated as 2.3%; in children up to 6 years this is 11.3%.¹ AD reduces patients' quality of life because of itching and sleep problems.² Most patients are treated by their general practitioner and about 8% of children or adult patients with AD are

treated by a dermatologist or paediatrician.¹ The usual treatment for patients with AD consists of topical corticosteroids and emollients.

In most hospitals, usual care for patients with this chronic skin disease is provided by a dermatologist and a dermatology nurse for patient education and self-management training with scheduled outpatient department visits. Previous studies have

shown that self-management training led to more effective skin care and improved coping with exacerbations by patients.^{3–6}

Due to the relapses and remissions in AD, scheduled visits of patients often take place during remission periods. Patients rarely search for or find effective care in times of exacerbations, when specialized care is most useful and needed. Thus, follow-up visits are offered at suboptimal moments. This contrasts with the use of e-health, which is available on any weekday. E-health and telemedicine are both terms for all information and communication technology applications in direct patient care.⁷ Recently, we showed that e-health interventions, for chronically ill patients, offered instead of or in addition to usual care, led to small to moderate positive effects on health outcomes; however, cost-effectiveness, quality of life and patient satisfaction have rarely been investigated.⁸

Aiming to create patient-tailored care, the dermatology department of the University Medical Centre Utrecht (UMCU) developed an e-health service for patients with AD: the eczema portal.⁹ This online portal offers the possibility of e-consultation, intensive monitoring of the skin at home and self-management training by the dermatology nurse. The dermatologist has no scheduled follow-up visits.

Currently it is unknown whether the e-health service results in health benefits when compared with usual care, and whether it is more or less expensive than usual care. Therefore, the aim of this study is to determine the cost-effectiveness of individualized e-health compared with usual care for children and adults with AD.

Materials and methods

Design

A randomized controlled study with economic evaluation was carried out from a societal perspective. If both treatments resulted in similar health effects a cost minimization analysis would be performed, otherwise a cost-effectiveness analysis would be performed.

An online randomization program was used ensuring concealment of the sequence of allocation, with stratification for age to achieve equal proportions of adults and parents of children in the intervention and control groups. Blinding of the patient or researcher was not possible.

The study was approved by the ethical committees of the two participating hospitals. Patients or their parents were asked by a member of the multidisciplinary team to participate in the study. After that, the researcher informed all patients or their parents about the study and obtained their informed consent.

Study population

The study population consisted of parents of children with moderate AD aged 0–4 years and adults with moderate AD aged 18 years or older, who visited the adult outpatient department of dermatology of the UMCU or Erasmus Medical

Centre Rotterdam in the Netherlands for the first time or the Wilhelmina Children's Hospital of the UMCU for the first time, and had internet access.

During the first year of the inclusion, we changed the age of children from 0–4 to 0–6 years to improve the inclusion of this group.

Emergency patients and patients using oral immunosuppressive drugs or undergoing ultraviolet (UV) B/UVA phototherapy were excluded.

Intervention: e-health by a personal eczema portal

After randomization, patients in the intervention group attended an initial appointment with the dermatologist (for diagnosis and initiation of therapy) and the dermatology nurse (to start self-management training and to explain e-health). A follow-up visit to the dermatologist was planned 6 weeks later to evaluate the medical treatment effect. After that, no scheduled visits were planned; patients had access to the password-protected eczema portal including e-consultations with the dermatology nurse. Face-to-face visits to the dermatology nurse or dermatologist were possible in individual cases where e-health was inadequate or when patients asked for such visits.

In addition to the possibility of e-consultation, the eczema portal consists of internet-guided monitoring and self-management training. The portal also contains general information about AD and personal information about prescribed treatment and daily skin care. The patient can monitor the disease using digital photographs of the skin and self-reported data of skin status, visual analogue scale (VAS) scores of sleeping and itching and by keeping a diary of topical treatment. The dermatology nurse uses the data to support patients or parents in self-management by e-consultation and can consult the dermatologist if necessary. The portal also facilitates assessment of psychosocial aspects and consequences on daily life of having AD. The dermatology nurse can provide counselling and give information or advice to individual patients.

Control condition: usual care

After randomization, patients in the control group attended an initial appointment with the dermatologist and dermatology nurse at the dermatology outpatient department. After that, the control group received usual care consisting of about five scheduled follow-up visits to the dermatologist for diagnosis, monitoring and treatment during the first year, and at least one additional visit to the dermatology nurse for self-management training, depending on disease severity. Self-management training consists of promoting compliance and of preventing exacerbations, coping with itching and managing psychosocial problems.

Outcome parameters

Data collection took place at three time points: at baseline (t0), 3 months (t1) and 12 months (t2) after randomization.

Primary outcome measures were disease-specific quality of life, self-reported data on skin status, and physical symptoms of itching. Secondary outcome measures were direct and indirect costs of care, costs of e-health service, outpatient visits, and days taken off work by adult patients and the parents of children with AD.

Quality of life was measured using the Dermatology Life Quality Index (DLQI) for adults online. This consists of 10 items, resulting in a total score ranging from 0 to 30.^{10,11} The Infants' Dermatitis Quality of Life Index (IDQOL) measures the quality of life of the child and is filled in online by the parents or caregivers of the child. The items and scoring of the IDQOL and DLQI are comparable.^{12,13}

Self-reported data on skin status and itching were collected using two parts of the (shortened) 'Impact of Chronic Skin Disease on Daily Life' questionnaire online.^{14,15} Extent and severity of AD were measured for nine parts of the body: adding up the scores gives the total score of the affected area, ranging from 9 to 36. A VAS ranging from 0 to 100 was used to measure the intensity of itch.

Direct medical costs were calculated by multiplying actual resource utilization with unit costs. Unit costs were estimated according to the guidelines for pharmacoeconomic research.¹⁶ Direct costs of care consisted of the costs of the e-health service and the costs of outpatient visits. Data on hospital visits and e-consultations or visits to the general practitioner were

collected from the corresponding Electronic Patient Record of the hospital or from the general practitioner. Indirect costs of care were estimated using two modules online of the 'Health and Labour Questionnaire' and by applying the friction cost approach to account for reduced productivity during paid work and unpaid labour.^{17,18} A written diary was developed to collect data about days off work. Patients filled in the diary at t1 and t2. As a computer, camera and internet access are commonly available to patients in the Netherlands, the cost of this equipment was not included in our analyses. All costs were updated to 2009 by applying Dutch price indices.

Data analysis

We calculated that 80 patients were required in each study arm to reach a power of 80% to establish a difference in costs of €150, enough to outweigh the costs of the service. Thereby we assumed that there would be no negative effects on disease-specific quality of life. Taking into account drop-out and the possibility of more heterogeneity than expected, we aimed to include 100 patients in each study arm.

Outcomes of quality of life, skin status and itch intensity were analysed using linear mixed models with random intercept, which are robust to missing data. Data of the adults and children were analysed together. The covariates sex, age and educational level of the patient were included in the model, as

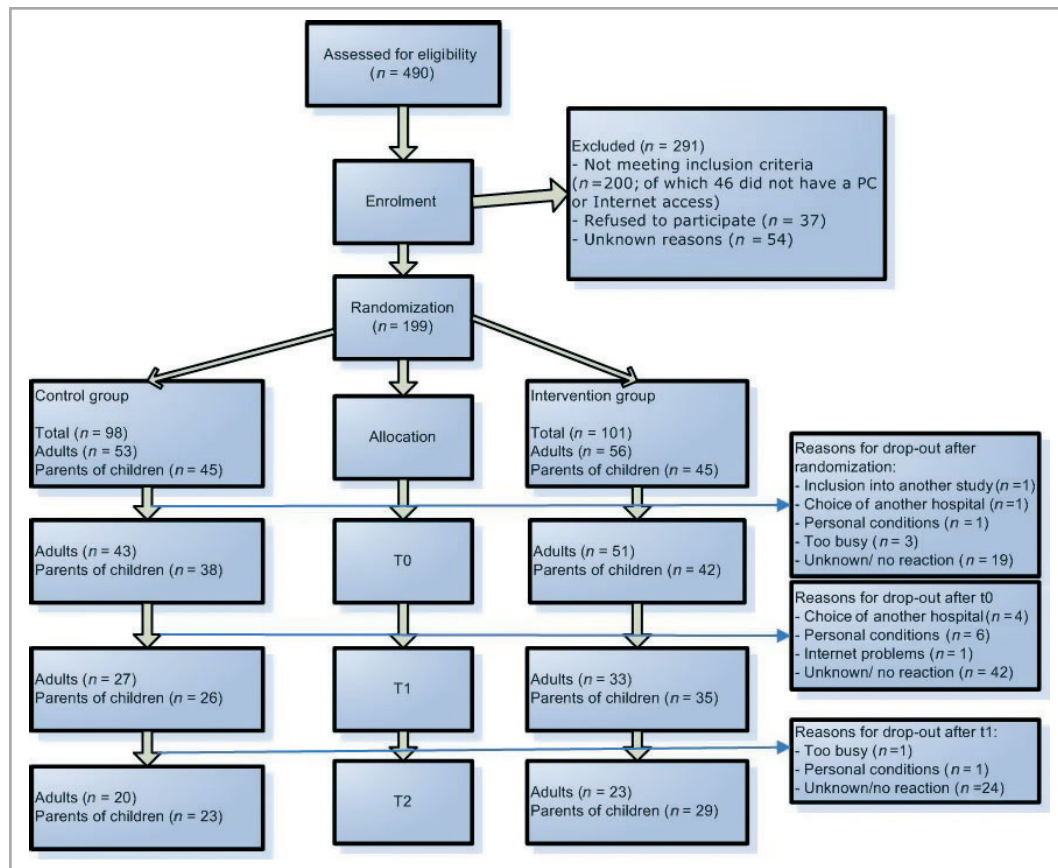


Fig 1. Flow chart of study participation, based on returned questionnaires for clinical outcomes.

well as group, time and the interaction of group and time. Intention-to-treat analyses were carried out.

Missing patient data on the volumes of utilized resources were imputed with multiple imputation multiple imputation.¹⁹ In addition, missing data were replaced by the corresponding group mean values, for comparison with results obtained after multiple imputation. Uncertainty in volumes and costs was assessed by bootstrapping (2000 samples). Direct, indirect and total costs of the intervention group and control group and their differences were calculated in each bootstrap sample. Based on these samples we determined the 95% confidence intervals (CIs), and the probability that the

e-health intervention was cost saving compared with usual care. Furthermore, the time required for the e-health intervention to yield positive returns, given the initial investment costs (development of the digital eczema portal: €40 000), as well as annual maintenance costs (€2000), was calculated.

Results

Study population

In total, 199 participants were included between 2006 and 2009 (Fig. 1). In adult patients, more men (10/15) than

Table 1 Characteristics of the study population

	Intervention group adults		Control group adults	
Demographic data	n		n	
Age (years), mean (SD)	56	30.9 (12.7)	53	32.1 (10.8)
Women, n (%)	56	39 (70)	53	26 (49)
Length of period with AD (years), mean (SD)	55	21.8 (14.3)	53	20.8 (13.8)
Educational level, n (%)	56		52	
Low		1 (2)		8 (15)
Medium		23 (41)		19 (37)
High		30 (54)		24 (46)
Other		2 (4)		1 (2)
Civil status, n (%)	56		53	
Married/living together		27 (48)		21 (40)
Single		26 (46)		30 (57)
Divorced		3 (5)		1 (2)
Widowed		0		1 (2)
<i>Clinical baseline data</i>				
Quality of life, mean (SD)	51	8.94 (5.66)	43	9.72 (6.79)
Severity of AD, mean (SD)	51	16.80 (3.23)	43	17.77 (3.83)
Intensity of itch, mean (SD)	51	59.02 (27.87)	43	64.23 (24.67)
	Intervention group parents of children		Control group parents of children	
Demographic data	n		n	
Age of child (years), mean (SD)	45	2.9 (1.7)	45	2.7 (1.6)
Girls, n (%)	45	14 (31)	45	26 (58)
Parent: mother, n (%)	45	38 (84)	45	35 (78)
Length of period with AD (years), mean (SD)	45	2.1 (1.5)	45	2.1 (1.5)
Educational level of parent, n (%)	45		45	
Low		4 (9)		4 (9)
Medium		12 (27)		17 (38)
High		29 (64)		24 (53)
Care for the child during working hours of parents, n (%)	45		45	
Nursery		11 (24)		11 (24)
Elementary school		16 (36)		16 (36)
Child care		11 (24)		7 (16)
Other		7 (16)		11 (24)
<i>Clinical baseline data</i>				
Quality of life, mean (SD)	42	6.88 (4.61)	38	7.37 (4.96)
Severity of AD, mean (SD)	42	17.02 (3.5)	38	16.84 (3.09)
Intensity of itch, mean (SD)	42	67.00 (24.96)	38	65.42 (21.72)

AD, atopic dermatitis. Educational level: low, elementary education; medium, high school or middle-level applied education; high, higher professional or academic education.

women (5/15) dropped out after randomization. There were no differences in the group of adult patients between drop-outs after t0 and completers.

Drop-out occurred more often in the control group of parents (16%) than in the intervention group of parents (7%). In parents, among completers more mothers (85%) than fathers (15%) filled in questionnaires whereas under drop-outs after randomization the number of fathers and mothers was equal. In the group of parents, drop-outs were more likely to be parents of girls, lower educated and with a slightly higher score on intensity of itching.

Characteristics of the intervention and control groups were similar (Table 1). However, due to chance, the intervention group of adults comprised more women than the control group (70% vs. 49%), whereas in the intervention group of parents there were fewer girls than in the control group (31% vs. 58%).

Clinical outcomes

There were no significant differences between both groups over time for quality of life (P for interaction = 0.45; Fig. 2) and intensity of itching (P for interaction = 1.00; Fig. 3). The severity of AD differed significantly over time between the two groups (P for interaction = 0.04; Fig. 4). However, the differences between the groups at each time point were not significantly different (Table 2).

Costs

In Table 3, an overview is given of the volumes of health care utilization. When applying multiple imputation, the difference in direct costs between intervention and control groups was €24 (95% CI -360 to 383), whereas this difference was -€618 (95% CI -2502 to 1143) for indirect costs. The difference in total costs between the intervention group and control group was -€594 (95% CI -2545 to 1227) per patient for the first year of treatment. Bootstrap analyses revealed that costs are expected to be lower in the intervention group with a probability of at least 73% (Table 4). Applying mean imputation resulted in similar results (Appendix 1).

In our hospital, each year, about 250 new patients with AD visit the outpatient clinic. If we assume, conservatively, that at least 20% of these new patients will use the eczema portal, then the expected annual savings are around $50 \times €590 = €29\,500$. Accounting for the initial investment costs for the development of the digital eczema portal (€40 000), as well as annual maintenance costs (€2000), the net profit after the first year equals -€10 500 [-€40 000 (development) + €29 500 (patient savings)]. After 2 years, the net profit will equal €17 000, namely -€40 000 (development) - €2000 (maintenance costs for year 2) + $2 \times €29\,500$ (annual savings). Along these lines, the net profit after 4 years increases to €72 000 (Appendix 2). In practice, the willingness to use the portal may be much higher than 20%, given the benefits of the portal for patients with

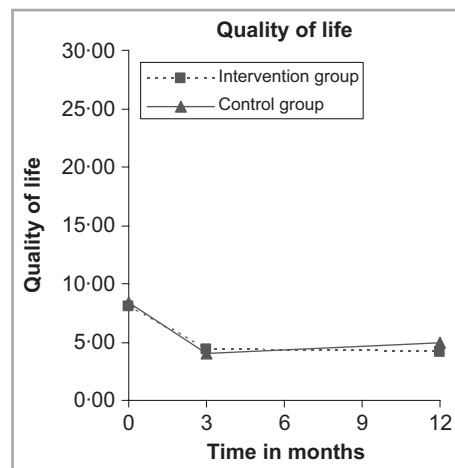


Fig 2. Quality of life scores.

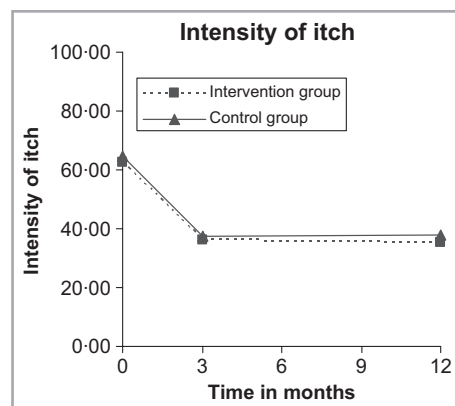


Fig 3. Intensity of itch.

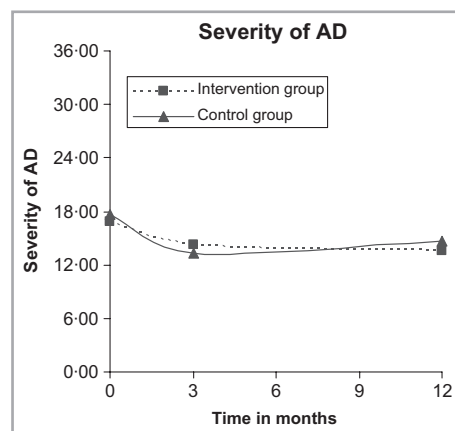


Fig 4. Severity of atopic dermatitis (AD).

AD. In that case, future savings incurred by the portal will, of course, also be higher than shown in Appendix 2.

Discussion

In this randomized controlled trial with economic evaluation in patients with AD, we showed that during follow-up after

Table 2 Differences between intervention and control group at clinical outcomes based on a mixed model analysis

Variable	Group	n	Difference (I – C) (95% CI)	P-value
Quality of life t0	I	93	–0.36 (–1.79 to 1.07)	0.62
	C	80		
Quality of life t1	I	68	0.74 (–0.92 to 2.40)	0.38
	C	53		
Quality of life t2	I	52	–0.11 (–1.93 to 1.71)	0.90
	C	43		
Severity atopic dermatitis t0	I	93	–0.34 (–1.31 to 0.63)	0.49
	C	80		
Severity atopic dermatitis t1	I	68	1.01 (–0.14 to 2.15)	0.08
	C	53		
Severity atopic dermatitis t2	I	52	–0.78 (–2.04 to 0.49)	0.23
	C	43		
Intensity itching t0	I	93	–1.24 (–8.74 to 6.25)	0.74
	C	80		
Intensity itching t1	I	68	–0.94 (–9.79 to 7.92)	0.83
	C	53		
Intensity itching t2	I	52	–0.96 (–10.80 to 8.89)	0.85
	C	43		

I, intervention group; C, control group; CI, confidence interval; t0, baseline; t1, at 3 months; t2, at 12 months.

initial diagnosis and treatment during a face-to-face contact, e-health is as effective as the usual face-to-face care with regard to disease-specific quality of life, severity of the eczema and intensity of itching. A cost-minimization analysis from a societal perspective showed that the chance that the e-health intervention is cheaper is at least 73%. The differences in costs can be attributed to lower indirect costs in the intervention group due to lower work absenteeism. Furthermore, costs at the dermatology department for the intervention group appear to be lower, due to a lower number of consultations, and the relatively low costs of e-consultations. Conversely, direct costs related to care in other hospital departments are higher in the intervention group, because of a slight increase, on average, in days of hospitalization.

A previous Norwegian study has shown that web-based consultations are feasible for parents of children with AD.²⁰ Both the intervention and the control group received an educational session prior to the intervention; the intervention group had access to remote dermatology consultations, while the control group received traditional face-to-face care. The intervention did not affect disease severity but the mean number of skin treatments decreased in both groups, implying better self-management.²⁰ Our findings demonstrate that

Table 3 Unit costs and volumes of resource utilization

	Unit costs (€)	Volumes of resource utilization, mean (95% CI)	
		Intervention group	Control group
Direct costs			
Care at the dermatology department			
Telephone consultation with a dermatologist	54.85	0.3 (0.2–0.5)	0.6 (0.4–0.9)
Combined visit to dermatology nurse and dermatologist	155.79	1.0 (0.9–1.1)	1.4 (1.2–1.6)
Visit to a dermatologist	109.70	2.0 (1.6–2.3)	2.3 (1.9–2.8)
Visit to a dermatology nurse	46.09	0.1 (0.0–0.2)	0.1 (0.0–0.2)
Day of hospitalization	522.17	0.3 (0.0–0.8)	0.3 (0.0–0.8)
Number of e-consultations with dermatology nurse	13.82	3.4 (2.7–4.2)	0.0 (0.0–0.0)
Care at other hospital departments			
Telephone consultation with a medical specialist	54,854.85	0.1 (0.0–0.1)	0.2 (0.0–0.3)
Combined visit to medical specialist and specialized nurse	155.79	0.0 (0.0–0.1)	0.0 (0.0–0.1)
Visit to a medical specialist	109.70	0.4 (0.2–0.7)	0.5 (0.1–1.0)
Visit to a specialized nurse	46.09	0.1 (0.0–0.1)	0.0 (0.0–0.0)
Day of hospitalization	522.17	0.2 (0.0–0.5)	0.1 (0.0–0.2)
Care by the general practitioner			
Telephone consultation with a general practitioner	11.08	0.8 (0.5–1.1)	0.8 (0.5–1.1)
Visit to a general practitioner	22.16	2.5 (1.8–3.3)	2.7 (2.0–3.5)
Home visit by a general practitioner	44.32	0.1 (0.0–0.1)	0.0 (0.0–0.1)
Indirect costs			
Visits with transportation and parking costs to a medical specialist or nurse in a hospital	5.19	3.6 (3.1–4.1)	4.4 (3.7–5.1)
Visits with transportation and parking costs to a general practitioner	3.37	2.5 (1.8–3.3)	2.7 (2.0–3.5)
Days of work absenteeism	306.96	2.0 (0.7–4.1)	4.0 (1.4–7.6)
Hours with loss of productivity during work	38.37	34.0 (14.0–61.1)	35.5 (15.0–62.4)
Hours with loss of productivity at unpaid work	13.93	41.3 (13.8–80.1)	39.5 (13.8–74.9)

CI, confidence interval.

Table 4 Costs of resource utilization after multiple imputation nonlinear

	Intervention group (€), mean (95% CI)	Control group (€), mean (95% CI)	Cost difference I – C (€), mean (95% CI)
Direct costs			
Dermatology department	563 (385–816)	656 (481–960)	
E-consultation	47 (37–58)	0	
Other hospital departments	171 (70–324)	97 (40–181)	
General practitioner	67 (49–88)	70 (53–91)	
Total direct costs	848 (622–1134)	823 (620–1137)	24 (–360 to 383)
Total indirect costs	2530 (1414–3958)	3148 (1672–5013)	–618 (–2502 to 1143)
Total costs	3378 (2210–4845)	3972 (2453–5871)	–594 (–2545 to 1227)
Probability intervention is cost-saving			73.00%

I, intervention group; C, control group; CI, confidence interval.

severity of the eczema and impact on quality of life decreased in both groups, concluding that both interventions are equally effective. This is in line with other studies offering e-health instead of usual care to patients with a chronic disease. Differences in effects on clinical outcome parameters were absent or small.^{21–26}

We showed that e-health is expected to reduce costs. However, the outcome of economic evaluations of e-health interventions is not consistent, perhaps (partially) due to great heterogeneity in interventions.²⁷ In the study of Bergmo *et al.*²⁰ on web-based consultations for children with AD, no differences in resource use or absence from work were found between intervention group and control group. Other studies on e-health interventions in patients with heart failure, diabetes and asthma, however, did show a reduction in rehospitalization^{28,29} and travelling costs.^{28,30}

Our study has some limitations. A high number of participants dropped out in both study arms despite reminders by e-mail and telephone. We therefore analysed data on clinical outcomes with the linear mixed models approach which makes full use of the available data and minimizes the bias from missing longitudinal normal continuous data in small or moderate sample sizes.³¹ All missing volumes of resource utilization were imputed using multiple imputation and uncertainty was handled using bootstrapping. Multiple imputation has been shown to be a reliable method for missing cost data.³²

Drop-out is a well-known phenomenon in intervention studies^{33,34} and e-health studies with long-term follow-up.^{35,36} In e-health studies, drop-out rates of up to 57% are described.³⁷ In this study, reasons for not returning questionnaires were in most cases unknown. However, based on our clinical experience, we think that drop-out in this study may be explained by a decrease in disease activity at 3 months after inclusion, which was shown in both study arms. Improvement in condition was earlier revealed as one of the predictors for drop-out in web-based interventions for anxiety and depression.³⁷

Only a limited number of patients with moderate disease severity was included, and this may limit the generalizability of

our findings. Patients with severe AD using oral immunosuppressive drugs or UVB/UVA phototherapy were excluded because these medical treatments require intensive face-to-face and laboratory control. Another limitation of our study is the study period, which was confined to 1 year. This may have been too short to unveil differences in direct costs, as it may be expected that patients in the intervention group will have fewer follow-up visits after the first year, leading to lower costs.

Finally, blinding was not feasible, so patients and dermatologists and nurses were aware of the allocation. Clinical outcomes were self-reported in both arms and could have been influenced by the awareness of the allocation. However, the study took place in a clinical setting and may therefore be characterized as a pragmatic trial reflecting intervention effects in real-life conditions.³⁸

We did not perform subgroup analyses, e.g. for adults and parents of children separately, due to sample size restrictions. Future research in a larger population is needed to investigate which patients benefit most from e-health and if there are differences between adults and parents of children with AD. In addition, a longer follow-up period is recommended to determine long-term cost-effectiveness. To allow further comparison with costs of e-health interventions for other chronic diseases, a generic outcome measure should be incorporated.

We conclude that e-health, after initial diagnosis and treatment, for patients with mild to moderate AD is as effective as usual face-to-face care with regard to quality of life and severity of disease. Considering all direct and indirect costs over a 1-year period, there is a substantial chance that e-health is cheaper because of fewer days of absenteeism from work. Therefore, e-health is a valuable service for patients with AD.

What's already known about this topic?

- E-health, consisting of e-consultation, monitoring, treatment instruction and patient information, is used increasingly in care for patients with chronic conditions.

What does this study add?

- E-health for patients with mild to moderate atopic dermatitis is, after initial diagnosis and treatment, as effective as usual face-to-face care with regard to quality of life and severity of disease.
- Considering all direct and indirect costs over a 1-year period, there is a substantial chance that e-health is cheaper because of fewer days of absenteeism from work.

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Appendix 1. Comparison of missing values replaced by mean and nonlinear multiple imputation for direct and indirect costs

Costs	Missing values replaced by mean, € (95% CI)	Multiple imputation nonlinear, € (95% CI)
Control group		
Direct costs		
Dermatology department	670 (492–980)	656 (481–960)
E-consultation	0	0
Other hospital departments	103 (47–179)	97 (40–181)
General practitioner	69 (51–90)	70 (53–91)
Total direct costs	842 (637–1171)	823 (620–1137)
Total indirect costs	3055 (1340–5327)	3148 (1672–5013)
Total costs	3898 (2147–6241)	3972 (2453–5871)
Intervention group		
Direct costs		
Dermatology department	567 (386–823)	563 (385–816)
E-consultation	47 (37–58)	47 (37–58)
Other hospital departments	172 (69–331)	171 (70–324)
General practitioner	65 (48–87)	67 (49–88)
Total direct costs	852 (619–1143)	848 (622–1134)
Total indirect costs	2519 (1307–4027)	2530 (1414–3958)
Total costs	3371 (2105–4914)	3378 (2210–4845)
Costs difference, intervention group – control group		
Total direct costs	10 (–359 to 341)	24 (–360 to 383)
Total indirect costs	–536 (–2065 to 716)	–618 (–2502 to 1143)
Total costs	–527 (–2122 to 818)	–594 (–2545 to 1227)
Probability intervention is cost-saving	75.20%	73.00%

CI, confidence interval.

Appendix 2. Costs (negative) and savings (positive) of using the eczema portal

Year	Development costs (one-off), €	Annual maintenance costs, €	Cumulative (total) costs, €	Number of patients per year	Annual savings, €	Cumulative (total) savings, €	Net profit of the eczema portal, €
1	–40 000	0	–40 000	50	29 500	29 500	–10 500
2	0	–2000	–42 000	50	29 500	59 000	17 000
3	0	–2000	–44 000	50	29 500	88 500	44 500
4	0	–2000	–46 000	50	29 500	118 000	72 000