

Frequency and Effects of Dialogue Support Elements in Web-Based Interventions

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Abstract

Web-based interventions in different health areas have been proven to be effective, but show poor adherence rates. The definition of dialogue support elements by Oinas-Kukkonen was used. In this study, the frequency and the effects of dialogue support elements on adherence in 31 interventions are compared. In contrast to other studies, results indicate that dialogue support elements have no effects on adherence in web-based interventions. This could be explained by a reduced model used in this study and poorly implemented or described dialogue support elements in the interventions. Future studies should use more complex models and focus on the effects of separate elements on adherence.

Introduction

Over the last years web-based interventions have been proven to be effective in various areas of health care (Krebs et al., 2010; Portnoy et al., 2008; Wofford et al., 2005). When it comes to the definition of a web-based intervention, we follow the definition of Barak et al (2009) who distinguished the concept of a web-based intervention from other tools in the eHealth sector. He defines a web-based intervention as:

...a primarily self-guided intervention program that is executed by means of a prescriptive online program operated through a website and used by consumers seeking health- and mental health-related assistance. The intervention program itself attempts to create positive change and or improve/enhance knowledge, awareness, and understanding via the provision of sound health-related material and use of interactive web-based components. (Barak et al., 2009, p.2)

To be classified as a web-based intervention by Barak's definition, an intervention must contain the following 4 key elements: program content, multimedia choices, interactive online activities and guidance and supportive feedback. These elements are important to distinguish web-based interventions from related programs such as online counseling or therapeutic software. Duration of web-based interventions can vary from a predetermined period of time for some therapies to a continuous program for people suffering from chronic conditions.

While the effectiveness of web-based interventions in general has been proven, many of them struggle with high rates of non-adherence (Christensen et al., 2009; Cubelman et al., 2011), i.e. many of the interventions' clients don't use the interventions as it has been intended by the inventors. However, low adherence has proven to be an important predictor for poor intervention effects in web-based interventions (Cubelman et al., 2011; Donkin et al, 2011; Manwaring et al., 2008). Therefore it seems useful and important to address this problem of non-adherence in web-based interventions.

To do that, it's important to clarify the concept of adherence and to distinguish it from related concepts. Adherence applies to the extent of which clients follow the entire content of an intervention (Christensen et al., 2009; Cubelman et al., 2011). Dropout describes the extent of which clients don't complete the research protocol. Therefore, if a client completes a whole intervention, but doesn't fill out a questionnaire, he would have adhered to the intervention but drop out of the research. Another concept to distinguish from adherence is "e-loyalty", a concept introduced by Crutzen (2011). E-loyalty goes a step further than adherence. Besides

experiencing the content of an intervention, an e-loyal person also recommends the intervention to others.

When it comes to factors that predict adherence to the intervention, a lot of research has been done investigating the influence of respondents' characteristics on adherence (Christensen, 2009; Kelders, 2011). Some studies investigated the influence of intervention factors, as well. However, these two studies by Brouwer (2011) and Schubart (2011) either lack in finding an appropriate outcome measure for adherence or they fail to distinguish adherence and dropout. Kelders (2012) was the first who focused on intervention factors on adherence, finding a proper outcome measure for adherence, as well.

Therefore she introduced the concept of "intended usage". Intended usage refers to the extent to which individuals should experience an intervention according to its creators. Adherence then is achieved when a client uses the intervention as intended. This approach fits better to the idea of adherence than the approach by Brouwer (2011), who used the exposure to an intervention (visits on the website, time spent on the website) as a measure for adherence, regardless the intended use of an intervention. Because some interventions require more activity from the client than others, exposure to an intervention is not a valid measure and oversimplifies adherence.

Kelders (2012) also criticized Brouwer and Schubart for an ad hoc classification of the intervention factors. These classifications struggled to distinguish its elements from each other. Substantial overlap in the goals to be achieved with the elements makes it difficult to classify a specific tool of an intervention into one of the elements used in the classification by Brouwer and Schubart.

To avoid this problem, Kelders implemented the persuasive system design (PSD) model by Oinas-Kukkonen et al. (2009), which has been used in other studies, as well (Lehto and Oinas-Kukkonen, 2011; Myneni et al, 2013). This model introduces four groups, namely primary task support, dialogue support, social support and credibility support. Separate, specific intervention elements like reminders or an online forum are coded into these groups. Kelders (2012) applied the PSD-model to web-based interventions, categorizing the techniques of 83 interventions into these groups. However, credibility support has been dropped out of the analysis because techniques within this very group were difficult to code.

Kelders' study found some intervention characteristics that predict adherence. Her final model, featuring other characteristics besides the PSD-model, as well, explained 55% of the

variance in adherence. Significant predictors for better adherence were frequency of interaction with a counselor, provision of frequent updates, frequent intended usage, extensive use of dialogue support and interventions which are designed as RCTs. Furthermore the frequency of interaction with the system seems to negatively influence adherence, whereas social support seems to influence adherence positively. However, both predictors haven't proved to be significant.

Though dialogue support has been proven to be a significant predictor for adherence, it has been poorly implemented in the interventions reviewed by Kelders. Only an average of 1.5 out of 7 possible dialogue support elements has been implemented per web-based intervention. In most cases reminders (implemented in 74% of all interventions) and suggestion (29%) were these elements, whereas especially praise (0%), rewards (4%) and social role (6%) barely have been used. Suggestion was more frequently used in interventions targeting chronic conditions than in other health care areas. The findings over the effect of reminders confirmed the results of earlier studies, which stated that reminders have positive influence on effectiveness and adherence of interventions (Andersen et al, 2013; Donkin et al, 2012; Dowshen et al, 2012; Fry and Neff, 2009; Soureti et al, 2011; Webb et al, 2010). However, studies have shown that also praise and rewards may benefit adherence in health interventions (Deterding, Dixon and Khaled, 2011; Wang and Sun, 2011). Therefore, it's interesting to see which elements of dialogue support are crucial when it comes to predicting adherence.

Consequently, this article features a follow-up study of the study of Kelders (2012) focusing on dialogue support. The research questions are: (1) What elements of dialogue support are used in what health care areas? (2) Does dialogue support predict adherence? (3) If (2) is confirmed, which elements are crucial for Dialogue Support to predict adherence? (4) Which separate elements of Dialogue Support predict adherence?

Methods

Search Strategy

As in the study by Kelders, a comprehensive literature search has been made, using five databases: Web of Knowledge, EBSCOhost, PiCarta, SciVerse Scopus and Science Direct. Also the same combination of constructs “web-based”, “intervention”, “adherence” and “health” have been used. The search commands are listed in appendix 1.

Since Kelders compared studies which have been published until the end of October 2011, we looked for studies which have been published from 1st of November 2011 until February 29, 2013. In this way, 5784 articles have been identified. A detailed view of the article selection is presented in Figure 1.

Eligibility criteria

Only interventions in the health care domain have been used in this study. The inclusion criteria were: (1) The article is written in either English or Dutch; (2) intervention is meant to be used repeatedly (more than once); (3) the intervention was predominantly an online intervention; (4) the goal of the intervention was to enhance the health situation and/or to change the lifestyle of the respondent; (5) the study measures the effect of an intervention; (6) the study reports the actual use of the intervention by its respondents; (7) the target group were the patients. The exclusion criteria were as follows: (1) the intervention is applied by family members, nurses, care providers, etc.; (2) no effects have been measured; (3) no intervention has been implemented; (4) the intervention has not been (fully) described; (5) patients aren't the primary target group; (6) The intervention is primarily a patient-caregiver interaction with only few online elements in it; (7) drop-out and non-adherence are undistinguishable; (8) self-reported use; (9) obligated use, no individual choice; (10) intervention only provided information and was not intended to change the *behavior*. Furthermore, only published and reviewed literature has been implemented in this study.

Study Selection and Data Collection

After removing the duplicates, the articles have been screened based on their titles, first. If there was absolutely no link between the title and a web-based intervention in any health care area, the article was excluded. Second, the remaining articles have been screened based on their abstracts. Articles were excluded if they clearly did not comply with the inclusion and/or exclusion criteria. These two steps have been done individually by two researchers (LW and TS), resulting in two lists of articles. The two lists have been unified to one list for full-text analysis of eligibility. If an article has been judged as eligible by one researcher only, it had been implemented into this list to prevent selection bias. The resulting 140 articles have been listed in the alphabetical order of their authors and split up between the two researchers. One researcher (LW) started the full-text analysis at the top of the list, analyzing the first 77

articles and coding them if they have proven eligibility, the other researcher (TS) started at the bottom of the list, doing the same with the last 63 articles.

The data extraction was focused on the interventions. If an article presented and/or compared two or more online interventions, the interventions have been coded separately. Both researchers had access to all coded interventions and therefore used the same data in their studies.

Data Items

The following interventions have been coded:

Intervention Name

The name of the intervention was recorded. If the intervention had no name, the intervention was named after the inventor or the common description used in the article (e.g. web- CBT for Panic Disorder).

Health care area

The area of health care was coded into either “chronic condition”, “lifestyle” or “mental health”. Therefore study design and adherence in different health care areas can be compared to each other.

Specific condition/behavior

The specific condition or behavior the intervention was made for was recorded.

Study design

The study design was coded into 3 groups, namely randomized controlled trials (RCTs), observational studies and pilot studies.

Participants

The number of people who participated in the intervention have been recorded, also the amount of people who participated in the whole study, i.e. in the intervention group and – if existent - the control group.

Intended frequency/intended usage

The intended usage of the intervention has been briefly recorded. The intended frequency of the intervention has been coded into the ordinal variables “used less than once a month”, “used once a month”, “used between one month and one week”, “used once a week” and “used more than once a week”.

Adherence

The adherence of the respondents to the intervention was recorded. For the most studies adherence was defined as the percentage of people who completed the whole intervention (as intended by the creators). Some studies (Pitkanen, 2011) used own definitions of adherence (adherence was accomplished when a respondent finished 3 out of 5 intervention’s modules). In that case adherence was recorded according to the definition of the author.

Persuasive technology in the Intervention

The applied principles of persuasive technology in the intervention have been recorded the same way as in the study by Kelders (2012). System credibility was dropped out of the analysis. Dialogue support, social support and primary task support were coded. Primary task support and social support are only briefly analyzed to compare them with dialogue support. The study focuses on the latter, describing its elements in Table 1. When it came to coding the elements according to the PSD-model, the technology was central, not the content of the interaction. Only web-based elements of the intervention itself were recorded. Therefore, human-computer interaction (e.g.: an automatic reminder email before an online module of the intervention) was coded, whereas computer-mediated interaction (e.g. a counselor sends a feedback email containing an individual reminder for the next module) wasn’t.

Analysis

All data was recorded with SPSS version 21. Every intervention was coded separately. All analysis were performed using SPSS. Descriptive data of all interventions have been calculated and listed per health care area. Differences between the variables were calculated using chi-square tests. To investigate whether dialogue support correlates with adherence, the correlation between these variables was calculated. T-tests were performed to analyze the link between the separate dialogue support elements and adherence.

Table 1: Dialogue Support Elements of the PSD framework

Dialogue support element		Element included when the intervention...:	Example
Praise	By offering praise, a system can make users more open to persuasion.	Offers praise to the participant on any occasion.	A web-based intervention for people with social anxiety compliments participants when they talked to a group of people during an exposure exercises.
Rewards	Systems that reward target behaviors may have great persuasive powers.	Offers some kind of reward when the participant performs a target behavior relating to the use or goal of the intervention.	A web-based intervention for cutting down on alcohol rewards its participants with one point for every day they didn't drink alcohol.
Reminders	If a system reminds users of their target behavior, the users will more likely achieve their goals.	Provides reminders about the use of the intervention or the performance of target behavior.	A web-based intervention to support self-management among patients with rheumatic arthritis sends an automatic email message to remind the participant that the new lesson may begin
Suggestion	Systems offering fitting suggestions will have greater persuasive powers.	Provides a suggestion to help the participants reach the target behavior.	A web-based intervention for weight management provides low-calorie recipes.
Similarity	People are more readily persuaded through systems that remind	Is designed to look familiar and designed especially for the participant.	A web-based intervention for the treatment of panic

	them of themselves in some meaningful way.		disorder in teenage girls explains the exercises through a teenage girl with panic problems.
Liking	A system that is visually attractive for its users is likely to be more persuasive.	Is visually designed to be attractive to the participants.	During the design of a web-based intervention to increase physical activity in middle-aged women, a representative group is asked for feedback on the design and their feedback is subsequently incorporated in the new design.
Social role	If a system adopts a social role, users will more likely use it for persuasive purposes.	Acts as if it has a social role (e.g., a coach, instructor, or buddy).	A web-based intervention to support self-management among patients with migraine incorporated an avatar to guide the participant through the intervention.

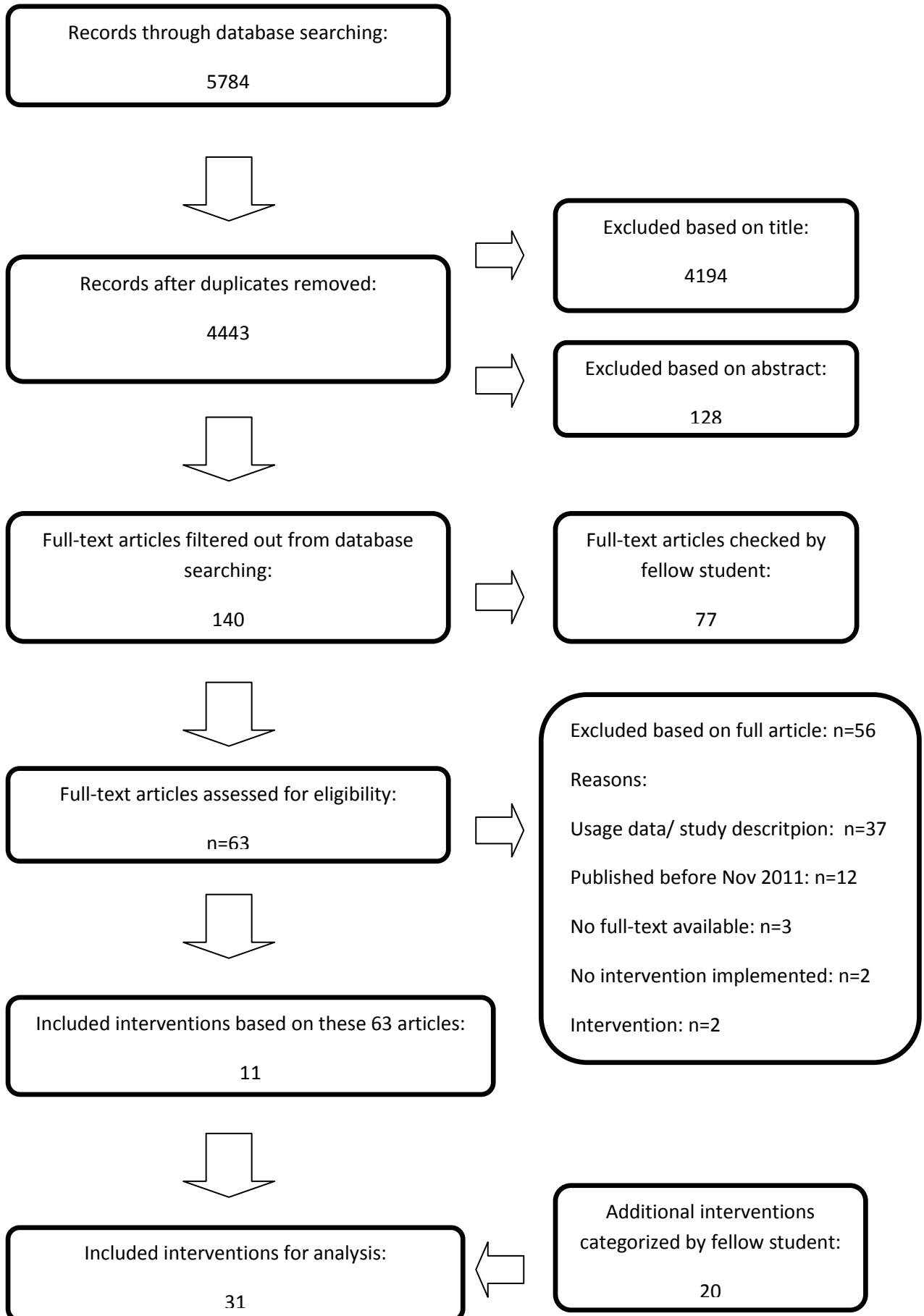
Results

Study Selection

With EndNote removing all duplicates, the data research identified 4443 articles from 2011 to February 29, 2013. After excluding articles based on their titles and abstracts, 140 articles were included for full-text analysis. A full overview of the data research is presented in Figure 1. Originally there were 181 articles in that list, but due to an error in the EndNote file, 41 articles dropped out of the analysis. Of the 140 articles, 12 were excluded because they were published before November 2011. Some of the used databases only provide customized research per year, so 12 articles had to be excluded by hand. 58 studies were excluded because of insufficient data description, mostly due to the lack of recording adherence. 10 studies were excluded because the study design didn't meet the eligibility criteria. Two

studies were excluded because they didn't measure an intervention at all. One study was excluded because its intervention was used only once. Another intervention was excluded because it was meant to provide information only instead of changing behavior. Finally, there was no full-text available for 31 articles. Therefore, these articles were excluded, as well. The remaining 25 articles measured the effects of 31 interventions. These interventions were included in the analysis.

Figure 1: Flow diagram of study selection



Characteristics of the included interventions

Of the 31 included interventions, 8 target a specific chronic condition, including 2 interventions targeting self-management. 6 interventions belong to lifestyle. Here, two interventions aimed at weight management. 17 interventions were coded in the mental health area. Of these 17 interventions, respectively two interventions targeted depression, social phobia and insomnia disorder. An overview of the general data of and adherence to all interventions is presented in appendix 2.

Table 2 presents an overview of relevant descriptive statistics. Most studies were RCTs (77,4%) and were used once a week (61,3%) or more than once a week (32,3%). When it comes to the applied principles, Primary Task Support was applied more often (a mean of 2,6 applied principles per intervention) than Social Support (1,35) and Dialogue Support (1,52). Of all Dialogue Support elements, reminders and suggestion (both 41,9%) were implemented most. There were few differences between the health care areas concerning the elements. Only suggestion ($p=.005$) and liking ($p=.008$) were used differently in different health care areas. Suggestions were primarily used in lifestyle interventions, whereas liking was only used in interventions targeting chronic conditions.

Influence of Dialogue Support on adherence

Table 3 shows the influence of Dialogue Support on adherence. The frequent application of Dialogue Support shows no correlation with adherence ($r=.41$, $P=.829$). Therefore, no further analysis of reduced Dialogue Support concepts with less than its 7 elements was done.

Influence of separate Dialogue Support Elements

In table 3, the effects of the separate Dialogue Support elements on adherence are presented. No Dialogue Support elements have been proven to be significant for adherence. Reminders, as one of the most implemented elements, had no impact at all ($P=.961$), whereas the use of suggestion was insignificantly correlated to lower adherence ($P=.139$). Liking ($P=.139$) and Similarity ($P=.139$) were positively correlated with adherence. However, these correlations weren't significant, either.

Table 2: Descriptive variables of the included interventions per health care area

Variable		Chronic (n=8)		Lifestyle (n=6)		Mental (n=17)		Total (n=31)		P
		n	(%)	n	(%)	n	(%)	n	(%)	
		Study	RCT	5	(62,5)	5	(83,3)	14	(82,4)	
	Obs, real life	1	(12,5)	1	(16,7)	0	(0)	2	(6,5)	
	Obs, pilot	2	(25)	0	(0)	3	(17,6)	5	(16,1)	
Intended Usage Frequency	<=once a month	0	(0)	1	(16,7)	0	(0)	1	(3,2)	.232
	1/month-1/week	1	(12,5)	0	(0)	0	(0)	1	(3,2)	
	1/week	5	(62,5)	4	(66,7)	10	(58,8)	19	(61,3)	
	>1/week	2	(25)	1	(16,1)	7	(41,2)	10	(32,3)	
Primary Task Support – mean (sd)		2,5	(1,77)	2,7	(1,5)	2,6	(1)	2,6	(1,3)	
Social Support – mean (sd)		1,8	(1,2)	2,17	(1,6)	0,9	(1,4)	1,35	(1,45)	
Dialogue Support – mean (sd)		1,8	(0,46)	1,33	(0,52)	1,47	(1,2)	1,52	(0,93)	
Dialogue Support Elements	Praise	0	(0)	0	(0)	5	(29,4)	5	(16,1)	.086
	Rewards	1	(12,5)	0	(0)	2	(11,8)	3	(9,7)	.67
	Reminders	2	(25)	1	(16,7)	10	(58,8)	13	(41,9)	.105
	Suggestion	3	(37,5)	6	(100)	4	(23,5)	13	(41,9)	.005
	Similarity	1	(12,5)	0	(0)	1	(5,9)	2	(6,5)	.635
	Liking	3	(37,5)	0	(0)	0	(0)	3	(9,7)	.008
	Social role	4	(50)	1	(16,7)	3	(17,6)	8	(25,8)	.192
PSD-elements – total		6	(1,4)	6,2	(3,1)	4,9	(2,66)	5,4	(2,5)	

Table 3: Dialogue Support as a predictor of adherence

Element	Not available		Available		Significance p
	N	Average adherence (%)	N	Average adherence (%)	
Praise*	26	61,98	5	70,9	.522 (.938)
Rewards	28	62,57	3	71,48	.609

Reminders	18	63,21	13	63,72	.961
Suggestion	18	63,21	13	54,61	.139
Similarity	29	61,73	2	88	.205
Liking	28	60,97	3	86,34	.139
Social Role	23	65,05	8	58,78	,595

* Levene's Test for Equality of Variances was $<.05$ Therefore, the Mann Whitney U Test has been used to test the 0-hypothesis.

Discussion

This article presents a follow-up study of the study by Kelders (2012), who analyzed the combined effects of various intervention factors such as study design and frequency of PSD elements on adherence. This follow-up study focused on dialogue support, a branch of the PSD system. The usage of dialogue support elements per health care area was described; the effects of dialogue support on adherence as well as the effects of the separate dialogue support elements on adherence were analyzed.

Characteristics of included interventions

The frequency of PSD elements in the analyzed interventions were listed the same way as they have been in the study of Kelders (2012). On the surface, the results are similar. Primary task support is significantly more applied in web-based interventions than dialogue support and social support. When it comes to the frequency of the specific dialogue support elements, however, the data shows differences. Reminders, liking and similarity are far less used in the interventions of this study than in the interventions of Kelders' study. Especially the decreased use of reminders is striking, regarding various studies pointing out the effectiveness of reminders on adherence and effectiveness of web-based interventions (Andersen et al, 2013; Donkin et al, 2012; Dowshen et al, 2012; Fry and Neff, 2009; Soureti et al, 2011; Webb et al, 2010). On the contrary, praise, rewards, suggestion and social role were more often implemented. The use of praise in particular is remarkable since no intervention of Kelders' study used praise, whereas 16,1 % of all interventions in this study used it. A possible explanation would be that the creators of the latest interventions considered research results which indicated that implementation of praise and rewards could benefit health interventions (Deterding, Dixon and Khaled, 2011; Wang and Sun, 2011).

Suggestion and liking were the only dialogue support elements that varied in their frequency per health care area. Suggestion was primarily applied in lifestyle interventions, which is surprising; in the study of Kelders (2012), suggestion was more often used in interventions

aimed at chronic conditions. Therefore lifestyle interventions show a trend to present more concrete ideas to its clients to change their behavior. Clients are free to use them. That confirms another outcome of Kelders (2012), who described lifestyle interventions as less strict than interventions in the mental health area.

Influence of Dialogue Support on adherence

Surprisingly, the frequency of dialogue support elements in web-based interventions had no influence on adherence. Earlier research concluded that dialogue support or at least some dialogue support elements were connected with better adherence (Fry, 2009; Kelders, 2012; Webb, 2010). The data in this study did not confirm this assumption. Therefore, the third research question was discarded from further analysis.

A possible explanation for this result could be the reduced model used in this study compared to the study of Kelders. This study focused on the influence of dialogue support on adherence, whereas the model of Kelders included various potential predictors of adherence, of which study design, dialogue support, increased interaction with a counselor and more frequent updates significantly predicted adherence (2012). It seems like the approach in this study oversimplified the complex interactions of the predictors by focusing on dialogue support only.

Separate elements on adherence

As for dialogue support in general, no significant influence of its separate elements on adherence was found. Unfortunately, little research has been done about the separate elements and their effects on interventions, so far. Reminders are the only exception with various studies documenting their effectiveness on adherence in interventions (e.g. Fry and Neff, 2009; Webb et al, 2010). Therefore, it's surprising that the frequent use of reminders was not a predictor for adherence in the interventions of this study.

There are different reasons why reminders can be ineffective. Dowshen et al (2012) show that personalized and interactive reminders are more effective than standardized text messages. Donkin and Glozier (2012) describe the importance of "external motivators in the forms of reminders of their [the clients'] reasons for engagement and demonstrations of the benefits of completing the program" (p.7). These two studies show examples of well developed reminders which were more thought out than a standardized reminder message. A study of Pop-Eleches (2011) shows, that standardized reminders do not always predict adherence.

Daily reminders had no significant effect on adherence in that study. It seems that not only the frequency of reminders, but also their quality, predict adherence. It's possible that other dialogue support elements become more effective when applied in a personalized and interactive way. Unfortunately, there is no research available to prove this thesis.

Limitations

Compared with the study of Kelders (2012), this follow-up study used a reduced model to analyze adherence in web-based interventions. PSD elements were only coded when they were web-based. If a counselor personally reminded a client of a module the client has to do the following day, the reminder was not coded. The counselor contact itself was also not coded, although has been proven to be a valid predictor of adherence in web-based interventions. Along with the exclusion of other relevant factors like the frequency of updates in data-analysis, this may led to an oversimplified model. With a more extensive model the results in this study may have been different.

Reporting adherence was another problem in this study. Many studies were excluded because they didn't report any rates of adherence or failed to distinguish between drop-out and adherence. The concept of adherence was different among some studies, as well. Most studies defined adherence as the percentage of clients who finished the whole intervention. However, some studies (e.g. Pitkanen, 2012) defined adherence as the percentage of clients who finished a specified minimum or more of all modules in the intervention. Of course, this approach results in higher adherence. It seems valid to do so since some studies report significant effects for people who finished a certain number of intervention modules. Powell et al. found significant differences for clients who finished 2 or more out of 5 modules of their intervention (2013).

Both researchers coded each one half of the interventions. The inclusion and exclusion criteria were strictly defined. However, the number of PSD elements coded per intervention differed significantly per researcher ($p=.008$). It is most likely that the interrater reliability would be low if both researchers would have coded all interventions.

This problem was probably caused by the PSD-model itself. Many of its elements are not explicitly described in the articles. Therefore, the interpretation of the researcher determines whether to code one potential element.

Future study

Very little research has been done for dialogue support elements as predictors for adherence, so far. The effects of praise, rewards, social role, liking, suggestion and similarity on adherence in web-based interventions remain unclear, due to the limitations of this study. Experimental studies could focus on the effects of dialogue support elements by comparing two similar interventions which only differ in the (non-)use of separate elements.

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Appendix 1: Constructs for literature search per database

CLOSING DATE: 29-02-2013

Web of knowledge

EBSCOhost

Scopus

Sciencedirect

Picarta

WEB OF KNOWLEDGE

Topic=("web page" OR "web application" OR website OR "internet delivered" OR "web based" OR "internet based" OR "internet mediated" OR "internet supported" OR online* OR "Medical informatics" OR "Information technology" OR "e health*" OR ehealth* OR "e therap*" OR telemedic* OR telecare OR telehealth OR (("e mental" OR emental) SAME health))

AND

Topic=((treatment* OR intervention* OR program OR programme OR therapy OR coach))

AND

Topic=((motiv* OR attrition OR dropout OR "drop out" OR adherence OR nonadherence OR compliance OR noncompliance OR persist* OR response* OR nonresponse OR loyalty OR engagement OR disengagement OR involvement OR noninvolvement OR reach OR intention* OR satisf*))

AND

Topic=((health* OR behavio* OR manage* OR "self help" OR "self control" OR selfmanagement OR "self care"))

REFINED BY

Languages=(DUTCH OR ENGLISH) AND [excluding] Subject Areas=(GERIATRICS & GERONTOLOGY OR ONCOLOGY OR IMMUNOLOGY OR BUSINESS & ECONOMICS OR INFECTIOUS DISEASES OR GENETICS & HEREDITY OR TOXICOLOGY OR MATHEMATICS)

Timespan=2011-2013.

EBSCO

AB=

"web page" OR "web application" OR website OR "internet delivered" OR "web based" OR "internet based" OR "internet mediated" OR "internet supported" OR online* OR "Medical informatics" OR "Information technology" OR "e health*" OR ehealth* OR "e therap*" OR telemedic* OR telecare OR telehealth OR ("e#mental" N3 health)

AND

AB= treatment* OR intervention* OR program OR programme OR therapy OR coach

AND

AB= motiv* OR attrition OR dropout OR "drop out" OR adherence OR nonadherence OR compliance OR noncompliance OR persist* OR response* OR nonresponse OR loyalty OR engagement OR disengagement OR involvement OR noninvolvement OR reach OR intention* OR satisf*

AND

AB= health* OR behavio* OR manage* OR "self help" OR "self control" OR selfmanagement OR "self care"

LIMITERS

Peer reviewed

Date Published from: 20111101-20130229

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TITLE-ABS-KEY(telemedic* OR telecare OR telehealth OR "e mental health" OR "emental health" OR "web page" OR "web application" OR WEBSITE OR "internet delivered" OR "web based" OR "internet based" OR "internet mediated" OR "internet supported" OR online* OR "Medical informatics" OR "Information technology" OR "e health*" OR ehealth* OR "e therap*") AND TITLE-ABS-KEY(treatment* OR intervention* OR program OR programme OR therapy OR coach) AND TITLE-ABS-KEY(health* OR behavio* OR manage* OR "self help" OR "self control" OR selfmanagement OR "self care") AND TITLE-ABS-KEY(motiv* OR attrition OR dropout OR "drop out" OR adherence OR nonadherence OR compliance OR noncompliance OR persist* OR response* OR nonresponse OR loyalty OR engagement OR disengagement OR involvement OR noninvolvement OR reach OR intention* OR satisf*) AND DOCTYPE(ar OR re) AND PUBYEAR AFT 2010 AND (EXCLUDE(SUBJAREA, "BIOC") OR EXCLUDE(SUBJAREA, "ENGI") OR EXCLUDE(SUBJAREA, "BUSI") OR EXCLUDE(SUBJAREA, "CENG") OR EXCLUDE(SUBJAREA, "ENVI") OR EXCLUDE(SUBJAREA, "IMMU") OR EXCLUDE(SUBJAREA, "AGRI") OR EXCLUDE(SUBJAREA, "MATH") OR EXCLUDE(SUBJAREA, "ECON") OR EXCLUDE(SUBJAREA, "MATE")) AND (LIMIT-TO(LANGUAGE, "English") OR LIMIT-TO(LANGUAGE, "Dutch")) AND (EXCLUDE(SUBJAREA, "DENT") OR EXCLUDE(SUBJAREA, "VETE") OR EXCLUDE(SUBJAREA, "EART") OR EXCLUDE(SUBJAREA, "ENER") OR EXCLUDE(SUBJAREA, "CHEM") OR EXCLUDE(SUBJAREA, "PHYS") OR EXCLUDE(SUBJAREA, "MULT") OR EXCLUDE(SUBJAREA, "ARTS") OR EXCLUDE(SUBJAREA, "DECI"))

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telemedic* OR telecare OR telehealth OR "e#mental#health" OR "emental#health" OR "web#page" OR "web#application" OR website OR "internet#delivered" OR "web#based" OR "internet#based" OR "internet#mediated" OR "internet#supported" OR online* OR "Medical#informatics" OR "Information#technology" OR "e#health*" OR ehealth* OR "e#therap*"

AND

treatment* OR intervention* OR program OR programme OR therapy OR coach

AND

health* OR behavio* OR manage* OR "self#help" OR "self#control" OR selfmanagement OR "self#care"

AND

motiv* OR attrition#dropout OR "drop#out" OR adherence OR nonadherence OR compliance noncompliance OR persist* OR response* OR nonresponse OR loyalty OR engagement OR disengagement OR involvement OR noninvolvement OR reach OR intention* OR satisf*

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Appendix 2: General characteristics of, and adherence to interventions

Name intervention <i>Study design</i>	Area of Health Care	Targeted behavior/ condition	Sample Size	Intended Usage	Actual Use	Adherence	Applied elements of PSD model*			
							PTS	DS	SS	TPSD
HORYZONS <i>Pilot</i>	Mental health	First episode psychosis	N=20 I=20	Once a week, 7 modules	3 users finished all modules	15%	4	2	5	11
Brindal, site III <i>RCT</i>	Lifestyle	Weight management	N=8112 I=3935	Once a week; 12 weeks overall	206 users were active in week 12	5,2%	3	1	4	8
Carlbring <i>RCT</i>	Mental health	Social phobia	N=79 I=40	8 sessions in 4 weeks	37 users finished all 8 sessions	92,5%	1	1	0	2
Wellness Workbook <i>Pilot</i>	Chronic	Physical activity/ nutrition	N=141 I=70	6 modules in 3 weeks	65 users finished WW.	85,16%	3	2	1	6
Espie, CBT <i>RCT</i>	Mental health	Insomnia Disorder	N=164 I=55	6 sessions; once a week	43 participants finished all sessions	78,18%	3	4	3	10
Fang <i>RCT</i>	Lifestyle	Alcohol and drugs	N=108 I=56	9 sessions	54 mother-daughter couples finished all sessions	96,4%	3	1	2	6
Ghaharai <i>RCT</i>	Chronic	Self- management	N=115 I=34	7 weekly sessions; at least 5 sessions had to be done	25 respondents finished 5 or more sessions	74%	2	1	2	5
Glück <i>RCT</i>	Mental health	Self- management	N=49 I=28	2 weeks; 6 times per week	18 respondents used the intervention 6 or more times per week	64,3%	3	1	0	4
Women to Women (WTW) <i>RCT</i>	Chronic	Self- management	N=309 I=155	11 weeks, 9 modules	123 women finished the online activities	79,35%	3	2	1	6
Quitting is Winning <i>RCT</i>	Lifestyle	Smoking Cessation	N=1409 I=702	At least finish 5 out of 6 parts of the intervention	562 participants adhered to the intervention	80,06%	2	1	0	3
YourWay	Chronic	Diabetes	N=41	10 weeks, 2 cycles	31 adults finished the two	76%	3	2	3	8

<i>Observation</i>			I=41		cycles						
Brindal, site I <i>RCT</i>	Lifestyle	Weight Management	N=8112 I=164	Once a week; 12 weeks overall	16 users finished the intervention	8,74%	0	1	1	2	
Espie, IRT <i>RCT</i>	Mental Health	Insomnia Disorder	N=42 I=21	Once a week; 6 sessions overall	41 respondents finished all 6 sessions	74,55%	1	3	2	6	
BEO <i>RCT</i>	Chronic	Chronic Respiratory Condition	N=42 I=21	6 modules	19 participants finished the intervention	90,48%	5	2	1	8	
Barnfather <i>Pilot</i>	Chronic	Cerebral Palsy/ Spina Bifida	N=27 I=27	Once a week; 6 weeks overall	22 adults participated	81,48%	0	1	3	4	
Holländare <i>RCT</i>	Mental health	Depression	N=84 I=42	10 weeks; 9 modules	11 participants finished all modules	26,20%	2	3	1	6	
The Biggest Loser Club <i>RCT</i>	Lifestyle	Nutrition	N=309 I=205	Once a week; 12 weeks overall	164 participants in the two intervention groups completed the intervention	80%	4	2	2	8	
10.000 Steps <i>Observation</i>	Lifestyle	Physical Activity	N=348 I=348	Walk 10.000 steps per day	161 participants walked averaged 10.000 steps per day	46,3%	4	2	4	10	
CHESS <i>RCT</i>	Chronic	Asthma	N=301 I=148	Once a month; once year overall	132 participants completed the study	89,19%	0	2	3	5	
Carrard <i>RCT</i>	Mental health	Self-management	N=74 I=42	6 months; 11 modules	22 persons participated	47,62%	4	3	1	8	
Cognitive-behaviour therapy for anxiety – Managing Stress and Anxiety Program <i>Pilot</i>	Mental health	Anxiety	N=22 I=22	5 online lessons + homework; 8 weeks time	All participants finished online lessons and homework	100%	3	2	1	6	
Online self-help for suicidal ideation <i>RCT</i>	Mental health	Suicidal thoughts	N=236 I=116	6 modules; 6 weeks	25 participants finished all modules	21,6%	3	1	0	4	
Ruward (Burnout)	Mental	Burnout	N=1500	Once a week; 16 weeks	364 completers	77%	3	1	0	4	

<i>RCT</i>	health		I=470								
Ruward (Depression) <i>RCT</i>	Mental health	Depression	N=1500 I=413	More than once a week; 7 phases of CBT, homework assignments	258 completers	62%	3	1	0	4	
Ruward (PTSD) <i>RCT</i>	Mental health	PTSD	N=1500 I=478	More than once a week; 3 phases of CBT, homework assignments	361 completers	76%	3	0	0	3	
Ruward (Panic Disorder) <i>RCT</i>	Mental health	Panic Disorder	N=1500 I=130	More than once a week; max duration of treatment: 11 weeks	88 completers	63%	4	1	0	5	
MoodGYM <i>Pilot</i>	Mental health	Mental Well-being	N=3070 I=1534	Once a week; 5 modules	Ca. 140 participants (number of people who finished the intervention is only shown in an inaccurate picture)	9,1%	1	1	0	2	
Web-based alcohol treatment <i>RCT</i>	Mental health	alcohol	N=824 I=144	More than once a week; 3 month average duration	65 treatment completers	45%	2	0	0	2	
Mileli.Net <i>RCT</i>	Mental health	schizophrenia	N=311 I=100	Finish at least 3/5 sessions; one month time	87 participants completed 3 or more sessions	87%	2	0	2	4	
Guided self-help for SAD <i>RCT</i>	Mental health	Social Phobia	N=245 I=149	Once a week; 9 modules; adherence: at least 7/9 modules finished	109 participants finished 7 or more modules	73,2%	2	1	0	3	
CardioFit <i>RCT</i>	Chronic	CVD* ²	N=223 I=105	5 tutorials, log daily activity on CardioFit website; finish at least 3 modules or more; 6 month period	65 participants finished the intervention	61,7%	4	2	0	6	

***PSD**: Persuasive System Design; **PTS**: Primary Task Support; **DS**: Dialogue Support; **SS**: Social Support

*²**CVD**: Cardiovascular disease

Appendix 3: Usage of PSD-elements (detailed view)

Primary Task Support

Intervention	Reduction	Tunneling	Tailoring	Personalization	Self-Monitoring	Simulation	Rehearsal	Total
HORYZONS	X	Y Module only available after completing the previous one	Y Psycho educative modules are tailored to the user's needs	Y Personalized homepage	Y Homepage shows relevant activities of the user	X	X	4
brindal site3	Y Interactive scheduler for daily nutrition	X	X	Y Personalized recipe suggestions	Y Graphical feedback on progress	X	X	3
brindal site1	x	X	X	X	X	X	X	0
carlbring	X	X	X	X	X	X	Y Repeating trials	1
carrard	Y Journal on eating habits	Y Sequential modules	X	X	Y Automatic graphical summary on eating habits	Y "Beverly en Scott" demonstrate the use of the intervention	X	4
Wellness Workbook	Y Modules guide different skills step by step	Y Modules have to be done in a specified order	X	X	X	X	Y "checking-in" summary questions about the recently completed module	3
espie cbt	X	X	X	Y Personal feedback by the counselor on user's data	Y Sleep diary	X	Y Quiz in the end of a session	3
Espie irt	X	X	X	X	X	X	Y Repeating exercises before	1

							going to bed	
fang	Y Sub-goals per module	Y Modules sequential available	X	X	X	Y Characters demonstrate behavior and its consequences.	X	3
ghahari	X	Y Weekly information	Y Facilitators answer personally on users posts and provide encouragement	X	X	X	X	2
glück	Y Smaller sub-tasks per module	Y After finishing one module, the following module will be unlocked	X	X	X	X	Y Repeatedly practicing the techniques	3
Women to women	Y Each module focuses on another angle how to deal with chronic conditions.	Y Health teaching units are sequential unlocked	X	X	Y Personal health record contains information about the own health status and other useful information	X	X	3
quitting is winning	X	Y Modules sequential unlocked	X	X	Y Daily cigarette consumption	X	X	2
yourway	Y Tasks were split up into subtasks	Y Problems are handled step by step	X	X	X	X	Y Problem solving is practiced repeatedly.	3

BEO	Y “My work” deals with modules, each of them training different skills of the child	Y Modules provide progressive insight in one’s own condition	Y “My condition” information about own condition and the conditions of others	Y “My Page” - Users can present information about themselves	Y “daily diary” section with checklist for used medicine	X	X	5
barnfather	X	X	X	X	X	X	X	0
holländare	Y Each module provides another strategy to deal with depression	Y Modules have to be completed in a strict order	X	X	X	X	X	2
Biggest loser club	Y Keep a diary; report own weight	X	Y Weekly activity plans according to the user’s preferences	Y Personalized feedback; customized goals for reduction of weight	Y Diary about nutrition and activity; calculation of calorie consumption; weight and girth	X	X	4
10.000 steps	Y More activity is encouraged by a table of walked steps per day	Y New tasks available per month	X	Y Users can choose between different, default goals	Y Measured amount of steps can be reviewed in diagrams	X	X	4
chess	X	X	X	X	X	X	X	0
Cognitive-behaviour therapy for anxiety – Managing Stress and Anxiety Program	Y All online lessons cover different topics. Furthermore summaries of the prior lessons and homework.	Y 5 online lessons in chronological order	Y Intervention is tailored for the focus group (e.g. cohort beliefs, health status, sociocultural context)	X	X	X	X	3

Online self-help for suicidal ideation	Y A module starts by providing information, followed by an assignment and several exercises	Y 6 modules covering different topics	Y Each module contains a number of optional exercises from which the subject can choose the ones that appeal to him	X	X	X	X	3
Ruward (Burnout)	Y Different phases during intervention, e.g. one week focuses on relaxation, another week focuses on worrying etc. Furthermore small steps to improve the behavior were taught.	Y Fixed order of CBT	Y Tailored feedback, depending on the outcome of the homework assignment	x	x	x	X	3
Ruward (Depression)	Y Scheduled therapeutic sessions, including symptom awareness training, structuring of daily activities, challenging of dysfunctional	Y 3 phases of CBT in a specified order	Y Tailored by the therapist to the specific situation of the patient	x	x	x	X	3

	thinking patterns, etc; assignments							
Ruward (PTSD)	Y Structured writing exercises, cognitive reappraisal and social sharing	Y 3 phases of CBT in a specified order	Y Tailored by the therapist to the specific situation of the patient	x	x	x	x	3
Ruward (Panic Disorder)	Y 7 therapeutic sessions, homework assignments, Panic Diary.	Y Scheduled therapeutic sessions, therefore a strict order of the modules and topics	Y CBT tailored to people with panic disorder	X	Y Panic Diary: participants had to report each distinct period that was characterized by fear, terror, etc	X	X	4
MoodGYM	Y Program consists of 5 modules, each module consists of separate elements	x	x	x	x	x	X	1
Web-based alcohol treatment	X	Y 2-part-intervention	Y Assessments and assignments target the specific drinking habits of the participant	X	X	X	x	2
Mileli.Net	Y Program was reduced to 5 sessions, each session dealt with single area		Y Patients were encouraged to describe any burning issues or particular questions close to					2

			the topic of the sessions					
Guided self-help for SAD	Y 9 modules with different topics	Y 9 modules in logical order						2
CardioFit	Y e.g. physical activity: a walking problem starting at 5-10 minutes, once or twice per day in week 1, progressing to 30 minutes, once or twice per day, everyday, by week 3. Furthermore activities on how to stop smoking, reducing stress etc.	Y Respondents are guided through the program. It's not mentioned that they have to finish all steps to go further, but they can't do the program of week 5 when they are in week 3 (for example)		Y The coach completes a registration survey to get the personalized CardioFit "discharge booklet"	Y Participants are asked to log on their daily physical activity on the Cardio-Fit website			4

Dialogue Support

Intervention	Praise	Rewards	Reminders	Suggestion	Similarity	Liking	Social Role	Total
HORYZONS	X	X	X	Y “wiki” with existing solutions	X	X	Y Experts as moderators	2
brindal site3	X	X	X	Y Recipes, food plans, shopping lists	X	X	X	1
brindal site1	X	X	X	Y Recipes, food plans, shopping lists	X	X	X	1
carlbring	X	X	Y SMS and e-mail at the training day	X	X	X	X	1
carrard	X	X	Y Via telephone, as soon as a user doesn't show any sign of activity	Y “Beverly and Scott” give concrete suggestions for completing exercises; strategies to prevent binge-eating	X	X	Y Persoonlijke coach- wekelijkse emailcontact Personal coach – weekly contact	3
Wellness Workbook	X	X	Y Email reminder if user doesn't log in to the site	Y Examples of how to implement new behavior in one's life	X	X	X	2
espie cbt	Y Praise in case of progress	Y Graduation ceremony	Y Email, sms	Y Counselor suggests new solutions	X	X	X	4

Espie irt	Y Prais in case of progress	Graduation ceremony	Y Email, sms	X	X	X	X	3
fang	X	X	X	Y A module provides examples on how to cope with peer pressure	X	X	X	1
ghahari	X	X	X	X	X	X	Y Facilitators who personally respond to user	1
glück	X	X	Y emails	X	X	X	X	1
Women to women	X	X	X	Y Examples for healthy nutrition and activity	X	Y Much work to make texts understandable and descriptive	X	2
quitting is winning	X	X	X	Y Strategies and therapies for stopping	X	X	X	1
yourway	X	X	Y Weekly emails	X	Y Gebruikers worden gevraagd om eigen problemen in casussen terug te vinden Users are asked to finde their own problems in cases	X	X	2

BEO	X	X	X	X	X	Y Colourful design, tailored to children/young people	Y "My Talk": Intervention is especially made for isolated users and therefore provides solidarity with the system	2
barnfather	X	X	X	X	X	X	Y Peer mentoren ontmoeten de gebruiker regelmatig in chatsessies	1
holländare	X	X	Y Prompts van begeleider wanneer inactief	Y Modules leveren suggesties voor omgaan met depressie	X	X	Y Persoonlijke therapeut die leiding geeft	3
Biggest loser club	X	X	Y Herinnert nieuwe informatie te lezen en gewicht aan te geven; email, sms en aanroep	Y Wekelijkse low- fat recepten en boodschappen- lijsten	X	X	X	2
10.000 steps	X	X	X	Y Verschillende doelen, plannen om stappen te bereiken worden voorgesteld	X	X	Y Virtuele "walking buddies"	2
chess	X	X	X	X	X	Y Makkelijk gebruik, teksten aangepast aan kinderen	Y Case manager voor ieder gebruiker	2

Cognitive-behaviour therapy for anxiety – Managing Stress and Anxiety Program	X	X	Y Weekly email reminders	X	Y Illustrated examples about people with anxiety practicing those skills described in the lesson	X	X	2
Online self-help for suicidal ideation	X	X	Y Weekly email reminders	X	X	X	X	1
Ruward (Burnout)	Y Tailored feedback with praise when the respondent did well	X	X	X	X	X	X	1
Ruward (Depression)	Y Tailored feedback with praise when the respondent did well	X	X	X	X	X	X	1
Ruward (PTSD)	X	X	X	X	X	X	X	0
Ruward (Panic Disorder)	Y Tailored feedback with praise when the respondent did well	X	X	X	X	X	X	1
MoodGYM	X	X	Y e-mail reminders	X	X	X	x	1
Web-based alcohol treatment	X	X	X	X	X	X	X	0
Mileli.Net	X	X	X	X	X	X	X	0
Guided self-help for SAD	X	X	X	X	X	X	x	1

CardioFit	X	X	Y e-mail reminders	X	Y Suggestions on how to stop smoking during the first week	X	X	2
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Social Support

Intervention	Social learning	Social comparison	Normative influence	Social facilitation	Cooperation	Competition	Recognition	Total
HORYZONS	Y „what works for me“- Share ways of coping	Y Discussion forum; „newsfeed“	Y Database	Y Online environment; „friends“-function	Y Problem solving groups	X	X	5
brindal site3	Y Success stories	Y Discussion board	X	Y Social network platform; friends function	X	X	Y Elections in “social quiz” for e.g. best blogger	4
brindal site1	Y Success stories	X	X	X	X	X	X	1
carlbring	X	X	X	X	X	X	X	0
carrard	Y “Beverly and Scott” Virtual characters explain program and provide	X	X	X	X	X	X	1
Wellness Workbook	Y Stories of patients	X	X	X	X	X	X	1
espie cbt	X	x	Y Praise/encouragement in case of progress	Y Social online environment	X	X	Y “graduation ceremony” after finishing	3
Espie irt	X	X	Y Praise in case of progress	X	X	X	Y Graduation ceremony	2
fang	Y Characters in the program demonstrate	X	X	x	Y Deepen the cooperation between mother	X	x	2

	behavior and its consequences				and daughter			
ghahari	Y Blogs of previous users	X	X	Y Discussion board	X	X	X	2
glück	X	X	X	X	X	X	X	0
Women to women	X	X	X	Y "sharing cycle"	X	X	X	1
quitting is winning	X	X	X	X	X	X	X	0
yourway	Y Presentation for website usage; other users profiles	Y It's possible to see answers of other users	x	Y Peer discussion board	X	X	X	3
BEO	X	X	X	Y "My Talk", discussion board and instant messenger	X	X	X	1
barnfather	Y Peer mentors (former patients) work as mediators and counselors	Y Chat sessions, compare different styles of coping, stressors and resources of support	X	Y Communication via email and message board	X	X	X	3
holländare	X	X	Y Personal feedback on homework and exercises	X	X	X	X	1
Biggest loser club	X	x	Y Compare user's calorie consumption with recommended	Y Community discussion board	X	X	x	2

			measures					
10.000 steps	X	Y Share progress with a "buddy"	Y peer pressure through group tasks	Y Virtual "walking buddy"	Y Team challenges	X	X	4
chess	Y Personal stories	x	Y Feedback and control by managers	Y Peer discussion board	X	X	X	3
Cognitive- behaviour therapy for anxiety – Managing Stress and Anxiety Program	X	X	X	X	X	X	X	1
Online self-help for suicidal ideation	X	X	X	X	X	X	X	0
Ruward (Burnout)	X	X	X	X	X	X	X	0
Ruward (Depression)	X	X	X	X	X	X	X	0
Ruward (PTSD)	X	X	X	X	X	X	X	0
Ruward (Panic Disorder)	X	X	X	X	X	X	X	0
MoodGYM	X	X	X	X	X	X	X	0
Web-based alcohol treatment	X	X	X	X	X	X	X	0
Mileli.Net	X	X	X	Y Discussion room and chat room	X	X	Y To illustrate the information to be processed the Mileli.Net portal included stories	2

							told by other patients in the same situation (voices), photos and reliable world wide web (www) links.	
Guided self-help for SAD	X	X	X	X	X	X	X	0
CardioFit	X	X	X	X	X	X	x	0