Feasibility and user experience of the unguided web-based self-help app ‘MyDiaMate’ aimed to prevent and reduce psychological distress and fatigue in adults with diabetes

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A R T I C L E I N F O

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A B S T R A C T

Introduction: Psychological distress and fatigue are common in persons with diabetes, adversely affecting quality of life and complicating diabetes self-management. Offering diabetes-specific self-guided cognitive behavioral therapy (CBT) may be helpful for persons with diabetes and mild symptoms of psychological distress and fatigue. We are the first to test the feasibility and user experiences of a web-based self-help app called ‘MyDiaMate’ in adults with type 1 and type 2 diabetes.

Methods and materials: MyDiaMate was developed in close collaboration with persons with diabetes and professionals, building on elements from existing (guided) diabetes-specific CBT interventions. The study was advertised, offering free access to the app for adults with diabetes for a period of three months. Feasibility and user experiences were tested in a non-randomized study with pre- and post- measurements and interviews in a small sample. In addition, usage of the app was studied using log-data.

Results: In total \(N = 55\) adults with diabetes signed up for the study. Mean age was \(M = 42.7\) (SD = 15.6), mostly women (\(n = 39, 70.9\%\)), higher educated (\(n = 36, 65.5\%\)), and diagnosed with type 1 diabetes (\(n = 37, 67.3\%\)). About half reported current or a history of psychological complaints. All the participants completed baseline assessments, and \(n = 32\) participants (58\%) completed the follow-up questionnaire. Main reasons for participating in the study were: to preserve or improve mental fitness (40.6\%), curiosity (25.0\%) and wanting to contribute to research (34.4\%). No major technical issues were encountered in accessing or using the app. The app was opened at least once by \(n = 51\) participants, median use of the modules was 28 min (1–80) within a period of \(1–92\) days (median = 10). Almost all participants (\(n = 50, 98.0\%\)) opened the basic module ‘Diabetes in balance’, of whom \(32 (62.7\%)\) completed this module. ‘My mood’ and ‘My energy’ were opened by \(n = 40 (78.4\%)\) and \(n = 32 (62.7\%)\) participants, respectively, and completed by \(n = 21 (52.5\%)\) and \(n = 9 (28.1\%)\) of the participants. Of all participants, 40.6\% would recommend the app to others living with diabetes.

Conclusions: This study confirmed the feasibility of MyDiaMate as a diabetes-specific self-guided app for adults wishing to preserve or improve their psychological health. While user experiences were overall positive, further tailoring the content to individual needs and preferences could enhance uptake, usage and appreciation. Future research should explore its effectiveness in a randomized controlled trial.

1. Introduction

Self-management is the cornerstone of overall diabetes management, aiming for near normal blood glucose levels in order to reduce the risk of acute blood glucose excursions and disabling long-term complications (Young-Hyman et al., 2016). The continuous need to self-regulate blood glucose in the face of the social, behavioral, and emotional challenges of daily life is psychologically burdensome and can lead to ‘diabetes burnout’ (Polonsky, 1999). Diabetes-related distress (diabetes distress) is highly prevalent in people living with diabetes and associated with adverse health outcomes (Perrin et al., 2017; KMP et al., 2010; Fisher et al., 2010). Moreover, depression, anxiety and chronic fatigue are common among both persons with type 1 and type 2 diabetes (Smith et al., 2013; Roy and Lloyd, 2012; Fisher et al., 2012; Pouwer et al.,

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CBT programs could suffice, characterized by a minimum level of based on user-input, quotes, milestones, and diaries. The homepage of intervention time and no health care professional support, to create mild to moderate levels of psychological distress or fatigue, low intensity maximum gain (Bennett-Levy et al., 2010).

2. Materials and methods

The content of ‘MyDiaMate’ was developed following an iterative process, involving researchers in diabetes psychology, mental health-care professionals specialized in diabetes, and end-users i.e. adults with diabetes (user panel). The content was largely derived from a self-help book (Snoek, 2001) and previously proven efficacious diabetes CBT-based interventions: Dia-Fit (Menting et al., 2017), HypoAware (Rondags et al., 2016a; Rondags et al., 2016b), ‘Diabetes de baas’ (NCW et al., 2005), ‘Elke dag diabetes’ (Snoek, 2001) and ‘Diabetergestemd.nl’ (van Bastelaar et al., 2011) was reviewed, selected and adapted to the goals and demands of the app under development.

MyDiaMate is shown in Fig. 1, Fig. 2 illustrates the flow and content of MyDiaMate. MyDiaMate offers two ‘basic’ psychoeducational modules which include (1) adaptive coping and problem solving and the topics stress, (hypo)fear & worries; hypo-awareness and relaxation, called ‘Diabetes in balance’ and (2) receiving social support, communication and assertiveness, ‘My social environment’. This is followed by two CBT modules: (3) ‘My mood’ including helpful thinking, undertaking enjoyable activities and relaxation and mindfulness, and (4) ‘My energy’, including establishing a regular sleep-wake pattern, activity regulation and graded activity and helpful fatigue-related thinking. Both modules are based on evidence-based guided internet-based interventions for persons with diabetes developed by our group (van Bastelaar et al., 2011; Menting et al., 2017).

Based on preference and a short self-assessment at the end of the psychoeducational modules, users can choose to stop, or start My mood or My energy, or both with no prescribed order. The self-assessment is based on four statements, indicating either mood problems e.g. ‘Over the last 2 weeks, I had little interest or pleasure in doing things’, and fatigue symptoms e.g. ‘Over the last 2 weeks, I did not do the things I would have liked to do because I was tired’. Parallel to the CBT modules, users can enter the page My goals to formulate a personal goal, and ascertain to what degree they have reached their goal. Within the CBT modules, the user is encouraged to work on their goal, and use the Mood diary and Energy diary to monitor their progress. The Energy diary is triggered when starting with graded activity in the module My energy. For both diaries users receive scheduled notifications.

2.2. Study design

We tested the feasibility of MyDiaMate and user experiences in a non-randomized study with pre- and post-measurements, using online questionnaires and additional interviews. After online consent, participants were given free access to the app for a period of three months. Gift cards of 50 euros were randomly allotted to five participants. The Medical Ethics Committee of the VU University Medical Center approved the study protocol (2017.492).
2.3. Study procedure

We recruited participants from February to March 2019 by means of advertisements. Flyers were distributed among three diabetes clinics in the Amsterdam area, and we posted on social media (diabetes-related Facebook groups and Twitter) and other diabetes-related platforms, such as the website of the Dutch Diabetes Research Foundation. Participants were also recruited indirectly via the members of our user panel. People could express their interest to participate in the study by e-mail in response to which they received an information letter describing the purpose and design of the study. People were eligible if they had been diagnosed with diabetes by a physician (self-report, all types were included; diagnosed since at least 12 months), were 18 years or older, owned an Android (version 11 or higher) or iOS (version 5.0 or higher) operating smartphone, had no current diagnosis of any severe mental illness (self-report) and were interested in using the app based on the information provided in the flyer. After providing online informed consent by checking a box, participants filled out an online questionnaire at baseline, pertaining to participants’ socio-demographic and clinical characteristics and psychosocial outcomes of interest. Next, they received an e-mail with instructions to log in into the Minddistrict platform and access MyDiaMate. Within the three month period data was collected on each individual’s usage of the app. Participants could decide for themselves how often and for how long they wished to use the app. At the end of the study period, participants were invited to complete online questionnaires pertaining to their psychological health, fatigue, user experience and asking for suggestions for further development. We randomly selected four participants for a telephone interview around user satisfaction that was audio recorded after consent was given.

2.4. Outcome measures

The primary outcomes are 1) feasibility (the number and characteristics of participants, practicalities around access, usage of the app), and 2) user experiences (user friendliness and satisfaction with the app and its features).

2.4.1. Feasibility

2.4.1.1. Participant characteristics. At baseline we collected socio-demographic data (age, gender, education, living status), and clinical information (type of diabetes, diabetes duration, diabetes complications, comorbidity), history or current psychological complaints, current psychological treatment. Pre- and post-three-month use of the app psychological distress and fatigue symptoms were assessed (with the 5-item ‘World Health Organization Wellbeing Index’ (WHO-5) (TRS et al., 2013), 5-item ‘Problem Areas in Diabetes 5’ (PAID-5) (McGuire et al., 2010), and the 8-item fatigue severity subscale of the ‘Checklist Individual Strength’ (CIS) (Vercoulen et al., 1999)). A WHO-5 score of less than 50 (range 0 to 100), indicates poor emotional-wellbeing (De Wit et al., 2007), a PAID score of score of 8 or higher (range 0 to 20) suggests elevated diabetes-distress (McGuire et al., 2010), and a CIS subscale score of 35 or higher (range 8 to 56) indicates fatigue severity (Goedendorp et al., 2014).

Motivation for using the app was assessed at follow-up with the question “What was the most important reason for you to start using MyDiaMate?” with answer options “1) I wanted to improve or maintain
my mental fitness; (2) I wanted to participate in research; (3) I was curious about MyDiaMate; (4) Other, namely...

2.4.1.2. Practicalities and usage. For technical issues, participants could e-mail the research coordinator. At follow-up, participants could indicate if they encountered any technical issues regarding the app.

To determine usage of MyDiaMate, we used the reported creation and completion time-stamps of each module page to calculate the number of participants using the modules at least once, the total usage period of modules in days, and the duration in minutes of participants using the modules at least once. Time spent on a page was considered invalid when exceeding 14 min. Timestamps of the filled in diaries were

Fig. 2. Content and structure of MyDiaMate.
used to calculate the number of participants who used the diaries at least once, the user period of diaries in days per participant, and the frequency of diary use per participant.

2.4.2. User experiences

Experience and satisfaction with the app were measured using questions regarding the values attributed to the overall content, text and other features of the app. Likert-scales ranging from 1 ‘completely disagree’ to 5 ‘completely agree’ were used, with higher scores indicating more behavior change (intention) or higher satisfaction. Furthermore, participants were asked whether they would recommend the app to others with diabetes (‘no’, ‘yes’, ‘I don’t know’), and were asked to grade the app on a scale from 1 to 10, with higher scores representing higher appreciation. In addition, participants were asked: ‘By using MyDiaMate, I came to the following conclusion: 1) I feel mentally well and I would not use MyDiaMate any further; 2) I feel mentally well, and I would like to use MyDiaMate to remain well; 3) Right now, I feel mentally well and I would use MyDiaMate again when I feel worse; 4) I need more help; 5) I don’t know’. Qualitative data from the interviews and open-ended questions derived from the questionnaire were used to enrich and interpret the quantitative data.

At the end of the access period, participants were asked with open-ended question if they had any recommendations for further improvements, both in the self-reported questionnaire (all) and the interviews (n = 4).

With a view on the potential efficacy of MyDiaMate we documented pre-post change scores related to psychological well-being (WHO-5) (De Wit et al., 2007), diabetes-distress (PAID-5) (McGuire et al., 2010), and fatigue severity (fatigue severity subscale of the CIS) (Vercoulen et al., 1999).

2.5. Statistical analysis

1) Baseline measures were summarized using mean and standard deviation or frequencies and percentages in case of categorical data. Current/history of psychological complaints at baseline and total scores on the WHO-5, PAID-5, CIS fatigue severity at baseline and follow-up were calculated. Participants who completely filled out the second questionnaire after the access period were compared to those who did not by t-tests or Chi-square tests.

Frequency and duration of use per module and diary was summarized using the range and the median, due to the skewness of the data. Users were identified as low and high-users by median split in minutes of usage, and Chi-square analysis were used to examine if the groups differed terms of psychological measures.

2) We calculated the frequency and percentages of the user experience scores and summarized the themes of our qualitative interview findings. SPSS version 26.0 was used for all analyses.

3. Results

A total of N = 55 eligible participants signed up for the study. Fig. 3 shows the participant flow. After the 3-month study period, n = 32 participants (58%) filled out the follow-up questionnaires, with no missing data within those n = 32 participants. No differences in baseline participants characteristics and psychological measures were found between those who completed the follow-up (n = 32), and those who did not (n = 23). The usage of the modules in minutes was significantly higher (p < .05) among participants who completed the follow-up questionnaire (median = 34 min, 0 to 80 min), compared to those who did not (median = 24 min, 0 to 59 min).

3.1. Feasibility (N = 55)

3.1.1. Participant characteristics

Table 2 provides demographical and diabetes-related data (N = 55). Most participants were female (n = 39, 70.9%), higher educated (n = 36, 65.5%), and diagnosed with type 1 diabetes (n = 37, 67.3%). Mean age was 42 years, ranging from 19 to 73 years of age. Almost half of the participants indicated that they had 1 or more comorbidities (n = 27, 49.1%). More than 1 out of 5 were currently seeing a psychologist (n = 12, 21.8%). About half reported a current/history of psychological complaints and/or a low wellbeing and/or high fatigue symptoms scores.

3.1.2. Practicalities and usage

No major issues were encountered with respect to the technology or download/onboarding procedure. Some minor issues were reported: slow start (n = 2), audio stopped, when screen went on standby (n = 1). Within the period of three months, n = 51 (92.7%) opened one or more modules of MyDiaMate, and used the modules 1 to 80 min (median = 28 min) in a period of 1 to 92 days (median = 10 days). Data of
usage of participants who logged in at least once (n = 51) is displayed in Table 3. Of those participant, almost all (n = 50, 98.0%) opened the basic module Diabetes in balance, and 32 (62.7%) and arrived at the final page of this module. The CBT modules My mood and My energy were opened by n = 40 (78.4%) and 32 (62.7%) participants, respectively, and completed by n = 21 (52.5%) and 9 (28.1%) of the participants. My goals was accessed by n = 27 (52.9%) participants. Most goals were related to healthy life style behaviors: increasing exercise (n = 14) and healthy eating (n = 8). The Mood diary was filled in once to 156 times (mean = 15.7 times) by n = 27 (52.9%) participants. Most goals were filled in once to 156 times (median = 13.0 times) by n = 19, 59.4%). Twenty-five percent felt supervened or improving their mental fitness (n = 25, 49.1%). The low and high-user groups did not differ in terms of their psychological profile.

3.2. User experiences (n = 32)

Data on the user experience of MyDiaMate gathered at follow-up (n = 32) are summarized in Table 4.

Preserving or improving mental fitness (n = 13, 40.6%) was the primary reason for using MyDiaMate, followed by wanting to participate in research (n = 11, 34.4%), and curiosity (n = 8, 25.0%). Most participants found the app informative (n = 24, 75.0%), trustworthy (n = 20, 62.5%), and clear (n = 19, 59.4%). Twenty-five percent felt supported in preserving or improving their mental fitness (n = 8), about half of the participants was neutral. MyDiaMate stimulated most participants to think about how they can preserve or improve their mental fitness (n = 27, 62.5%), e.g., “gives insight”.

Less than half of the participants did not find MyDiaMate useful (n = 8, 25.0%). For example, one participant noted: “the app is not useful for me, because I do not want to be occupied with my diabetes the whole day”.

Those who did find the app of use, mentioned the app was “helpful” and “easily accessible and effective”. 40.6% would recommend the app to other persons living with diabetes. Overall, participants rated the app on average a with a 6.2 (range 2 to 10) on a 1–10 scale.

Suggestions for further development of the app were put forward by 19 participants. Five participants would like to have access to more information, of which three suggested the possibility to use drop-down menus or links. One participant suggested videos to clarify or reduce uncertainty. Six participants found the notifications unclear, not helpful or even disruptive. One participant would like to have the option to receive feedback on the diaries. Other suggestions were the possibility to link the mood diary to a blood glucose monitor (n = 1), and having the option to communicate with other persons with diabetes via a chat feature (n = 1).

Table 5 shows the observed pre-post scores of psychological outcomes of interest of the 32 participants that completed the study.

4. Discussion

We developed the web-based self-help MyDiaMate for adults with diabetes and conducted a feasibility study looking at uptake, patient characteristics, practicalities, usage and user experiences. The number of patients that signed up for the study (n = 55) within a recruitment period of 2 months seems to confirm a demand for this type of self-help. Future research should further explore the potential reach and adoption of MyDiaMate in a large scale study.

We found evidence to support feasibility and overall positive user experiences of MyDiaMate. No major technical or practical obstacles...
32).

Table 4
Usability (user behavior, experience and satisfaction) rated by participants (n = 32).

| Theme | Question | (Totally) agree | Neutral | (Totally) disagree |
|-------|----------|-----------------|---------|-------------------|
| Learnability | I learned something new by using MyDiaMate, n (%) | 13 (40.7) | 8 (25.0) | 11 (34.4) |
| Self-efficacy | MyDiaMate gives me the confidence to work on my mental fitness, n (%) | 12 (37.5) | 10 (31.3) | 10 (31.3) |
| Motivation | By using MyDiaMate, I feel supported in preserving or improving my mental fitness, n (%) | 8 (25.0) | 16 (50.0) | 8 (25.0) |
| | MyDiaMate stimulates me to think about how I can preserve or improve my mental fitness, n (%) | 18 (56.3) | 7 (21.9) | 7 (21.9) |
| | MyDiaMate encourages me to take actions which might be beneficial to my mental fitness, n (%) | 14 (43.7) | 6 (18.8) | 12 (37.5) |
| Overall | I find MyDiaMate... n (%) | 20 (62.5) | 10 (31.3) | 2 (6.3) |
| Trustworthy | 24 (75.0) | 7 (21.9) | 12 (37.5) |
| Informative | 19 (59.4) | 8 (25.0) | 5 (15.6) |
| Useful | 8 (24.0) | 13 (40.6) | 11 (34.4) |
| Clear | 19 (59.4) | 8 (25.0) | 5 (15.6) |
| Attractive | 17 (53.1) | 8 (25.0) | 7 (21.9) |
| Easy to use | 18 (56.3) | 8 (25.0) | 6 (18.8) |
| Text | I find the text of MyDiaMate..., n(%) | 20 (62.5) | 10 (31.3) | 2 (6.3) |
| Appealing | 24 (75.0) | 7 (21.9) | 12 (37.5) |
| Positive | 19 (59.4) | 8 (25.0) | 5 (15.6) |
| Put things in perspective | 8 (24.0) | 13 (40.6) | 11 (34.4) |
| Negative | 0 (0.0) | 7 (21.9) | 25 (78.1) |
| Confusing | 3 (9.4) | 8 (25.0) | 21 (65.6) |
| Pedantic | 7 (21.9) | 8 (25.0) | 17 (53.1) |
| Recognizable | 21 (65.6) | 8 (25.0) | 3 (9.4) |
| Confrontational | 6 (18.8) | 15 (46.9) | 11 (34.4) |
| Complicated | 1 (3.1) | 6 (18.8) | 25 (78.1) |
| Length | 2 (6.3) | 17 (53.1) | 13 (40.6) |
| Illustrations | I find the illustrations of MyDiaMate..., n (%) | 10 (31.3) | 18 (56.3) | 4 (12.5) |
| Appealing | 9 (28.1) | 19 (59.4) | 4 (12.5) |
| Quantity | 20 (62.5) | 2 (6.3) | 1 (3.1) |
| Exercises | I understand how I can execute the exercises, n (%) | 10 (31.3) | 10 (31.3) | 3 (9.4) |
| Dairies | 19 (59.4) | 2 (6.3) | 4 (12.5) |

Table 4 (continued)

| Theme | Question | (Totally) agree | Neutral | (Totally) disagree |
|-------|----------|-----------------|---------|-------------------|
| Recommendation | I would recommend MyDiaMate to others with diabetes, n (%) | No | 9 (28.1) | 6 (18.8) |
| | Yes | 14 (43.8) | 2 (6.3) |
| Grade | On a scale from 1 to 10, I would give MyDiaMate the grade, mean (SD), range | 6.2 (1.9) | 2–10 |
| Conclusion | By using MyDiaMate, I came to the following conclusion, mean (SD) | I feel mentally well and I would not use MyDiaMate any further. | 6 (18.8) |
| | I feel mentally well, and I would still use MyDiaMate to stay this way. | 2 (6.3) |
| | Right now, I feel mentally well and I would use MyDiaMate again when I feel worse. | 5 (15.6) |
| | I need more help. | 4 (12.5) |
| | I don’t know. | 1 (3.1) |

Table 5
Change scores of psychological outcomes, n = 32.

| Construct | Measure | Pre | Post |
|-----------|---------|-----|------|
| Well-being | WHO 5 | 54.0 (20.1) | 57.9 (20.9) |
| Diabetes distress | PAID 5 | 6.7 (4.2) | 6.0 (3.6) |
| Fatigue | CIS fatigue severity | 36.2 (11.8) | 32.6 (13.4) |

WHO, World Health Organization Wellbeing Index; PAID, Problem Areas in Diabetes.
GIS, Checklist Individual Strength.

were encountered in the process of accessing, onboarding or using the app as intended. The findings with regard to the user experiences are encouraging. Overall, participants experienced MyDiaMate as informative, trustworthy and clear. The text was generally appreciated as appealing, positive and recognizable. However, slightly less than half of the participants found that there was too much text to read. The app provides mostly written information and may require (too) much cognitive effort, at least for some. Limiting and replacing text by providing videos or animations may be helpful in this respect and experienced as more engaging (Cheung et al., 2017; Stanczyk et al., 2014). The way the app is structured, starting with a basic module followed by two optional modules provides clarity on the route to follow. This probably partly explains that most participants experienced the app as ‘easy to use’, but such a fixed structure may not be preferred by everyone. For example, users who look for certain information may...
prefer to go directly to the content within a few clicks, without having to go through the large parts of the program. As a result, users may not be able to directly access the sought information on psychosocial issues and therefore feel less supported. Offering more flexibility would appear particularly salient for the psychoeducational modules of the app.

The app seems to stimulate most users to think about how to improve and preserve their mental fitness in the context of living with and having to self-manage diabetes. However, not everyone reported to have felt supported, which may be related to the fact that the app does not connect to a professional or support network. Incorporating the option of a group chat, may prove helpful to some to feel more connected and emotionally supported (Brouwer et al., 2011).

The app offers prescheduled notifications, reminding the user to fill out the mood and/or energy diary. Such push notifications can increase app engagement, but only few in our study found them to be helpful. Tailoring push notifications to the individual’s needs and preferences may help to increase acceptance and effectiveness (Bidargaddi et al., 2018).

4.1. Strengths and limitations

We involved multiple professionals and patients in developing MyDiaMate. Another strength worth mentioning is the fact that much of the content is evidence-based. As noted, the app was offered within a research context, which might have resulted in a selection bias in par

4.1.1. Strengths

- Tailoring push notifications to the individual’s needs and preferences may help to increase acceptance and effectiveness (Bidargaddi et al., 2018).

4.1.2. Limitations

- The majority of patients has type 1 diabetes.

- Over 40% joined the study with the aim to preserve and improve their mental health and energy, in line with the purpose of MyDiaMate. At this stage, based on the observed pre-post change scores in our small sample we cannot draw conclusions regarding the efficacy nor of any potential harm of MyDiaMate. For further research it would be helpful to determine a minimum level of engagement, expressed in time or completed exercises, to experience improvement in mental fitness and energy level.

5. Conclusion

This study showed promising results with respect to feasibility and user experiences of the unguided self-help app ‘MyDiaMate’, designed to help persons with diabetes reduce and possibly prevent psychological distress and fatigue. Future research should aim to examine its effectiveness and to explore ways to further personalize content and features based on individual preferences and needs.

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Declaration of competing interest

The authors declare that they have no conflict of interest.

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References

Baptista, S., Traylor, S., Pouwer, F., Oldenburg, B., Wadley, G., Speight, J., 2019. What do adults with type 2 diabetes want from the “perfect” app? Results from the second diabetes MILES: Australia (MILES-2) study. Diabetes Technol. Ther. 21 (7), 393–399.

Baumeister, H., Reichler, L., Munzing, M., Liz, J., 2014. The impact of guidance on internet-based mental health interventions—a systematic review. Internet Interv. 1, 69–75.

Bennett-Levy, J., Richards, D., Farrand, P., Christensen, H., Griffiths, K., 2010. Oxford Guide to Low Intensity CBT Interventions. Oxford University Press.

Bidargaddi, N., Almirall, D., Murphy, S., Nahum-Shani, I., Kováčik, M., Pituch, T., et al., 2018. To prompt or not to prompt? A microrandomized trial of time-varying push notifications to increase proximal engagement with a mobile health app. JMIR Mhealth Uhealth 6 (11).

Brouwer, W., Knoez, R., Czutzen, R., de Nooijer, J., de Vries, N.K., Brug, J., et al., 2011. Which intervention characteristics are related to more exposure to internet-delivered healthy lifestyle promotion interventions? A systematic review. J. Med. Internet Res. 13 (1), 23–41.

Cheung, K.L., Schwabe, I.J.L., Walthouwer, Oenema, A., Lechner, L., de Vries, H., 2017. Effectiveness of a video versus text-based computer-tailored intervention for obesity prevention after one year: a randomized controlled trial. Int. J. Environ. Res. Public Health 14 (10).

De Wit, M., Pouwer, F., Giske, R.J., Delemarre-van de Waal, H.A., Snoek, F.J., 2007. Validation of the WHO-5 well-being index in adolescents with type 1 diabetes. Diabetes Care 30 (8), 2003–2006.

Donker, T., Blankers, M., Hedman, E., Ljotsson, B., Petrie, K., Christensen, H., 2015. Economic evaluations of internet interventions for mental health: a systematic review. Psychol. Med. 45 (16), 3357–3376.

Ebert, D.D., Nobis, S., Lehr, D., Baumeister, H., Riper, H., Auerbach, R.P., et al., 2017. The 6-month effectiveness of internet-based guided self-help for depression in adults with type 1 and 2 diabetes mellitus. Diabet. Med. 34 (1), 99–107.

Fisher, L., Mullan, J.T., Arean, P., Glasgow, R.E., Hessler, D., Masharani, U., 2010. Diabetes distress but not clinical depression or depressive symptoms is associated with glycemic control in both cross-sectional and longitudinal analyses. Diabetes Care 33 (1), 23–28.

Fisher, E.B., JCN, Chan, Nan, H., Sartorius, N., Oldenburg, B., 2012. Co-occurrence of diabetes and depression: conceptual considerations for an emerging global health challenge. J. Affect. Disord. 142, S56–S66.

Frischke, L., Gallardo, A.M., Urtubey, X., 2018. Web-based interventions for depression in individuals with diabetes: review and discussion. JMIR Diabetes 3 (3), e13.

Goedendorp, M.M., Tack, C.J., Stegink, E., Broot, L., Bazelmans, E., Knoop, H., 2014. Chronic fatigue in type 1 diabetes: highly prevalent but not explained by hyperglycemia or glucose variability. Diabetes Care 37 (1), 73–80.

Kitsiou, S., Fare, G., Jaana, M., Gerber, B., 2017. Effectiveness of mHealth interventions for patients with diabetes: an overview of systematic reviews. PLoS One 12 (3).

KMP, Van Bastelaar, Pouwer, F., PHELM, Geelhoed-Duijvestijn, Tack, C.J., Bazelmans, E., Beekman, A.T., et al., 2017. Diabetes-specific emotional distress mediates the association between depressive symptoms and glycemic control in type 1 and type 2 diabetes. Diabet. Med. 27 (7), 798–803.

Liddon, L., Kingerlee, R., Barry, J.A., 2018. Gender differences in preferences for psychological treatment, coping strategies, and triggers to help-seeking. Br. J. Clin. Psychol. 57 (1), 42–58.

McGuire, B.E., Morrison, T.G., Hermanns, N., Skovlund, S., Eldrup, E., Gagliardino, J., et al., 2010. Short-form measures of diabetes-related emotional distress: the problem areas in diabetes scale (PAID)-S and PAID-1. Diabetologia 53 (1), 66–69.

Menting, J., van der Veld, W.M., Goedendorp, M.M., Tack, C.J., Knoop, H., 2016. Severe fatigue in type 1 diabetes: exploring its course, predictors and relationship with HbA1c in a prospective study. Diabetes Res. Clin. Pract. 121, 127–134.

Minddistrict. [cited 2020. Available from: https://www.minddistrict.com/.

NCW, van der Ven, MHL, Hogeneste, AME, Tromp-Wever, JWR, Twisk, van der Ploeg, H., NCW, van der Ven, MHE, Hogenelst, AME, Tromp-Wever, JWR, Twisk, van der Ploeg, H., 2007. Chronic fatigue in type 1 diabetes: highly prevalent but not explained by hyperglycemia or glucose variability. Diabetes Care 31 (1), 69–75.

Peyrot, M., Burns, K.K., Davies, M., Forbes, A., Hermanns, N., Holt, R., et al., 2013. Diabetes attitudes wishes and needs 2 (DAWN2): a multinational, multi-stakeholder control. A randomized controlled trial. Diabet. Med. 22 (11), 1619–1623.

Park, H., Park, C., Quinn, L., Fritschi, C., 2015. Glycose control and fatigue in type 2 diabetes: the mediating roles of diabetes symptoms and distress. J. Adv. Nurs. 71 (7), 1650–1660.

Perrin, N.E., Davies, M.J., Robertson, N., Snoek, F.J., Khunti, K., 2017. The prevalence of diabetes-specific emotional distress in people with type 2 diabetes: a systematic review and meta-analysis. Diabet. Med. 34 (11), 1508–1520.

Public Health 14 (10).

Minddistrict. [cited 2020. Available from: https://www.minddistrict.com/.

NCW, van der Ven, MHL, Hogeneste, AME, Tromp-Wever, JWR, Twisk, van der Ploeg, H., NCW, van der Ven, MHE, Hogenelst, AME, Tromp-Wever, JWR, Twisk, van der Ploeg, H., 2007. Chronic fatigue in type 1 diabetes: highly prevalent but not explained by hyperglycemia or glucose variability. Diabetes Care 31 (1), 69–75.

Peyrot, M., Burns, K.K., Davies, M., Forbes, A., Hermanns, N., Holt, R., et al., 2013. Diabetes attitudes wishes and needs 2 (DAWN2): a multinational, multi-stakeholder study of psychosocial issues in diabetes and person-centred diabetes care. Diabetes Res. Clin. Pract. 99 (2), 174–184.
Polonsky, W., 1999. Diabetes Burnout: What to Do When You Can’t Take it Anymore. American Diabetes Association.

Pouwer, F., Skinner, I.C., Pibernik-Okanovic, M., Beekman, A.T.F., Cradock, S., Szabo, S., et al., 2005. Serious diabetes-specific emotional problems and depression in a Croatian-Dutch-English survey from the European depression in diabetes (EDID) research consortium. Diabetes Res. Clin. Pract. 70 (2), 166–173.

Rondags, S.M.P.A., de Wit, M., Twisk, J.W., Snoek, F.J., 2016a. Effectiveness of HypoAware, a brief partly web-based Psychoeducational intervention for adults with type 1 and insulin-treated type 2 diabetes and problematic hypoglycaemia: a cluster randomized controlled trial. Diabetes Care 39 (12), 2190–2196.

Rondags, S.M.P.A., de Wit, M., Snoek, F.J., 2016b. HypoAware: development and pilot study of a brief and partly web-based psychoeducational group intervention for adults with type 1 and insulin-treated type 2 diabetes and problematic hypoglycaemia. Diabet. Med. 33 (2), 184–191.

Roy, T., Lloyd, C.E., 2012. Epidemiology of depression and diabetes: a systematic review. J. Affect. Disord. 142, S8–S21.

Schlicker, S., Weisel, K.K., Buntrock, C., Berking, M., Nobis, S., Lehr, D., et al., 2019. Do nonsuicidal severely depressed individuals with diabetes profit from internet-based guided self-help? Secondary analyses of a pragmatic randomized trial. J. Diabetes Res., 2634094 eCollection (11 pages).

Schmidt, C.B., van Loon, B.J.P., Vergouwen, A.C.M., Snoek, F.J., Honig, A., 2018. Systematic review and meta-analysis of psychological interventions in people with diabetes and elevated diabetes-distress. Diabet. Med. 35 (9), 1157–1172.

Smith, K.J., Beland, M., Clyde, M., Gariepy, G., Page, V., Badawi, G., et al., 2013. Association of diabetes with anxiety: a systematic review and meta-analysis. J. Psychosom. Res. 74 (2), 89–99.

Snoek, F.J., 2001. Elke dag diabetes: zoeken naar balans: Teleac/NOT.

Snoek, F.J., 2020. #DiabetesPsychologyMatters. Diabetes Spectr. 33 (1), 95–96.

Stansczyk, N., Rolman, C., van Adrichem, M., Candel, M., Maris, J., de Vries, K., 2014. Comparison of text and video computer-tailored interventions for smoking cessation: randomized controlled trial. J. Med. Internet Res. 16 (3), 35–52.

TRS, Hajo, Pouwer, F., Skovlund, S.E., Den Oudsten, B.L., PHLM, Geelhoed-Duijvestijn, Tuck, C.J., et al., 2013. Psychometric and screening properties of the WHO-5 well-being index in adult outpatients with type 1 or type 2 diabetes mellitus. Diabet. Med. 30 (2), E63-E9.

van Bastelaar, K.M.P., Pouwer, F., Cuijpers, P., Riper, H., Snoek, F.J., 2011. Web-based depression treatment for type 1 and type 2 diabetic patients a randomized, controlled trial. Diabetes Care 34 (2), 320–325.

van Bastelaar, K.M., Pouwer, F., Cuijpers, P., Riper, H., Twisk, J.W., Snoek, F.J., 2012. Is a severe clinical profile an effect modifier in a web-based depression treatment for adults with type 1 or type 2 diabetes? Secondary analyses from a randomized controlled trial. J. Med. Internet Res. 14 (1), e2.

Vercoulen, J.H., Alberts, M., Bleijenberg, G., 1999. De checklist individual strength (CIS). Gevergetherapie 32, 383–392.

Ye, Q., Khan, U., Boren, S.A., Simons, E.J., Kim, M.S., 2018. An analysis of diabetes mobile applications features compared to AADE7: addressing self-management behaviors in people with diabetes. J. Diabetes Sci. Technol. 12 (4), 808–816.

Young-Hyman, D., de Groot, M., Hill-Briggs, F., Gonzalez, J.S., Hood, K., Peyrot, M., 2016. Psychosocial care for people with diabetes: a position statement of the American Diabetes Association. Diabetes Care 39 (12), 2126–2140.