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ORIGINAL ARTICLE

The Challenge for Successful Self-Help: Side Effects of Discontinuing an Internet-Based Program for Skin Picking Disorder

Linda M. Mehrmann[1] · **Alexander L. Gerlach**[1]

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Abstract

Background Research suggests that many people enrolled in internet-based mental health interventions drop out without completing the program. We implemented an efficacious internet-based self-help tool for people affected by skin picking disorder, aiming to evaluate the impact of an early withdrawal in terms of self-efficacy and treatment motivation.

Method We compared skin picking symptomatology (SPS), skin picking related self-efficacy (SP-SE) and motivation to change (SP-MtC) of 208 completers (52%) vs. 192 non-completers at 12-weeks post-assessment.

Results The decrease in SPS was significantly greater for completers ($n = 208$; $M = 13.34$; $SD = 4.72$) compared to non-completers ($n = 192$; $M = 14.35$; $SD = 4.94$; Cohen's $d = -.39$) at post-assessment. SP-SE increased significantly more for program completers ($M = 31.72$; $SD = 6.50$) compared to non-completers ($M = 28.25$; $SD = 6.30$; Cohen's $d = .66$) at post-assessment. SP-MtC significantly decreased in both groups, with higher scores for completers across all assessments ($d_{\text{pre-post}} = .06$).

Conclusions Internet-based self-help tools can effectively reduce symptomatology. Participants, who do not complete the program, report lower treatment motivation and treatment-oriented self-efficacy, potentially reducing their help-seeking efforts. Treatment providers need to consider how to address these potentially adverse effects.

Keywords Self-help interventions · Skin picking · Adherence · Attrition · Self-efficacy · Motivation to change

Introduction

Skin picking disorder (SPD) or excoriation disorder was first included in the Diagnostic and Statistical Manual (DSM-5) in 2013 (American Psychiatric Association [APA], 2013) and in the International Classification of Diseases (ICD-11; World Health Organization [WHO], 2023) it is newly introduced as a subtype of body-focused repetitive behaviors (BFRBs). SPD involves recurrent picking of one's own skin leading to skin lesions. This behavior is accompanied by unsuccessful attempts to decrease or stop picking (WHO, 2023). Lifetime prevalence according to DSM-5 is 1.4% (APA, 2013). However, prevalence estimates in other studies are somewhat higher. In a systematic review by Farhat and colleagues (2023) on SPD with 19 studies including 38,038 individuals, SPD prevalence estimate was to be as high as 3.35%. With picking behavior leading to visible skin damage and scarring, not surprisingly, individuals affected by SPD report strong psychosocial impairment, e.g., disgust, shame and psychosocial avoidance (Anderson & Clarke, 2019; Tucker et al., 2011).

Despite this detrimental impact of skin picking, more than half of the participants in two different studies reported that they had not been seeking any help for their picking behavior ($n = 393$, 52% [Tucker et al., 2011]; $n = 74$, 56% [Gallinat et al., 2019a]). Commonly reported reasons for not seeking help included doubts about severity ($n = 44$, 60%), insecurity on who to turn to ($n = 34$, 46%), doubts about whether doctors/therapists may have expert knowledge on SPD ($n = 31$, 42%), and embarrassment ($n = 30$, 40.5%; Gallinat et al., 2019a). In order to provide convenient access to help and to overcome barriers to treatment (e.g., stigma and shame; Asplund et al., 2022; Bower & Gilbody, 2005), five internet-based interventions targeting skin picking have been recently developed. Each showed positive effects on symptomatology related to SPD (Asplund et al., 2022; Flessner et al., 2007; Gallinat et al., 2019b; Moritz et al., 2012; Mehrmann et al., 2023).

✉ Linda M. Mehrmann
linda.mehrmann@uni-koeln.de

[1] Institute of Clinical Psychology and Psychotherapy, University of Cologne, Pohligstrasse 1, 50969 Cologne, Germany

In an uncontrolled trial Flessner et al. (2007) investigated the efficacy of an internet-based interactive self-help program ("stoppicking.com"). The program included three modules: assessment (e.g., awareness training; 3–5 weeks), intervention (coping skills to reduce picking, stimulus-control) and maintenance (e.g., relapse prevention; accessed when a goal was met for four consequent weeks). The participants ($n = 313$) used the program on average for 11.7 weeks ($SD = 12.3$), and 4% ($n = 15$) reached the maintenance module. Forty-three percent ($n = 159$) reported at least two post-intervention data points (e.g., during the intervention module) and their symptomatology decreased significantly pre- to post-assessment. Moritz et al. (2012) compared the feasibility and efficacy of two 4-week self-help interventions (habit reversal training [HRT] vs. "Decoupling" [DC]) for SPD-affected participants ($n = 70$). The HRT-manual was a 5-page pdf document helping participants to (1) identify triggers, (2) explain HRT and (3) how to implement the competing response into daily life. The DC-manual was similarly structured except for offering explanations on "decoupling" instead of HRT, which instructed the participants to change the maladaptive behavior into a resembling movement of picking, without damaging the skin. Completion rate was 89% at post-assessment with a significant stronger positive symptom reduction pre- to post-assessment in the HRT-group compared to the DC-group. Gallinat et al. (2019b) investigated the efficaciousness of a 12-week internet-based self-help intervention ("SaveMySkin") for SPD for individuals with self-reported SPD ($n = 64$) in comparison to a waitlist control group ($n = 69$). The program contained psychoeducation, training of self-management skills, a daily supportive monitoring system, and dermatological/psychological counseling via online chat. Completion rate was 65.4% at post-assessment with a significant positive symptom reduction pre- to post-assessment ($d = .67$) compared to the waitlist control group. Asplund et al. (2022) investigated the effectiveness of a 10-week therapist-guided internet-delivered behavioral therapy for patients in a routine psychiatric setting with eighteen SPD and seven hair-pulling affected individuals. Traditional behavioral interventions (e.g., HRT) and acceptance-based techniques (e.g., mindfulness) were included represented in 10 modules. Participants on average completed 7.2/10 modules ($SD = 3.5$, *range* 1–10) and 64% ($n = 16$) completed at least six of the 10 modules, which entailed the core components of treatment. SPD-affected participants experienced a positive symptom reduction pre- to post-assessment ($d = 1.75$), which remained significant at 12-month follow-up ($d = 1.2$). Finally, Mehrmann et al. (2023) investigated the efficacy of an online-based self-help program ("Knibbelstopp") for 43 skin picking affected individuals with a multiple baseline design. The CBT-based program included three parts (psychoeducation and awareness training, strategies against picking [e.g., HRT, stimulus control], and relapse prevention). Completion rate was 58% ($n = 25$) at post-assessment with a significant positive symptom reduction pre- to post-assessment and throughout a 6-month follow-up.

In summary, several effective online programs have been developed, however, a substantial number of participants seem to discontinue participation of these programs early (i.e., before completion of all treatment modules). Some studies documented the reasons provided by participants for discontinuing the treatment. These reasons included factors such as heavy workloads and worsening of other mental health issues unrelated to the treatment itself (Asplund et al., 2022). Other reasons mentioned were infrequent access to the internet, early reduction in symptoms, and financial costs associated with the program (Flessner et al., 2007). Lack of motivation, increased life stress, exacerbation of mental or physical problems, and insufficient social support were also reported as additional reasons for discontinuation (Mehrmann et al., 2023). Two of the studies compared completers vs. non-completers and both did find only few differences with regard to background variables or questionnaire scores at pre-assessment. In one study, non-completers were found to be older than completers (Moritz et al., 2012), while the other study reported a higher rate of comorbidity among non-completers (Mehrmann et al., 2023).

High attrition rates (dropouts) are a common issue among internet-based self-guided interventions for physical or mental health topics (Cavanagh, 2010). According to a systematic review by Donkin et al. (2011) half of 69 e-therapy interventions ($n = 33$; 48%) reported on adherence and examined the relationship between adherence and outcome. In a study conducted by Linardon and Fuller-Tyszkiewicz (2020), which analyzed 70 randomized controlled trials (RCTs) of smartphone-delivered interventions for mental health problems, the mean meta-analytic attrition rate was found to be 24.1% at short-term follow-up (≤ 8 weeks) and 35.5% at long-term follow-up (> 8 weeks). In most studies, the number of logins from participants measured adherence. However, research has shown that the number of completed modules is the most significant factor in determining outcomes in psychological health interventions (Donkin et al., 2011).

Considering the potential significance of impaired adherence and attrition, Beatty and Binnion (2016) examined potential predictors of adherence and reported reasons for discontinuation in psychological online interventions. Significant predictors for high adherence were found to be female gender, higher treatment expectancy/credibility and the presence of guidance or therapist support (Beatty & Binnion, 2016). Negative predictors were not having enough time, dissatisfaction with program content, perceiving the content as impersonal, and computer difficulties (Beatty & Binnion, 2016). The findings regarding

age, baseline symptom severity, control group allocation, and numerous other assessed predictors were inconclusive or insufficient (Beatty & Binnion, 2016). Interestingly, the authors also looked at motivation and readiness to change as well as self-efficacy/self-confidence (Beatty & Binnion, 2016). In two of seven studies, that assessed motivation-related characteristics, motivation/readiness to engage in therapy significantly predicted adherence (Al-Asadi et al., 2014; Postel et al., 2010). Motivation/intention to complete treatment was assessed in four studies, and out of these, two studies found significant associations between these variables and adherence (Strecher et al., 2008; Wojtowicz et al., 2013). From the four studies that examined self-efficacy or self-confidence to predict adherence (Al-Asadi et al., 2014; El Alaoui et al., 2015; Hebert et al., 2010; Wagner et al., 2015), only one found that "self-directedness", or taking responsibility for one's own choices and having confidence in solving problems, positively predicted adherence (Wagner et al., 2015).

In summary, although some research has examined predictors for adherence and attrition in internet-based self-guided programs (Beatty & Binnion, 2016; Linardon & Fuller-Tyszkiewicz, 2020), results are mixed, and more research is needed. Moreover, there is a lack of research looking at the consequences of discontinuing self-help treatment before completion.

Research on negative side effects of undergoing psychotherapy has gained importance in the past decade (Linden, 2013). While we know much about participants who complete online-interventions, little is known about effects of dropping out of one of the many offered internet-based self-guided interventions and the influence this may have for the individual.

Thus, we conducted a study to investigate possible changes of early withdrawal from an internet-based self-help program for skin picking disorder that may influence further help-seeking behavior and/or adherence to an intervention. Specifically, we considered two variables to be especially promising given that previous research demonstrated for both variables the potential to positively impact treatment outcomes. First, self-efficacy, which represents the confidence in one's ability to produce a desired outcome by their behavior (Bandura, 1997), may increase the ability to engage with an individually satisfactory behavior change (e.g., Meyerbröcker et al., 2022). Second, motivation to change, defined by Miller and Rollnick (2012) as the probability that a person will start, remain, or adhere to an intervention (DiClemente and Prochaska, 1998) has also been shown to be linked to more favorable treatment outcomes (e.g., Heider et al., 2021). Additionally, our aim was to replicate our previous finding regarding the effectiveness of our self-help program (Mehrmann et al., 2023).

Hypotheses

The online self-help program "Knippelstopp" reduces Skin Picking symptomatology measured at post-assessment (H1) with a lasting positive effect at 9-month follow-up (H2). This decrease in symptomatology arguably depends on adherence to the online intervention. Participants, who use the intervention as intended (access at least seven chapters within 12 weeks; further referred to as *completers*) should report less symptomatology at post-assessment compared to *non-completers* (who access less than seven chapters within 12 weeks; H3). Moreover, we expect *completers* to experience an increase of SP-related self-efficacy (SP-SE), and only a small decrease in SP-related motivation to change (SP-MtC), whereas *non-completers* report a weaker increase in SP-SE and relatively larger decrease in SP-MtC measured at post-assessment (H4). Finally, with an exploratory analysis, we examine possible predictors for adherence (H5).

Method

Study Design

In a naturalistic trial (uncontrolled effectiveness study) participants received free access to an unguided self-help intervention for SPD via the open-source learning management system (ILIAS) offered by the University of Cologne. Data was collected online using *Qualtrics* software (version 08/19; https://www.qualtrics.com/de/). The study received approval by the Ethics Committee of the Faculty of Human Sciences, University of Cologne (LMHF0041).

Study Procedure

Recruitment

On our website www.knibbelstopp.de we give information on SPD, our self-help program and the possibility of study participation. With the support of a German self-help group for BFRBs by spreading information in their newsletter and a heightened media interest in SPD our research and website were referred to in interviews on various print and online platforms. Due to great interest in our program, we did not want to decline anyone consenting to participate. Therefore, we extended the initially planned period of participation and recruitment took place from August 2019 to February 2021. Interested individuals were able to get into contact via E-mail and received further information on study participation.

Procedure

When individuals expressed interest, we provided them with information about study participation along with informed consent and a link to the first online-assessment. Upon obtaining participants' consent and completion of the pre-assessment questionnaires, they were provided with personalized login credentials for the online self-help program. After a short introductory text and disclaimer of program usage (i.e., focus on SPD, program is not intended as a substitute for psychotherapy, recommended time spent with the program) participants gained access to part-I (chapter 1–5) of the program. When participants reached the end of a part, they received access to the following part of the program upon request (part II: chapter 6–9, part-III: chapter 10). Regardless of actual time spent with the program or progress, participants received links to online-assessments via E-Mail at fixed time intervals. These intervals were based on median duration of participants to work with the three parts of the program from our pilot-trial (Mehrmann et al., 2023): pre-assessment (pre) + 2 weeks (T-1), + 8 weeks (T-2), + 2 weeks (post) and two 3-month follow-up assessments (FU-1 and FU-2).

The Self-Help Program "Knibbelstopp"

Part-I (chapter 1–5) includes psychoeducation, self-awareness training and a motivation to change module (e.g., goal-setting). In part-II participants get to know strategies against picking behavior: Stimulus control (chapter 6) and HRT (chapter 7), followed by general cognitive-behavioral strategies (chapter 8: cognitive restructuring; chapter 9: implementing positive activities). Part-III focuses on relapse prevention (e.g., emergency plan for difficult situations). Exercises, worksheets, and helpful tips accompany psychoeducational information. The material is illustrated by an example of a fictive participant, who shares her challenges, progress, and experiences across all chapters. For a more detailed description of the program, see Mehrmann et al., 2023.

Materials

Sociodemographic information (pre). We asked for age, gender, family status, educational level, and professional status.

Progress in the online program (T-1, T-2, Post, FU-1, FU-2). With each assessment participants answered, which chapter they last worked on in the online program (*Chapters 1* to *10* or *finished with the last chapter*).

Modified Skin Picking Scale, German version (mSPS-D; Pre, T-1, T-2, Post, FU-1, FU-2; Mehrmann et al., 2017). On a nine-item scale frequency, intensity of picking and impairment due to skin picking are measured on a 5-point Likert-type scale. Scores can range from 0–36 ($n = 770$; $\alpha = .78$).

Questionnaire for the assessment of resources and self-management skills (Ferus; Pre, Post, FU-1, FU-2; Jack, 2007; Subscale self-efficacy [F-SE] and motivation to change [F-MtC]; T-1, T-2). The Ferus is a 66-item (5-point Likert-type scale) self-report measure for health relevant resources and self-management skills. Seven subscales assess motivation to change, coping, self-monitoring, self-efficacy, self-verbalization, hope and social support. Five of these subscales (except motivation to change and social support) combined form an overall score on self-management skills (SMS) ranging from 44 to 220 ($n = 770$, α [SMS] = .95).

SP-related modified Ferus scale for self-efficacy (SP-SE; 9 items) *and motivation to change* (SP-MtC; 11-items; Pre, T-1, T-2, Post, FU-1, FU-2). We modified the self-efficacy and motivation to change scale from the original Ferus by changing the items from a general to a skin picking and program participation specific phrasing, e.g., "I feel able to achieve my intentions and goals." (F-SE) to "I feel able to achieve changing my picking in the future." (SP-SE); "I would like to learn to deal better with difficult situations." (F-MtC) to "I would like to learn to deal with difficult situations without picking." (SP-MtC). Scores on each scale can range from 9 to 45 (SE; $n = 770$, α [F-SE] = .89; α [SP-SE] = .81) and 11 to 55 (MtC; $n = 770$, α [F-MtC] = .79; α [SP-MtC] = .85).

Hospital Anxiety and Depression Scale, German version (HADS-D; Pre, Post, FU-1, FU-2; Petermann, 2011). The HADS-D measures anxiety and depression on a 14-item 4-point Likert-type scale with sum scores ranging from 0–42 ($n = 770$, $\alpha = .85$).

Data Analysis

When information was missing, we added the following data using multiple imputations: either one assessment missing before the last completed assessment ($n = 47$), missing values within one assessment ($n = 24$), or both ($n = 5$). Imputed data was checked for extreme outliers and all participants, who participated due to other BFRBs than Skin Picking were filtered out ($n = 19$). Finally, we split the sample into two groups, dependent on their progress at post-assessment: *chapter 1–6* = non-completers, *chapter 7–10* or *finished all chapters* = *completers*. The reliable change index (RCI; Jacobson & Truax, 1991) using the mSPS-D was calculated from pre- to post-assessment to test how many participants experienced a clinically significant change.

Effects on skin picking (SP) symptomatology (m-SPS-D) throughout 12 weeks (post) and 9-month follow-up (FU-2) were calculated with repeated measurement ANOVAs with planned contrasts to compare pre with post and post with

FU-2. With these repeated measurement ANOVAs SP symptomatology was additionally analyzed for group differences at post-assessment (*completers* vs. *non-completers*) with planned contrasts and Cohen's *d* based on the pooled pre- and posttest standard deviation (Morris, 2008). Pearson's chi-squared tests examined the relationship between RCI (clinically significant change vs. no change) and adherence (*completers* vs. *non-completers*).

In a repeated measurement MANOVA, F-MtC, SP-MtC, SP-MtC and SP-SE were analyzed for group differences (*completers* vs. *non-completers*) at post-assessment, followed by planned contrasts. Whenever sphericity was violated, the Greenhouse–Geisser adjustment was applied. To adjust for multiple comparisons, we used the Bonferroni method in the planned contrasts.

Finally, explorative analyses were conducted using a stepwise binary logistic regression to check for predictors of successful program participation (*completers* vs. *non-completers*) at post-assessment.

Results

Study Sample

Primary inclusion criteria were interest to use the online program, consent to study participation, age ≥ 16 years, and dermatillomania as primary BFRB. More than 1000 interested individuals contacted us via E-Mail. Of these, 770 participated in the pre-assessment after receiving some initial information and met inclusion criteria. Average age was 27 years ($SD = 7.6$; *range*: 16–76), the majority identified as female, $n = 725$ (94%), 38 as male (5%) and seven (1%) identified as divers or choose not to answer. Next to SP, one-fifth ($n = 157$; 20%) reported additional BFRBs: Onychophagia/nail biting ($n = 100$; 13%), Trichotillomania/hair pulling ($n = 22$; 3%), lip biting and/or Morsicatio Buccarum ($n = 17$; 2%) and others ($n = 4$; 0.5%). See Table 1 for sociodemographic and questionnaire-scores at pre-assessment. Half of the participants ($n = 400$; 52%) completed the post-assessment and 36% the FU-2 assessment ($n = 277$). See Fig. 1 for flowchart of study participation. At post-assessment 208 (52%) participants were allocated as *completers* (≥ chapter 7), and 192 (48%) participants as *non-completers* (≤ chapter 6). See Fig. 2 for SP symptomatology at all assessments.

Participants Lost to Analysis Before post-assessment

A multivariate MANOVA with all relevant study outcome parameters (mSPS-D, F-SE, SP-SE, F-MtC, SP-MtC, HADS-D and age) revealed no significant difference between participants, who were lost to analysis before post-assessment ($n = 370$) compared to study participants completing post-assessment ($n = 400$); Pillai's trace $V = .014$, $F[7, 762] = 1.56$, $p = .143$, $\eta p^2 = .014$.

Analysis

Skin Picking Symptomatology

Hypothesis 1 SP symptomatology (mSPS-D) decreased significantly throughout the assessments. A significant main effect of the time of assessment (pre, T-1, T-2, post; $n = 400$) was found in the repeated measures ANOVA for symptomatology scores (Pillai's trace $V = .59$, $F[3, 396] = 190.68$, $p < .001$, $\eta p^2 = .591$). Planned contrasts revealed a large symptom reduction from pre- ($M = 18.72$; $SD = 4.07$) to post-assessment ($M = 13.82$; $SD = 4.84$), $F(1, 398) = 402.24$, $p < .001$, $\eta p^2 = .503$, $d = -1.10$).

Hypothesis 2 This main effect for symptomatology remained significant in the repeated measures ANOVA including the follow-up assessments (pre, T-1, T-2, post, FU-1, FU-2; $n = 277$): Pillai's trace $V = .60$, $F[5, 271] = 91.96$, $p < 0.001$, $\eta p^2 = .602$. Importantly, planned contrasts showed no change of symptomatology from post- ($M = 13.45$; $SD = 4.71$) to FU-2-assessment ($M = 13.20$; $SD = 5.41$): $F(1, 275) = .91$, $p = .341$, *ns*, $\eta p^2 = .003$, $d = -.05$, indicating stability in symptomatology after treatment. See Table 2.

Hypothesis 3 The repeated measures ANOVA for SP symptomatology (mSPS-D) revealed a significant interaction effect for assessment (pre, T-1, T-2, post*;* $n = 400$) × group (*completers* vs. *non-completers*): Pillai's trace $V = .05$, $F[3, 396] = 6.54$, $p < 0.001$, $\eta_p^2 = .047$). Pairwise comparisons showed *completers* to report less symptomatology ($M = 13.34$, $SD = .33$) at post-assessment compared to *non-completers* ($M = 14.35$, $SD = .35$) with a mean difference of 1.00 (SE = .48, $p = .039$, $\eta_p^2 = .011$; $d = -0.39$). See Table 3.

However, we observed only a trend suggesting that participants, who completed the post-assessment, were more likely to show a clinically significant change in symptoms ($n = 99/208$; 47.6%) compared to *non-completers* ($n = 75/192$; 39%): X^2 (1, $n = 400$) = 2.96, $p = .053$ (one-sided), *phi* = .086.

Self-Efficacy and Motivation to Change

Hypothesis 4 The repeated measures MANOVA (assessment × group; F-SE, SP-SE, F-MtC, SP-MtC) revealed a significant main effect for group (Pillai's trace $V = .07$, $F[4, 395] = 7.56$, $p < 0.001$, $\eta_p^2 = .071$), assessment (Pillai's trace $V = .68$, $F[12, 387] = 67.21$, $p < 0.001$, $\eta_p^2 = .676$), and

Table 1 Descriptive statistics of all questionnaires and sociodemographic information at pre for all participants and × Group (completers vs. non-completers)

N	*Pre-assessment*							
	All		*Completers*		*Non-completers*			
	770		*208*		*192*			
	M	*(SD)*	*M*	*(SD)*	*M*	*(SD)*	*F (1, 398)*	η_p^2
Age	27.36	(7.64)	28.15	(8.20)	27.3	(7.40)	1.18	.003
mSPS-D	18.86	(4.31)	19.08	(4.17)	18.33	(3.93)	3.42	.009
HADS-D	14.33	(6.66)	14.21	(6.43)	13.81	(6.34)	.39	.001
Ferus								
F-SE	31.24	(5.95)	31.44	(5.81)	31.64	(5.48)	.12	.000
SP-SE	24.84	(5.54)	24.86	(5.52)	25.34	(5.70)	.74	.002
F-MtC	41.47	(7.34)	41.77	(7.36)	40.55	(7.52)	2.72	.007
SP-MtC	44.61	(6.40)	45.58	(6.09)	43.88	(6.63)	7.18*	.018
C	39.36	(6.76)	39.32	(6.88)	39.88	(6.29)	.73	.002
SM	25.40	(4.10)	25.40	(4.19)	26.05	(3.75)	2.67	.007
SV	18.52	(4.73)	18.71	(4.75)	18.96	(4.72)	.29	.001
H	38.66	(6.82)	38.75	(6.84)	39.18	(6.47)	.42	.001
SS	41.83	(7.62)	42.64	(6.99)	41.78	(7.80)	1.35	.003
SMS	153.19	(24.10)	153.61	(24.06)	155.71	(22.57)	.81	.003
	n	*%*	*n*	*%*	*n*	*%*	X^2	*df*
Gender							4.03	3
Female	342	92%	199	96%	184	96%		
Male	25	7%	7	3%	6	3%		
Other/no information	3	1%	2	1%	2	1%		
Family Status							1.85	4
Married/ Relationship	456	59%	122	59%	108	56%		
Single	298	39%	81	39%	82	43%		
Divorced	7	1%	2	1%	1	1%		
Other/No Information	9	1%	3	1%	1	1%		
Educational Degree							5.90	5
University	389	50%	118	57%	93	48%		
Secondary or Middle School	361	47%	86	41%	96	50%		
Others	20	3%	4	2%	2	1%		
Occupation							5.40	5
Employed	344	45%	100	48%	85	44%		
Students	330	43%	89	43%	87	45%		
Professional Training	51	6%	8	4%	13	7%		
Others	45	6%	11	5%	7	4%		
BFRB-comorbidity	157	20%	39	19%	34	18%	.07	1
Onychophagia/Nil biting	100	13%	21	10%	26	14%		
Trichotillomania/hair pulling	22	3%	8	4%	4	2%		
Lip biting and/or Morsicatio Buccarum	17	2%	5	2%	2	1%		
Others	4	1%	8	4%	2	1%		

mSPS-D = modified skin picking scale, German version; HADS-D = hospital anxiety and depression scale, German version; Ferus = questionnaire for the assessment of resources and self-management skills with the subscales: F-MtC = motivation to change, SP-MtC = skin picking related modified scale for motivation to change, F-SE = self-efficacy, SP-SE = skin picking related modified scale for self-efficacy, C = coping, SM = self-monitoring, SV = self-verbalization, H = hope, SS = social support, SMS = overall score on self-management skills

*$p < .05$, two-tailed

**$p < .001$, two-tailed

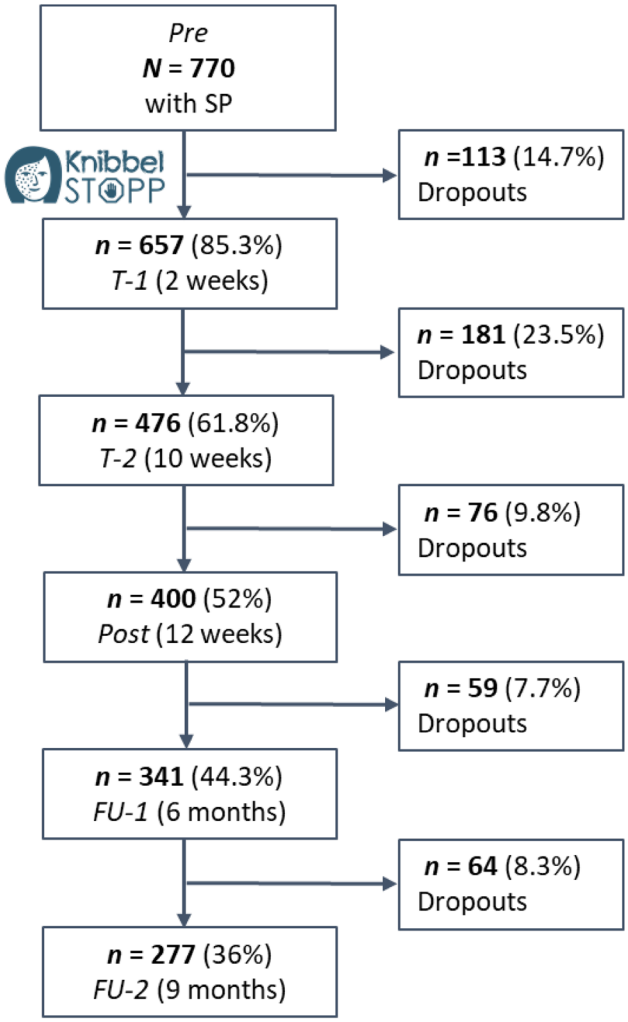

Fig. 1 Flowchart of study participation. Knibbelstopp = name of the online self-help program, pre = assessment at study entrance, T-1 = assessment two weeks after program access, T-2 = assessment 12 weeks after program access, post = assessment after 14 weeks after program access, FU-1 = Follow-up assessment six month after program access, FU-2 = Follow-up assessment nine month after program access, dropouts = participants did not answer the link for the following assessment

a significant interaction effect for assessment × group (Pillai's trace $V = .12$, $F[12, 387] = 4.24$, $p < 0.001$, $\eta_p^2 = .116$).

Univariate follow-up analyses of the four subscales showed significant main effects for assessment (see Table 2). Additionally, the F-SE and SP-SE subscales had significant interaction effect for assessment × group (F-SE: $F[2.63, 1045.31] = 4.66$, $p = .005$, $\eta_p^2 = .012$; SP-SE: $F[2.58, 1026.33] = 21.76$, $p < .001$, $\eta_p^2 = .052$).

While both groups did not differ at pre-assessment in the F-SE and SP-SE scales, the *completers* reported significantly higher self-efficacy ratings at post-assessment (F-SE: $M = 36.99$, $SD = 5.18$; SP-SE: $M = 31.72$, $SD = 6.50$) compared to *non-completers* (F-SE: $M = 35.58$, $SD = 6.03$; SP-SE: $M = 28.25$, $SD = 6.30$) with a mean difference of 1.41 (F-SE; SE = .56, $p = .012$, $\eta_p^2 = .016$, $d = .29$) and 3.47 (SP-SE; SE = .61, $p < 0.001$, $\eta_p^2 = .068$, $d = .66$).

For Motivation to Change, both groups differ significantly throughout the assessments with a main effect for group (F-MtC: $F[1. 398] = 7.50$, $p = .006$, $\eta_p^2 = .018$; SP-MtC: $F[1, 398] = 12.03$, $p < 0.001$, $\eta_p^2 = .029$). While *completers* ($M = 41.77$, $SD = 7.36$) and *non-completers* ($M = 40.55$, $SD = 7.52$) do not differ with regard to Motivation to Change (F-MtC) at pre-assessment, *completers* report higher Motivation to Change ($M = 41.77$, $SD = 5.39$) compared to *non-completers* ($M = 40.45$, $SD = 6.47$) at post-assessment with a mean difference of − 1.32 (SE = .59, $p = .027$, $\eta_p^2 = .012$, $d = .01$). For SP-related MtC *completers* ($40.39 \leq M \geq 45.58$; $6.09 \leq SD \geq 7.74$) report significantly higher ratings compared to *non-completers* ($38.25 \leq M \geq 43.88$; $6.63 \leq SD \geq 8.63$) at all assessments with mean differences ranging from − 1.7 to − 2.78 ($0.64 \leq SE \geq 0.82$, $0.001 \leq p \geq 0.009$, $0.017 \leq \eta_p^2 \geq 0.032$, $d_{\text{pre-post}} = .06$). See Table 3.

Exploratory Analysis (Predictors of Adherence)

Hypothesis 5 With a binary logistic regression, we explored the effects of age, comorbid BFRB, gender, mSPS-D, F-MtC, SP-MtC, F-SE, and SP-SE, and HADS-D on the likelihood that participants will complete the program (*completers/adherence*) versus discontinue program usage (*non-completers/non-adherence*). The logistic regression model was statistically significant (X^2 [1, $n = 400$] = 7.13, $p = .008$. However, the model explained only 2.4% (Nagelkerke R^2) of the variance in adherence. It classified 57.5% of cases correctly (compare Table 4). High SP-related MtC were 1.04 times as likely to complete the program (OR = 1.04, 95%CI [1.01, 1.08]). None of the other variables was associated with adherence.

Discussion

Early withdrawal from internet-based self-guided mental health interventions is common (Donkin et al., 2011; Linardon & Fuller-Tyszkiewicz, 2020), and it might be an underrecognized negative consequence with the provision of these tools. Therefore, we examined the effects of discontinuing an internet-based self-help program for SPD. We implemented an effective program, with a significant reduction on skin picking symptomatology at post-assessment (H1) lasting throughout the follow-up period for all participants regardless of their progress in the program (H2). As hypothesized, *completers* of the program experienced a stronger symptom

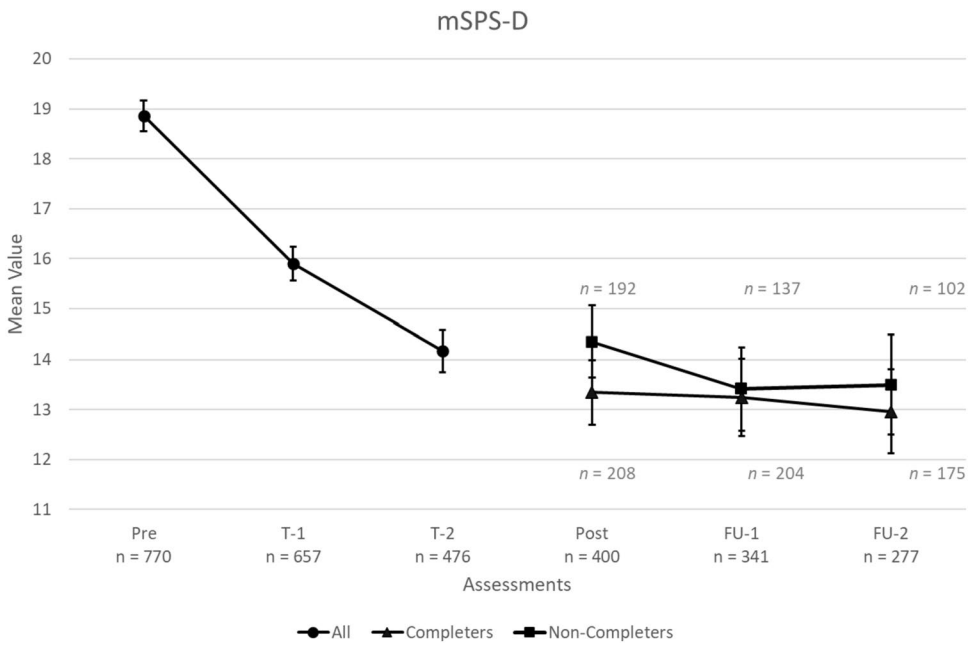

Fig. 2 Skin picking symptomatology at all assessments. mSPS-D = modified Skin Picking Scale, German version (range: 0–36); completers = access at least seven chapters at post-assessment, non-completers = access less than seven chapters at post-assessment; pre = assessment at study entrance, T-1 = Assessment two weeks after program access, T-2 = assessment 12 weeks after program access, post = assessment after 14 weeks after program access, FU-1 = Follow-up assessment six month after program access, FU-2 = follow-up assessment nine month after program access; error bars show 95%-confidence interval

reduction at post-assessment compared to *non-completers* (H3). In addition, completing the program at post-assessment also resulted in higher general self-efficacy and skin picking related self-efficacy compared to non-completion (H4). Being able to change one's own problem behavior by implementing suggestions or exercises from the online program may have improved the participants confidence to deal with difficult behavior changes.

Moreover, the *non-completers* experienced a stronger decrease in picking related motivation to change compared to *completers* at post-assessment (H4). In the exploratory analysis, we found only one predictor for adherence, namely skin picking related motivation to change (H5). However, this predictor was able to explain only a small proportion of 2.4% of the variance within the present sample.

These results suggest that the decision to discontinue the skin picking program may reduce skin picking related self-efficacy and skin picking related motivation to change, at least within the 12-week timeframe following program initiation. Notably, *completers* reported significant higher skin picking related motivation to change compared to *non-completers* from the first assessment onward.

The decrease of picking related motivation to change in the *non-completer* group may have several different reasons. Both groups reported significantly less symptomatology at post-assessment compared to pre-assessment. Thus, the reduction of symptomatology may be one reason for this comparable decrease in MtC and participants could have decided to discontinue the program participation due to the behavior change achieved at that moment. Lamentably, we do not know anything about the reasons why participants discontinued program usage and cannot rule out external (e.g., workload, life-events), internal (early reduction in symptoms, worsening of other health issues) or program-related aspects (e.g., technical issues, dissatisfaction with the content etc.). Nevertheless, it's important to recognize that many detrimental chronic behaviors, like skin picking, demand persistent motivation and effort even after effectively altering related behaviors, with the aim of maintaining personal achievements. Thus, the capacity to uphold elevated self-efficacy and the motivation to change may remain crucial for sustaining the progress achieved.

The adherence rate of 52% observed in this study for the online program is relatively high compared to adherence rates reported in other internet-based self-guided interventions for SPD, which have ranged from 11 to 57% (Asplund et al., 2022; Flessner et al., 2007; Gallinat et al., 2019b; Moritz et al., 2012; Mehrmann et al., 2023). Similar to the findings of Moritz et al. (2012) and Mehrmann et al. (2023) *completers* and *non-completers* did not differ on any variable at pre-assessment, except for skin picking related motivation to change. In contrast to the findings on age (Moritz et al., 2012) and comorbidity (Mehrmann et al., 2023) we did not find any difference regarding age or comorbidity. However, we assessed BFRB-comorbidity and not general comorbidity and used only a proxy (HADS-D) in order to estimate general comorbidity.

This was one of the first studies to focus on self-efficacy and motivation to change for an SP-intervention. Similarly, Al-Asadi et al. (2014) found completers of a web-based intervention for problem drinkers to report higher treatment readiness (subscale; TCU Motivation for Treatment scale; De Weert-Van Oene et al., 2002) compared to non-completers. Likewise, Al-Asadi et al. (2014) found

Table 2 Univariate ANOVAs for SP Symptomatology (mSPD-D), self-efficacy (F-SE), motivation to change (F-MtC), skin picking-related self-efficacy (SP-SE), skin picking-related motivation to change (SP-MtC), and general psychopathology (HADS-D) for $n = 400$ (post-assessment) and $n = 277$ (FU-2 assessment)

n	*400*														
	Pre		T-1		T-2		Post		FU-1		FU-2		*F*	*df1, df2*	η_p^2
	M	(*SD*)	*M*	(*SD*)	*M*	(*SD*)	*M*	(*SD*)							
mSPS-D	18.72	(4.07)	15.68	(4.28)	13.97	(4.61)	13.82	(4.84)					214.90**	2.56, 1019.14	.351
Cohen's d^a			.73		1.09		1.10								
Ferus															
F-SE	31.53	(5.65)	31.89	(5.78)	32.93	(5.73)	36.31	(5.65)					158.14**	2.63, 1026.33	.284
Cohen's d^a			− .06		− .25		− .85								
SP-SE	25.09	(5.61)	27.72	(5.90)	29.54	(6.48)	30.06	(6.63)					108.61**	2.58, 994.23	.214
Cohen's d^a			− .46		− .74		− .81								
F-MtC	41.19	(7.45)	39.38	(8.29)	37.50	(8.77)	41.14	(5.96)					31.80**	1.83, 726.19	.074
Cohen's d^a			.23		.45		.01								
SP-MtC	44.76	(6.40)	42.62	(6.96)	39.89	(7.81)	39.36	(8.24)					141.14**	2.67, 1063.85	.262
Cohen's d^a			.32		.69		.74								
HADS-D	14.02	(6.38)	–	–	–	–	12.61	(6.62)					26.17**	1, 399	.062
Cohen's d^a							.22								
n	277														
	M	(*SD*)	*M*	(*SD*)	*M*	(*SD*)	*M*	(*SD*)	*M*	(*SD*)	*M*	(*SD*)			
mSPS-D	18.49	(4.04)	15.30	(4.01)	13.53	(4.45)	13.45	(4.71)	13.08	(5.04)	13.20	(5.41)	106.18**	4.09, 1124.92	.279
Cohen's d^a			0.79		1.17		1.15		1.19		1.12				
Ferus															
F-SE	31.66	(5.67)	31.79	(5.89)	33.04	(5.77)	36.36	(5.57)	33.64	(6.16)	33.87	(6.78)	51.05**	4.45, 1223.91	.157
Cohen's d^a			− .02		− .24		− .84		− .33		− .36				
SP-SE	25.23	(5.83)	27.91	(5.98)	29.91	(6.77)	30.45	(6.85)	29.21	(7.30)	28.98	(7.75)	34.87**	4.06, 1117.12	.113
Cohen's d^a			− .45		− .74		− .82		− .61		− .55				
F-MtC	40.71	(7.64)	38.98	(8.53)	36.88	(9.00)	41.10	(5.85)	35.83	(8.64)	35.10	(9.03)	45.50**	3.04, 835.31	.142
Cohen's d^a			.21		.46		− .06		.60		.67				
SP-MtC	44.41	(6.43)	42.44	(7.01)	39.53	(7.72)	38.92	(8.63)	36.58	(8.72)	34.95	(9.08)	141.91**	4.12, 1132.01	.340
Cohen's d^a			.29		.69		.73		1.03		1.22				
HADS-D	13.85	(6.38)	–	–	–	–	12.25	(6.44)	12.43	(6.53)	11.82	(6.84)	13.84**	3, 828	.048
Cohen's d^a							.25		.22		.31				

mSPS-D = modified skin picking scale, German version; Ferus = questionnaire for the assessment of resources and self-management skills; *F-SE* = ferus subscale Self-efficacy, *SP-SE* = skin picking related modified scale for self-efficacy, *F-MtC* = ferus subscale motivation to change, *SP-MtC* = skin picking related modified scale for motivation to change; HADS-D = hospital anxiety and depression scale

[a]Respective Cohen's *d* compared to pre-assessment

**$p < .001$, two-tailed

decreased odds of formally withdrawing from a self-guided and therapist-assisted treatment programs for anxiety disorders for those who were prepared to make changes or were already making changes to improve their mental health. Only one of four studies in the systematic review by Beatty and Binnion (2016) found self-directedness (i.e., taking responsibility for one's own choices and having confidence in solving problems) to positively predict adherence to a bulimia self-guided program (Wagner et al., 2015). Arguably, self-efficacy may represent a relevant personal trait increasing the likelihood of a positive treatment outcome rather than predicting adherence.

Several limitations should be considered when interpreting our study. Firstly, only self-reported symptomatology was assessed and was not verified by a clinician. However, we expected individuals to be interested and motivated in participating in such a potentially time-consuming online-intervention to experience true impairment due to their picking behavior. We did not include a waitlist control group. Hence, no intention to treat analysis was possible. Since we were interested in possible side effects of (non-)adherence, it appeared most efficient to include all interested individuals in a naturalistic trial. One great limitation may be the assessment of progress in the program, which determined

Table 3 Univariate ANOVAs for SP Symptomatology (mSPD-D), Self-Efficacy (F-SE), motivation to change (F-MtC), skin picking-related self-efficacy (SP-SE), skin picking-related motivation to change (SP-MtC), and general psychopathology (HADS-D) for $n = 400$ (post-assessment) × Group (completers vs. non-completers)

	Pre				T-1				T-2				Post						
N	*400*																		
n	208		192		208		192		208		192		208		192				
	Comp		*Non-Comp*		*Comp*		*Non-Comp*		*Comp*		*Non-Comp*		*Comp*		*Non-Comp*				
	M	(*SD*)	*M*	(*SD*)	*M*	(*SD*)	*M*	(*SD*)	*M*	(*SD*)	*M*	(*SD*)	*M*	(*SD*)	*M*	(*SD*)	*F (1, 398)*	η_p^2	d^a
mSPS-D	19.08	(4.17)	18.33	(3.93)	15.44	(4.33)	15.68	(4.28)	13.53	(4.70)	14.41	(4.49)	13.34	(4.72)	14.35	(4.94)	1.28	.003	− .39
Ferus																			
F-SE	31.44	(5.81)	31.64	(5.48)	31.94	(5.76)	31.84	(5.81)	33.38	(5.77)	32.44	(5.67)	36.99	(5.18)	35.58	(6.03)	1.34	.003	.29
SP-SE	24.86	(5.52)	25.34	(5.70)	28.35	(6.12)	27.03	(5.58)	31.32	(6.31)	27.61	(6.12)	31.72	(6.50)	28.25	(6.30)	17.42**	.042	.66
F-MtC	41.77	(7.36)	40.55	(7.51)	40.15	(8.13)	38.54	(8.39)	38.38	(8.52)	36.55	(8.96)	41.77	(5.39)	40.45	(6.47)	7.50*	.018	.01
SP-MtC	45.58	(6.09)	43.88	(6.63)	43.66	(6.78)	41.49	(6.98)	41.22	(7.69)	38.44	(7.71)	40.39	(7.74)	38.25	(8.86)	12.03**	.029	.06

mSPS-D = modified Skin Picking Scale, German version; Ferus = Questionnaire for the assessment of resources and self-management skills; *F-SE* = Ferus subscale Self-efficacy, *SP-SE* = Skin picking related modified scale for self-efficacy, *F-MtC* = Ferus subscale Motivation to change, *SP-MtC* = skin picking related modified scale for motivation to change

[a]Effect size based on the pooled pre- and posttest standard deviation pre- to post-assessment

**$p < .001$, two-tailed

* $p < .05$, two-tailed

Table 4 Classification table for observed vs. predicted percentage of the model with SP-MtC as predictor

Observed		Predicted		
		Completion		Percentage correct
		Non-completers[a]	Completers[b]	
Completion	Non-completers[a]	76	116	39.6
	Completers[b]	54	154	74.0
Overall percentage				57.5*

SP-MtC = skin picking related modified scale for motivation to change

[a] $n = 192$

[b] $n = 208$

*$p < .05$, two-tailed

the group allocation of *completers* and *non-completers*. Due to data privacy guidelines of the learning management system, we were not able to track time spent online with the program or number of chapters accessed. We were only able to track which part participants had access to (I, II or III) and had to rely on self-information of participants about the chapters they were currently working on at each assessment. Note, however, that we observed some inconsistency between the self-reported information and online access. In such cases, we contacted the participants to ask about the chapter they were truly currently working on and corrected this information. There is also no information on how thoroughly participants worked with the program and whether they implemented changes into their daily life. However, monitoring program usage more closely, would somewhat contradict the notion of conducting a naturalistic study.

Unlike the results reported for SP symptomatology, we did not present any findings for the follow-up assessments of SE (self-efficacy) and MtC (motivation to change). While we collected information on program progress at each follow-up assessment, we deemed it inappropriate to compare *completers* and *non-completers* at the post-assessment for the Follow-up assessments. Some participants initially classified as *non-completers* at the post-assessment continued using the program beyond the 12-week period and would subsequently have to be reclassified as *completers*. This mixing of recent and non-recent completers during the follow-up assessments would have made it difficult to make valid assumptions about the follow-up period.

Since our goal is to provide the program free of charge on the internet, continuous supervision of participants will not be feasible. Consequently, we were mostly interested in examining side effects of a self-guided program without much interference from investigators interested in study-results. Nowadays, many self-guided programs for mental health issues are offered on the internet and it is therefore important, to be aware of possible adverse outcomes for participants. When considering the effects of participants discontinuing program use one should not only examine symptom reductions, but also effects on other aspects such as self-efficacy and motivation to change.

In summary, we provided participants with an effective internet-based cognitive-behavioral self-help intervention for skin picking disorder. We examined the impact of early withdrawal from the program (attrition) and observed that *non-completers* experienced less symptom reduction, lower treatment-oriented self-efficacy, and decreased treatment motivation. These negative effects of non-adherence must be taken into consideration when providing self-guided mental health interventions on the internet. Treatment providers should address these negative effects, and the wide availability of online interventions should be approached with caution.

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Declarations

Conflict of Interest Linda M. Mehrmann and Alexander L. Gerlach declare that they have no conflict of interest.

Informed Consent All participants provided written informed consent prior to participation.

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