An app-based Multicomponent Positive Psychology Intervention for health care professionals and their patients:

A monocenter pilot study to evaluate the adherence, appreciation, perceived impact and usefulness for patients

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Abstract

Background: Health care professionals are suffering from higher levels of psychological stress compared to other workforces. This is an increasing burden and needs to be addressed. Positive psychology interventions have shown promise in targeting psychological distress. App based interventions have the potential to overcome the barriers of face-to-face treatment.

Aim: The aim of this pilot study is to evaluate the adherence, appreciation, and the perceived impact of the *Training in Positivity* (TiP) app among health care professionals and the added value in using it for patients from the perspective of health care professionals.

Methods: A one group pre-posttest was used in which 32 healthcare professionals were asked to try out the TiP-app for three weeks. The outcome measures were self-compassion, stress, resilience. With a subsample (5) semi-structured in-depth interviews were conducted.

Results: In general, health care professionals appreciated the intervention, however the adherence was low. They reported disliking the 'repetitions' of exercises and the 'tunneled structure' of the intervention. The first 2 modules (*positive emotions* and *discovering strengths)* were most appreciated. The majority of the health care professionals reported being more aware after using the TiP-App. There were no significant differences for the variables *perceived stress*: T0 ($M =1.95$, $SD = .47$); T1($M = 1.75$, $SD = .42$), *resilience*: T0 ($M = 3.24$, $SD = .72$); T1($M = 3.42$, $SD = .55$), *self-compassion*: T0 ($M = 4.09$, $SD = .71$); T1 ($M = 4.55$, $SD = .67$). The health care professionals are reluctant to use it for patients because of the difficulty based on the qualitative data.

Conclusion: Health care professionals generally appreciated the TiP-app, even though they themselves did not feel they needed it and did not have much impact on them and this was confirmed by the pre-post analysis. Further research should be conducted to improve adherence, tailor interventions to health care professionals and to make it compatible for patient use.

Introduction

Health care professionals are facing significant work-related stressors, and mental health challenges (Sovold et al., 2021). There is an increasing burden on the healthcare system due to the aging population, meaning more long-term care is needed for adults (UN, 2022), with an already growing shortage of nursing staff (WHO, 2013). The World Health Organization (2016) foresees a shortfall of 18 million health care professionals by 2030. Compared to other workforces, health care professionals are exposed to higher levels of psychological stress due to high workload. The high stress levels can have a negative impact on the mental well-being, work productivity and functioning, job satisfaction and work engagement. This can cause large-scale consequences for the quality of healthcare, as a result of medical errors, sickness leaf, patient safety and patient well-being (Cimiotti, Aiken, Sloane & Wu, 2012; Khasawneh, Malkawi, Ababneh, Al-Araidah & Kremeret, 2021). During COVID-19 these issues have worsened (Sovold, et al., 2021). The recent study of Tabur et al. (2022) shows that health care workers attending COVID-19 patients, in a pandemic hospital, experienced significantly higher job stress compared to health care workers in a non COVID-19 hospital. Job stress and excessive workloads have been a long-standing concern of the healthcare industry, even without any crisis or pandemic (Karabulak & Kaya, 2021). Therefore, it is important to promote mental well-being among health care professionals.

Mental well-being is defined as "a state, in which the individual recognizes his or her own abilities, copes with normal stresses of life, works productively and contributes to his or her community" (WHO, 2022, concepts in mental health par. 1). This definition is in line with a new and growing area of research that is focused on promoting well-being (Rusk and Waters, 2013), convinced by the positive psychology movement (Seligman and Csikszentmihalyi, 2000), rather than focusing on the reduction of mental health problems. Previous studies have shown that higher levels of well-being can protect against the development of mental disorders (Schotanus-Dijkstra et al., 2017; Trompetter, Kleine & Bohlmeijer, 2017). In the research of Karabuluk & Kaya (2021) the

influence of psychological resilience is significant in explaining the perception of stress in nurses. Psychological resilience is the flexibility to bounce back from negative effects of stress factors that difficult life experiences can bring (Cam & Buyukbayram, 2017). In the study of Pollock et al. (2020) was found to be no strong evidence on effective workplace interventions for increasing resilience of health care professionals. Main barriers were for example, lack of awareness and lack of resources dedicated to the needs of health care professionals. There is need to integrate interventions to address increased mental distress and enhance resilience in health care professionals (Akinnusotu, 2023; Karabuluk & Kaya, 2021), especially interventions that are tailored to meet the changing needs of this population (DeTore et al., 2022).

Positive psychology interventions have shown promise in targeting psychological distress and can be defined as interventions promoting positive feelings, behaviors and cognitions, while also using theoretically and empirically based pathways or strategies to increase well-being (Sin & Lyubomirsky, 2009; Bolier et al. 2013b; Parks & Biswas-Diener, 2013; Schueller & Parks, 2014). These results are in line with earlier indication that healthcare professionals are willing to participate in online, wellness-focused interventions (Blake, Bermingham, Graham, & Tabner, 2020), and that such courses can be effective for this workforce (Maunder et al., 2010). For example, the *Three Good Things* exercise (Seligman et al., 2005) in which you savor positive emotions by thinking of three good things that went well that day. More recent studies have also used positive psychology interventions for nursing staff and the general population (Kloos et al., 2019; Schotanus-Dijkstra et al., 2015). A review has shown that efficacy is further improved when multiple evidence based positive psychology activities are combined into a multicomponent positive psychology intervention (MPPI). In several studies there was a small effect on subjective well-being and depression, and a small to moderate effect on psychological well-being although further research is necessary to strengthen claims on effectiveness of MPPI's (Hendriks, Schotanus-Dijkstra, Hassankhan, de Jong, & Bohlmeijer, 2019). Although studies have shown most interventions that teach principles of

mindfulness, acceptance, and self-compassion are through face-to-face delivery and they fall short due to limited dissemination (Cavanagh, Strauss, Forder & Jones, 2014; Fairburn & Patel, 2017).

App based interventions have the potential to overcome the barriers of face-to-face treatment, like limited acceptability, adherence, low self-perceived need for treatment, fear of stigmatization and lower costs (Serrano-Ripoll et al., 2022; Gulliver, Griffiths, & Christensen, 2010). Delivering mental health care online has become more feasible with the rapid increase in smartphone usage. Offering interventions in a mobile format may help with integration of newly learned skills into daily life, since most people nowadays carry their mobile device throughout daily activities (Jones et al, 2015). The emerging evidence for mental health apps that promote positive mental health and wellbeing in the general population suggests promising outcomes (Eisenstadt et al., 2021). A significant improvement of mental wellbeing was found in health care professionals using an app-based intervention named PsyCovidApp (Serrano-Ripoll et al., 2021). Another review suggests that the principles of acceptance, mindfulness and self-compassion can be learned by using mental health smartphone apps, although the quality of the available evidence was poor (Linardon, 2020). An analysis of user reviews shows most mental health apps experience usability problems which causes low adoption, low engagement and high attrition (Alqahtani & Orji, 2019). More development and evidence are therefore needed for app-based interventions.

Many studies have looked at app-based positive psychology interventions for health care professionals, however no previous studies have examined the interventions for the purpose of usefulness for patients. Health care professionals can offer insight in what could be useful for their own patient group. Interventions have been made either for patients or for health care workers so far.

Therefore, the University of Twente developed an app-based intervention on well-being called the TiP-app, a *Training in Positivity*. This app is partly based on a proven effective intervention with the potential to improve well-being and to decrease anxiety and depressive symptoms (Schotanus-Dijkstra et al., 2017). This is a MPPI and the primary aim of this study is to

evaluate the adherence, appreciation and the perceived impact of the TiP-app among health care professionals. The secondary aim is to evaluate the potential added value in using the TiP-app for patients. The following questions were addressed:

1. What was the uptake and adherence with the app?

2. How did the participants appreciate the app as a whole, the individual modules and the supportive features?

3. What is the perceived impact of the app?

4. What is the potential use of the app for patients?

Method

Design

This study was a mixed method monocentre pilot study, in which participants were asked to try out the TiP-app for three weeks. Participants were asked to complete questionnaires before (T0) and after the study (T1), and with a subsample semi-structured in-depth interviews were conducted.

This study was approved by the Ethics Committee of The University of Twente (no. 220959). All participants gave their online informed consent before participating.

Description of Training in Positivity (TiP)

Training in Positivity (TiP) app is a theory-based intervention that covers six sequential modules as well as features that are accessible at any time from the home page. Each module has a theme and consists of a psycho education with evidence based positive psychology exercises that need to be completed three times. After completing the exercises three times, the participants received automated information about their progress in developing a skill. See Table 1 for a brief overview of the intervention content. The intervention makes use of tunneling meaning the content of each lesson and the lessons themselves are delivered in a predetermined sequence of steps. For example, the second module could only be accessed when the previous module was completed. Every three days a new module becomes available. The participants could track their progress on the homepage where a maze symbol indicates which modules are completed. Every module starts with an introductory video and a written explanation about the theme of that module, followed by an exercise.

Push notifications are used to encourage to do the exercise every day and integrate the content into daily life. Features that are directly accessible from the homepage include a page with settings, a page with practical information and the inspirational page where pictures can be uploaded and quotes can be pinned. These last two components are optional. The features are accessible at any time from the homepage. See Table 2 for the features overview. The intervention was explained with

information provided in an email. Participants followed the intervention individually and whenever they could, since it was app-based. They received a login-code to make a personal account. The app remained available after the intervention period. The participant could continue using the app by restarting the modules and also continue receiving notifications. Figure 1 presents a few examples of the TiP app.
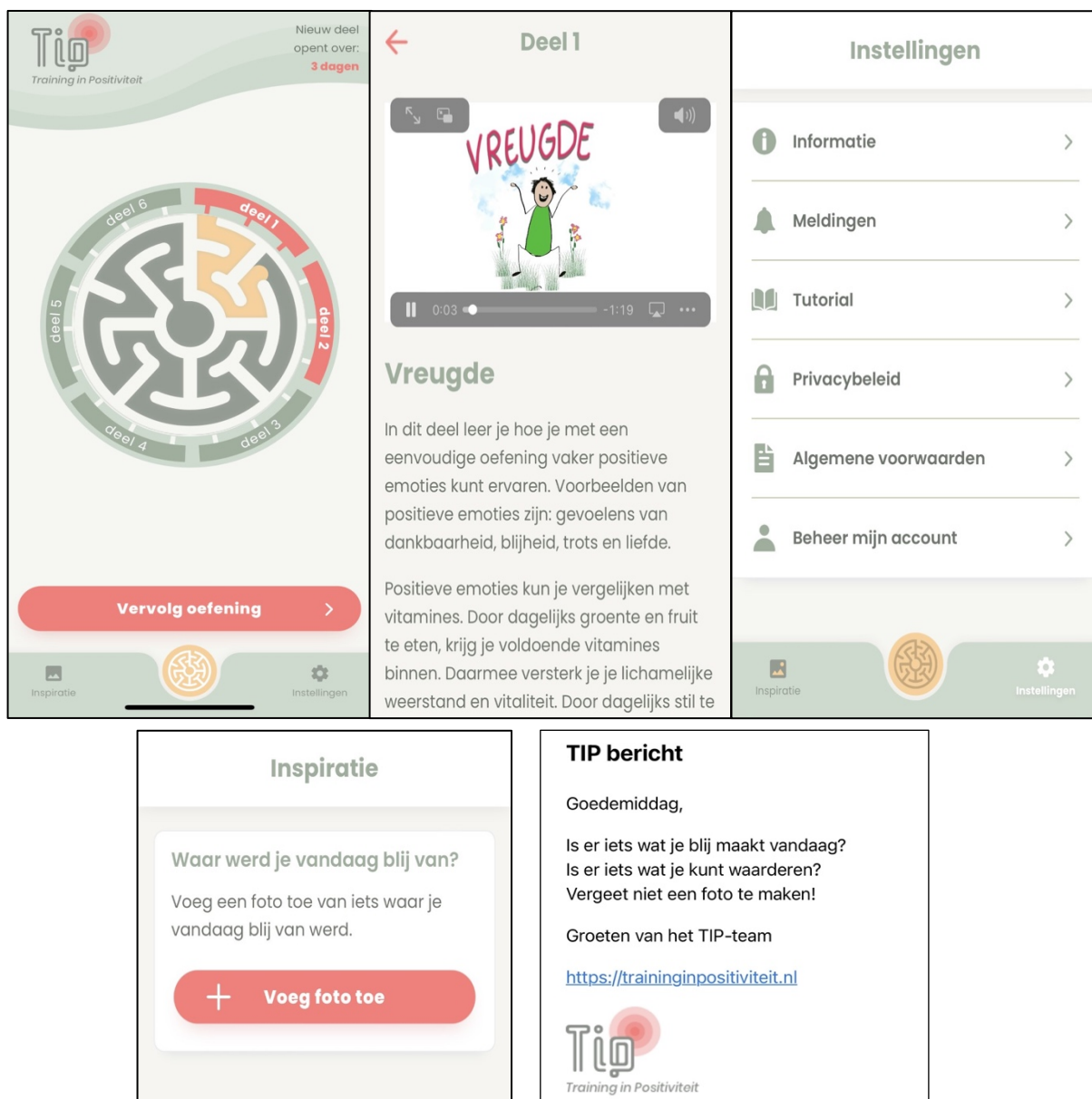

Figure 1. Visualization of the TiP-app. On the top left: homepage of the TiP-app. In the top middle: the introductory video and text of the first module. On the top right: the settings menu. On the bottom left: the exercise 'what lightened your day'. On the bottom right: a push notification.

Table 1

Overview of the TiP-app modules and the key components

Module	Key components
1. Joy	Psycho-education about positive emotions.
	Exercise: Three good things (Seligman et al., 2005). Participants identify three good thing that went well each day.
	Audio exercise 'Reminisce with attention"
2. Trust in yourself	Psycho-education about discovering strengths.
	Exercise: Vision of others 'ask 3 people about your top 3 strengths with examples from daily life' (Linley et al., 2010)
	Audio exercise 'Enjoying Flow'
3. Confidence in the future	Psycho-education about optimism and hope.
	Exercise: Imagine your best possible self' visualize yourself in the personal, relational and professional domain (Sheldon & Lyobomirsky, 2006). Formulate goals in one of these domains and visualize yourself when achieving a goal.
	Audio exercise 'Reminisce with attention"
4. Being kind to vulnerability	Psycho-education about self-compassion.
	Exercise in mindful self-compassion "How would you treat a friend?" Pick one of your own vulnerabities while listening to the audio exercises 'Loving care" and 'The compassionate other'.
5. Resilience	Psycho-education about resilience.
	Exercise in benefit finding: reappraisal of difficult events and find out if anything positive came out of it (Denborough, 2014).
	Audio exercise 'Cherish life lessons'
6. Connectedness	Psycho-education about positive relations.
	Exercise: Invest in positive relations. Make a loving investment in a relationship every day for the next few days and choose three people for this.

Table 2

Supportive functionalities and their description

Supportive functionalities	Description
Overview of modules	The maze symbol is a visual element on the homepage that displays the 6 modules and the user's progress. With each exercise, the participants go through the maze to eventually arrive at their own strength in the center
Pin a quote	Daily inspiration with a quote in positivity. When a quote inspires the user, then the user can pin the quote to their inspiration page
Upload a picture	Make a picture of something that lightened the day and upload this to the inspiration page
Feedback on improvement	After finishing each module, scores on improvement are given based on the users input
Mindfulness exercise	Every module contains a mindfulness audio exercise to strengthen the user's positivity
Push notifications	Daily notifications; a morning quote, reminders to make a picture and to do the exercises, with the option to turn each of these notifications off

Participants and procedures

Employees of the rheumatology and oral surgery department had indicated that they were looking for an intervention to increase the resilience of patients and responded positively to this well-being app TiP. Eligible participants were health care professionals from Medisch Spectrum Twente of the department of rheumatology and oral surgery, able to understand and read the Dutch language, who were willing to invest in 10 to 15 minutes each day for three weeks in the training via the TiP-app

and complete the questionnaire before and after the training. Potential participants were recruited by email through the contact person of the relevant departments.

Of the 60 employees who were approached, 32 employees participated and completed the baseline questionnaire and 15 completed the T1 questionnaire. Two participants withdrew from participation due to personal circumstances. Of this group, 13 participants indicated that they were willing to participate in the interview. These participants were contacted by e-mail and invited to participate in a Teams interview about their experiences with the TiP-app. They received a short summary of the interview questions and how much time it would consume. With the participants who were willing to participate, an appointment for a Teams interview was made. Five out of these 13 participants could not be reached after 2 email reminders and a phone call. Three of these 13 participants withdrew from participation. With the remaining 5 an interview was conducted, after the participants had given their oral informed consent. After the first two interviews there was a meeting with a supervisor from the University Twente to see if the interview scheme needed to be adjusted. The average duration of the interviews was 30 minutes. Figure 2 shows a diagram of the participants flow throughout the study.
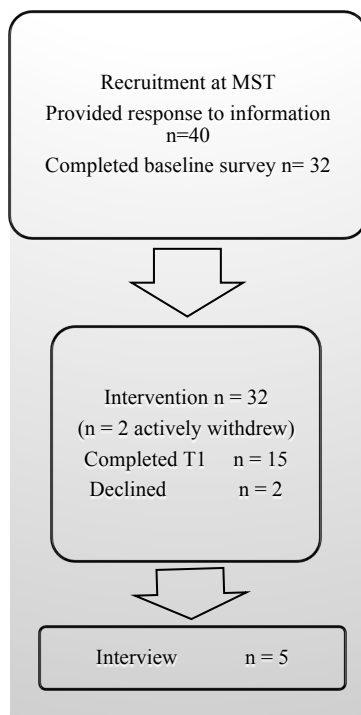
Figure 2. Flowchart of participants in the study

Measures

Demographic characteristics

At the pretest (T0) the following demographic characteristics were assessed: gender, age and

occupation at the hospital. For the occupation the participants had to choose from the following

categories: *medical specialist, nurse, nursing specialist/physician assistant, support*

staff/management and *other.*

Outcome measures

At both T0 and T1, scales measuring stress, resilience and self-compassion at individual participant level were assessed.

Stress; The Perceived Stress Scale (PSS) was used to measure stress (Cohen, Kamarck, & Mermelstein, 1983). This scale comprises ten items and the questions in the scale ask about your feelings and thoughts during the last month, with each item rated on a 5-point likert scale ranging from 1 (never) to 5 (very often). For example, *"In the last month, how often have you been upset because of something that happened unexpectedly?"* The responses to the four positively stated items were reversed (items 4, 5, 7 and 8). The mean score was calculated with higher scores indicating higher levels of perceived stress. This study sample Cronbach's α was .84 at pretest (T0) and .86 at posttest (T1).

Resilience; The Brief Resilience Scale (BRS) was used to assess resilience (Smith et al., 2008). This scale comprises six items with statements about your resilience in difficult times, with each item rated on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). Two examples include, *"I tend to bounce back quickly after hard times"*, and *"I have a hard time making it through stressful event*s". The answers to the 3 negative subscales items were reversed (items 2, 4 and 6). The mean score was calculated with higher scores indicating higher resilience. Internal reliability using Cronbach's α was .70 at pretest (T0). In the posttest (T1), Cronbach's α was 0.496.

Self-compassion; The Self-Compassion Scale Short-Form (SCS-SF) was used to assess self-compassion (Raes, Pommier, Neff & Van Gucht, 2011). This scale consists of 12 items and measures six components of self-compassion: self-kindness, self-judgement, common humanity, isolation, mindfulness and over-identification with 2 items for each component. For each item respondents'

rate on a 7-point scale from 1 (almost never) to 7 (almost always). For example, *"When something painful happens I try to take a balanced view of the situation"*. The answers to the negative subscales (self-judgment, isolation and over-identification) items were reversed. The mean score was calculated, with higher scores indicating higher levels of self-compassion. This study sample Cronbach's α was .93 at pretest (T0). In the posttest (T1), Cronbach's α was .84 at posttest.

Statistical analysis

SPSS was used for processing the data and for statistical analysis. The participants responses were compared before they started the TiP-app T0 and after T1. A paired sample T-test was performed to investigate the differences between the T0 and T1 tests on perceived stress, resilience and self-compassion.

Uptake and adherence

The participants were asked which parts of the TiP-app they completed and for those that selected response *"no parts"*, or 5 modules or less, the following question was asked *"If you have not completed all parts, can you indicate what prevented you from continuing?"*

Appreciation of the app in general, per module and the supportive features

Appreciation of the intervention was conducted with several items. Participants were asked to rate the overall intervention on a scale from *"bad"* to *"very good"*. In addition, participants indicated which module helped the most to experience more positivity, with no restriction on the number of modules they could tick. The intervention was further evaluated on quantity (of text, exercises, and modules), and duration (time spend each day). To what extent did the different parts appeal (text, video, quotes, mindfulness), and also were there aspects that were disliked. Two examples of other

items include, *"Did you receive the kind of support you hoped to receive?"* and *"Would you recommend this app to someone else?"*

Perceived impact

The impactof the intervention was conducted with 10 items of which 7 items with each item rated on a 5-point scale ranging from *totally disagree* to *totally agree*. Two examples include, *"Using the app has become a part of my daily routine"* and *"This app has motivated me to experience more positivity"*. Participants indicated the usefulness of the separate modules in 1 item: *'Which modules were most useful for you?* With no restriction on the number of modules they could tick. One item was open ended: *"What is the most important thing tip brought you?"*

Usefulness for patients

The participants were asked about the added value of using the TiP-app for their patient group. This was assessed by two items. The first assessed the usefulness: *"Do you think TiP could be useful for patients?"* The second item motivates to elaborate on the first item.

Interview scheme

A semi-structured in-depth interview scheme was used. The 5 participants were asked about their experiences regarding:

(1) The TiP-app in general:

- The uptake and adherence: Did they use the app; how many modules were completed and why did they stop using the app.

- Appreciation: The participants were asked to give an overall impression of the app, which module they liked the most, what did they like and dislike, and what could use improvement.

The participants were also asked if the app suits them as a person and if it contributed to their individual needs.

- Perceived effectiveness: Which module had the most impact and why.

- Useful for patients: Was the app suitable for patient use, did they learn anything they would apply to patients.

(2) The specific modules. For all six modules the same questions were asked.

- Uptake and adherence: Did they start and complete the module.

- Appreciation: What did they think of the specific module, what was good, less good and could this module be improved.

- Perceived effectiveness: What was useful, what effect did it have and is the app now a part of their daily life.

- Useful for patients: I the app suitable for patients, did they learn anything they would apply to patients.

(3) In the final part of the interview more general questions were asked. About the supportive features (notifications, design, texts, mindfulness), user-friendliness of the app (technical barriers), and the impact it had on the participant. What the recommendations were for others in general and for patient use specifically.

Qualitative data analysis

Qualitative data analysis was performed on the results of the semi-structured interviews. All interviews were audio recorded and transcribed verbatim. The statements appearing in this article were translated from Dutch into English. The data was analyzed by one researcher in Word. Firstly, by getting familiar with the data and then fragments/citations were coded into predefined categories based on the research questions and interview topic guide. Subsequently, the most important components were identified and codes were created. The codes were modified during the coding

process until no new codes emerged from the transcripts. This was an iterative process. Finally, final codes were created. A total of 198 fragments were used. For the *appreciation of the app* 5 codes and 9 subcodes were created. For the *appreciation per module* the codes were divided into *positive* (4 subcodes) and *negative* (3 subcodes). The same process was followed for the *supportive features* with 8 subcodes (positive) and 5 subcodes(negative). For the *perceived effect* the codes were divided into *impact* (2 subcodes) or *no impact* (5 subcodes). Finally, for *patient use* 3 codes and 4 subcodes were created.

Results

The results section starts with the description of the study group and their characteristics. The order of presenting the results is the same in every heading, namely first the data of the pre-posttests followed by the data from the interviews.

Description of the study group

The personal characteristics of the participants are listed in Table 3. The majority of participants were female, most worked as a nursing specialist/physician assistant and were in the age range 46 to 55 years with a mean age of 48.

Table 3

Characteristics of the participants

Characteristics	*Completed T0* *N=32*	*Completed T1* *N=16*	*Interview* *N=5*
Age, mean, range	48 (32-64)	47 (32-64)	47 (33-53)
26-35	3	3	1
36-45	8	2	
46-55	14	9	4
56-65	5	2	
Gender			
Male	3	2	1
Female	29	14	4
Position at hospital			
Medical specialist	5	3	1
Nurse	5	1	
Nursing specialist/physician assistant	14	9	3
Support staff/management	3	2	1
Other	5	1	

Uptake and adherence

Of the 60 healthcare professionals who were approached, 32 participated and completed the T0, 15 completed the T1 questionnaire and with a subsample of 5 health care professionals semi-structured in-depth interviews were conducted. The overall adherence to the intervention was low as shown in Table 4. Most participants failed to complete the whole intervention. Four participants (26,67%) completed all 6 modules, 8 participants (53,3%) completed 4 modules, and 12 participants (80%) completed 3 or less modules.

Table 4

Adherence (N = 15)

Outcome	N
Module 1 Joy	15 (100%)
Module 2 Trust in yourself	14 (93,3%)
Module 3 Confidence in the future	12 (80%)
Module 4 Being kind to vulnerability	8 (53,3%)
Module 5 Resilience	5 (33,3%)
Module 6 Connectedness	4 (26,67%)

It appeared that one participant reported to have not started or completed a single module of the program. Almost half of the participants (n=7) who completed the posttest T1 reported time as a barrier preventing them from completing the intervention as shown in Table 5. For example, one participant mentioned: *"I had taken less time to engage in the exercises on daily basis due to the everyday hustle."* Interview data revealed other barriers included forgetting to use the app and finding the exercises too repetitive.

Table 5

Coded responses and example quote for nonadherence mentioned in the T1 (N=15)

Codes	Subcodes	Example quotes
Time (6)	Lack of time	"It was very busy at work and also personally"
		"I haven't gotten to it yet"
Program barrier (5)	Disliking program	"Repetition in the exercise and introduction is starting to irritate me"
	Does not fit needs	"I'm not convinced that this app can help with my problems"
Other (3)	Completing it	"I'm still working through the program'
		"Not completed yet, sometimes I skip a few days"
	No interest	"No real interest in the app"

Appreciation

The app as a whole

Table 6 shows certain aspects of the TiP-app the participants were asked about. The mean of all answers lay between 3.73 and 4.07 meaning the majority of the participants found it overall "good". Every statement had at least one participant who answered with "really good".

Table 6

Rating of the TiP-app as a whole (N=15)

What did you think of	Minimum	Maximum	Mean	Std. Deviation
The language	2	5	3.9	.7
The amount of text	2	5	3.7	.8
The design of the app	3	5	4	.5
The user-friendliness	3	5	4	.7
The number of modules	3	5	3.8	.6

Note. 5 = very good, 4 = good, 3 = reasonable, 2 = moderate, 1 = bad

Two examples of other items from the T1 include, *"Did you receive the kind of support you hoped to receive?"* Where half of the participants (n=8, 50,1%) answered *"no, definitely not"* or *"no, barely"*. The item *"Would you recommend this app to someone else?"* was answered by 9 participants (56,3%) as *"Yes, I think I would"*, or *"Yes, for sure"*.

The interview data in Table 7 shows that the overall impression of how the app was designed was overall good. The app did not live up to the expectations. Two participants indicated that it brought nothing new compared to already existing apps. The satisfaction with the content of the app was low. Four participants felt like the app is not applicable to people who are happy with their lives and have no issues. It was mentioned by one participant that this app is only useful for people who need psychological attention or care. The structure of the intervention and the fact that every module was mandatory to go through the intervention was also seen as a negative aspect. All the interview participants particularly disliked the repetition of the exercises. More specific the audio exercise was mentioned by 2 participants as annoying to listen to everyday. However, in general the app was rated as very pleasant and user friendly.

Table 7

Appreciation of the TiP-app as a whole (N=5)

Codes	Subcodes	Example quotes
Motivation	Intrinsic motivation	*"I started very enthusiastically and I even made some notes, to work with it very consciously. That worked for the first 3 phases, but after that the motivation decreased"*
	Patient care	*"Specially to see if it would be something for our patient group"*
Content	Not innovative	*"What I found a bit disappointing that it was not very innovative compared to perhaps already existing apps, I don't have much insight into that, but I might have expected something different concerning the content of the app."*
	Insights	*"There are some exercises where you feel like, do I have to do that, but you never do these normally and doing it brings news insights"*
	Repetition	*"Repetition of the audio-exercises every day and the daily emails were unnecessary."*
	Satisfaction	*"I think it is good for people who are not feeling well or have insecurities. It didn't at much value to me because I feel good."*
Design	Easy and nice	*"I thought it was a nice application, in terms of design, clear language, and the exercises were applicable, the voice and intonation fit very well"*
Time	Time consuming	*"I thought it was nice that you spend relatively not much time on the app, because I wouldn't like to spend a lot of time with my phone"*
Structure	Flexibility	*"Should have had the opportunity to go through a lesson less intensively and go on with another part more intensively if you wanted to. The flexibility was not available."*

Appreciation of the modules

Overall the two modules covering positive emotions and discovering strengths (module 1 and 2) were evaluated as most useful, and the module on positive relations (module 6) the least (Table 8).

Module 6 was completed by 75% less participants than module 1 and 2 meaning module 6 is not well represented.

Table 8

Most appreciated modules of the TiP-app (N=15)

Module	N	%
Module 1 Positive emotions	6	37.5%
Module 2 Discovering strengths	4	25.0%
Module 3 Optimism	3	18.8%
Module 4 Self-compassion	3	18.8%
Module 5 Resilience	1	6.3%
Module 6 Positive relations	0	0.0%
No modules have helped me experience more positivity	3	18.8%

Note. Multiple answers were possible

The interview data also showed that the first two modules were particularly liked. Module 1 on positive emotions was appreciated as strong. It was easy and not much time consuming. Overall the majority of the participants are in favor of the first 2 modules.

Module 2 on discovering strengths participants mentioned that it was nice to ask other people, because it made the assignment broader than just working with the intervention by yourself, and it led to interesting conversations with other people. Two participants mentioned that during this module it was fun to work on their strengths. Others thought it was a hassle to ask other people.

Module 3 was a difficult exercise according to the interview data. It was difficult to formulate specific goals. For module 4, self-compassion, was indicated that listing 10 vulnerabilities was too much. Overall the participants were positive about this module, but the list of vulnerabilities could be shorter. There was only one participant who had completed module 5 (resilience) finding it confrontational and module 6 (positive relations), a good exercise to consciously look at all the domains in life and make conscious choices (See Table 9).

Table 9

Appreciation of the modules of the Tip-app (N=5)

Module	Positive	Negative	Example quotes
Module 1	Strong	-	*"The first one, because I thought it was a simple way and not much time consuming. It gives a pleasant feeling because you take a moment to think about the beautiful things of that day. Yes, that was my favorite part."*
Module 2	Fun	Hassle	*"I thought asking 3 people was a bit much, but I think that's personal. I found it a hassle to ask everyone.*
Module 3	-	Difficult	*"Part 3 yes I found that very difficult. I just found it difficult. Formulating it very specific"* *"For this exercise 3 times is too short"*
Module 4	Positive	Difficult	*"I thought 10 was a lot anyway. I thought to myself I should start making things up, so to speak.* *"It is very detailed, so a lot of thought has been put into it. I think the exercise is put together well."*
Module 5	Fun	Confronting	*"Yes, I found that fun and a bit confrontational. Also, because I was in the middle of that process with my work here, difficult conversations"*
Module 6	Conscious	-	*"It was good for me to look at all those domains, to what extent am I consciously involved in that and how do I make conscious choice. I deliberately leave certain parts aside for a while, which are less important to me at the moment. So that's what it brought me"*

Appreciation of supportive features

Table 10 consists of the responses to the appreciation of the supportive features. In the statement

about the audio exercises the mean is 3.4. This means the majority of the participants were neutral as

to whether the exercises were good or not. The means of the other statements (text,

video's/animation, quotes, pin quotes and photo's) are between 3.4 and 3.9, meaning the majority of

the participants think these features are good.

Table 10

Appreciation supportive features of the TiP-app (N=15)

What did you think of...	Minimum	Maximum	Mean
The text	2	5	3.8
The video's/animations	3	5	3.9
The exercises	2	5	3.4
The audio exercises	1	5	3.4
The daily quotes	2	5	3.6
Ability to pin quotes/ photo's	1	5	3.4

Note. 5 = very good, 4 = good, 3 = neutral, 2 = bad, 1 = very bad

In the data resulting from the interviews data (See Table 11) is evident that the visual element was much appreciated and the design well made. The mindfulness audio exercise was experienced as pleasant by two participants, but also indicated by another that there is no need for such exercises and is also not appealing because of the repetition. The notifications were working, although one participant mentioned they stopped working after using the app for the first 3 lessons. Others found the notifications annoying and turned them off. There was much appreciation for uploading pictures in the app because it was pleasant to look back at these pictures.

Table 11

Appreciation of the supportive features in the TiP-app (N=5)

Category	Positive	Negative	Example quotes
Mindfulness exercise	Voice Being in the moment	Repetition Not personally relevant	*"I really liked the mindfulness and I think it is something that is useful for everybody."* *"That was really a reason for me to stop. It's not something I could listen to every day."*
Design	Visual element Fun	Guided structure	*"I liked the way the maze symbol visualizes the progress, that was nicely made."*
Notifications	Reminders Personal setting	Not working Annoying	*"No, I didn't mind. It's more of a reminder that I have to attend to the app."* *"I have my phone set to block all notifications. Otherwise you will go crazy with all the notifications"*
Pinning quotes/photo's	Pleasant/fun Added value	Not personally relevant	*"I liked those quotes, some were more beautiful than the other, but they added value."* *"A moment of happiness and this makes you be more conscious at that moment"*

Perceived impact

For the variable self-compassion high values were found in T0. The value was moderate for resilience, and for perceived stress the value was moderate to low. All scores improved at T1 compared to T0. The results of the t-test showed no significant changes for all examined variables (See Table 14).

Table 14

T0 and T1 compared; means and change of Perceived stress, self-compassion and resilience (N=15)

	T0 M(SD)	T1 M(SD)	Change in score M(SD)	T	p-value
Perceived Stress	1.95(.47)	1.75(.42)	.20(69)	1.16	.266
Resilience	3.24(.72)	3.42(.55)	-1.77(.92)	-.74	.469
Self-compassion	4.09(.71)	4.55(.67)	-.46(1.07)	-1.67	.117

Note. Paired sample t-test

Table 12 consists of answers to statements about the perceived impact of the app. In the first statement the mean is 1.6. This means that the majority of the participants strongly disagreed as to this app becoming a part of their daily routine. The mean of the second statement is 3.33 meaning the majority of the participants strongly agreed as to whether using this technology takes little effort. The mean of the third, fourth and fifth statement are respectively 2.67, 2.8 and 3.00 meaning that the majority of the participants agreed that the app made it easier to experience more positivity, this app motivated to experience more positivity and has given more insight to experience more positivity. The mean of the last statement is 1.87 meaning the majority of the participants disagreed that the app suits them as a person.

Table 12

Perceived impact T1 (N=15)

	N	Minimum	Maximum	Mean
- Using the app has become a part of my daily routine	15	1	2	1.6
- Using this technology takes little effort for me	15	2	4	3.3
- This app made it easier to experience more positivity	15	2	4	2.6
- This app has motivated me to experience more positivity	15	2	4	2.8
- This app has given me insight to experience more positivity	15	2	4	3
- I enjoyed seeing my progress in this app	15	1	4	2.4
- I think this app suits me as a person	15	1	3	1.8

Note. 4 = strongly agree, 3 = agree, 2 = disagree, 1 = strongly disagree

To the open-ended question in T1"What is the most important thing the TiP app brought you?" four participants responded with awareness, for example:

"*Becoming aware of the responsibility we have for our own happiness*".

One participant mentioned that it helped with self-confidence.

Comparable with the T1 the interview data shows in Table 13, that the participants experienced more positivity and awareness after using the TiP app. In the interviews is also mentioned by 2 participants that the app did not bring anything new, and therefore did not have any effect.

Table 13

Perceived impact of the TiP-app (N=5)

Codes	Subcodes	Example quotes
Positive impact	Positivity	*"It was fun to learn more about positive health. Good to reflect on your own perception of the world in a busy life."*
	Awareness	*"Awareness of the many moments that I am happy/grateful for in a day."* *"The awareness, I think from all lessons."* *"Not everything in life needs to be in balance, you make conscious choices in life"*
	Gratitude	*"I do notice that I'm more aware of what makes me happy or grateful"*
No impact	Satisfaction	*"If you feel good and things are well in life or you are naturally a positive person the app has little added value"* *"No major impact, no.. but I have to say I'm naturally positive. So I didn't really experience the lessons as very useful, there was no need for me."*
	Not innovative	*"It brought nothing new compared to already existing apps"* *"The amount of time you put into it does not outweigh the result or effect."*

Usefulness for patients

Table 15 presents the answer to the question if the app is useful for their patients. Three participants indicated they would not use the app for their patients. Most participants (*N*=9) would 'maybe' or 'probable' use it for their patients, indicating the app has some added value, and 3 participants would 'certainly' use it within their patient group.

Table 15

Usefulness for patients (N = 15)

Useful	Frequency	Percent	Valid percent
No	3	16.7%	20
Maybe	6	33.3%	40
Probable	3	16.7%	20
Certainly	3	16.7%	20

A total of 8 participants answered the open-ended question of the T1 to explain why they think the TiP app is useful or not for their patients. Three were negative (*does not fit my patient category*), 2 participants were positive (*the app can be of added value*), and 3 participants would use it under certain conditions, for example including a pre-selection or by limiting repetitions in the exercises.

In Table 16 the interviews all 5 participants mentioned that the TiP app is not useful for every patient, but it could be useful if you find the right kind of patient for it. Participants found it difficult to assess how patients will cope while using the app. It could work in a negative way, for example the emotions it can reveal. However, it could also give them more awareness and new insights. Participants also mentioned they would use the app as a conversation tool with their patients.

Table 16

Usefulness for patients (N = 5)

Codes	Subcodes	Example quotes
Difficult	Language	*"The language is too difficult"*
		"It could be more tailored and not use so many difficult words. Our patient category is generally from low socio-economic status and less educated.
Useful	Insights	*"I think there are patients who are mentally not feeling well can profit from more awareness with the help of this app"*
		"The future perspective, setting goals, that is very important in our patient category. A good balance between hope and being realistic"
	Conversation tool	*"It can be supportive, but you have to give it a twist. I would recommend the app perhaps as a conversation tool when working with patients"*
Impact	Negative affect	*"A patient with a life-threatening disease will experience these exercises with emotions"*
		"The lightness with which this app is presented is sometimes not in line with how the patients feel"

Discussion

The first aim of this study, a mixed methods single group pre-posttest with 3 weeks training, was to evaluate the adherence, appreciation, perceived impact of the TiP-app in health care professionals. The second aim was to evaluate the usefulness of the TiP-app for patients from the perspective of health care professionals.

     The intervention was well received. 32 health care professionals wanted to participate and completed the pretest (T0). Unfortunately, only 15 participants completed the posttest (T1). Also, only 5 out of 13 participants who indicated wanting to participate in an interview after finishing the intervention, an interview was actually conducted. The adherence to the intervention was low, since just 4 participants mentioned completing all 6 modules in the posttest. Although, not completing the T1 test does not indicate participants did not use the app. It is possible participants used the app, but never filled out the posttest. Another possibility is that participants indicate to have completed certain modules when they really did not complete these modules since it is not visual to see for the researcher what participants did in the app. Poor adherence is a known problem with online interventions (Kelders et al., 2012; Ryan, Bergin, Wells, 2018) and low adherence is associated with reduced intervention efficacy (Vandelanotte et al., 2016). Adherence is operationalized as usage and it is assumed that more usage is better and can be seen as more adherence (Sieverink, Kelders & van Gemert-Pijnen, 2017). The main reasons for not continuing with the app was a lack of time and the app not fitting the needs of the participants. In a research by Krebs & Duncan (2015) the most common reason found for discontinuing with apps was the time needed to enter data, followed by a loss of interest. Other reasons mentioned were forgetting to use the app, finding the exercises too repetitive and the guided structure of the intervention. There is a possibility that a poor fit between the intervention and the needs of the healthcare professionals have had a negative impact on pursuing the intervention modules. Tailoring interventions to the needs of individuals may be required to improve adherence (Batterham et al., 2021). It was expected that the app-based intervention would

overcome face-2face treatment barriers. The recruitment procedure can also be an explanation for the mismatch. Instead of tailoring the app, one could also target the suited users for the intervention. Also, there was no testing for stress levels prior to participation. The health care professionals could have already been doing well in terms of mental health and not needing the intervention. A positive psychology intervention targeted at the general public at improving well-being (Schotanus-Dijkstra et al., 2017) was created by using the Human Centered Design technology approach (Ludden, Kelders & Snippert, 2014). Two versions were made, a gamified and a standard non-gamified version (Kelders et al., 2018). The results of the study showed that participants in the gamified intervention scored higher on involvement, flow, and emotions as interest and inspiration. This study merely shows that this design approach, a form of gamification, can have a positive effect. Research also indicates that gamification can have negative effects (Hyrynsalmi, Smed, & Kimppa, 2017).

In general, the participants were positive about the intervention. The language, text, ease of use, and the design were rated positively. The guided structure of the intervention and the fact that every module was mandatory to go through was negatively rated. The repetitions in the intervention were mentioned by several participants as annoying. The first 2 modules were found good and most appreciated. The evaluation of the other modules is not representative because the adherence to these modules is very low. This leading to a lack of personal relevance and reduced the motivation to continue. Personalization and allowing people to choose their own version of the intervention can increase autonomy (Kelders, 2019). Self-selection is equal to more intrinsic motivation to follow the intervention (Lyubomirsky et al., 2011). Intrinsic motivation could be supported in alternative ways for example by offering meaningful choices in the intervention. Researchers have argued that concepts as involvement, enjoyment and flow might be related to engagement in this specific context, but a common understanding is still missing (Kelders, 2015; Kelders et al., 2018). The subjective experience with the intervention is important (Perski et al., 2016).

The high base line well-being of the sample left limited room for improvement. Other studies used participants with low initial well-being (Schotanus-Dijkstra, 2017). This positive finding is in line with the high well-being scores found for nursing staff in nursing homes in Sweden and Spain (Yepes-Baldó, Romeo, Westerberg, Nordin, 2018). Also, to be considered is socially desirable answering by participants since the intervention because it was initiated and introduced by the employer. There were no significant improvements in perceived stress, resilience and self-compassion when comparing the results of the pre and posttest. Most participants indicated not experiencing any mayor beneficials, although the majority of the participants agreed that the app made it easier to experience more positivity.

For the usefulness for patients, participants found the intervention was developed for a higher educational level. They indicated it would be a challenge to help lower educated people with the intervention, which most of their patients are according to the health care professionals. The health care professionals described most patients are from lower socio-economic levels and they assume they will not understand the purpose of the intervention and therefore will not use it as intended or not use it at all. In a study was found some initial evidence that higher educated participants profited more from a positive psychology intervention than lower educated people (Boiler et al., 2013a). Furthermore, not much is known about the influence of education levels on effectiveness of positive psychology interventions (Kloos et al., 2019). A more blended approach to the intervention could be a solution. The health care professionals found the intervention usable as a tool during conversations with their patients, however they also mentioned having limited time during appointments and perceive it as time consuming. This study shows that the applicability to patients is not convincing. Although, most participants mentioned using the intervention to look at the usefulness for patients. This can suggest the need for such intervention for patients from the perspective of health care professionals.

Strengths and limitations

This study provides information for further development of a multicomponent positive psychology intervention for health care professionals and for patient use. There are a number of limitations recognized.

The main limitation is the small sample size. The small sample size contributed to a lack of saturation. For qualitative analysis in a homogeneous study the saturation of themes is reached by twelve interviews (Guest, Bunce, Johnson, 2006). A small sample size might not encompass the full range of experiences with the intervention and identifying recurring themes across different participants' responses might not emerge as strongly as it might would with a larger and more diverse sample. The findings might not be applicable to a broader population. This study was homogeneous and had a small sample size of 5 participants for the qualitative part of this research. Meaning new themes could have derived if more interview data was available. This means the outcome of the research could have been different. Also, these 5 participants completed the posttest (T1). The data of these 5 participants were also evaluated in the posttest (T1). If we look at the quantitative part of this research the results of both questionnaires are very similar so there is consistency. This sample scored high on most outcomes meaning there was little room for further improvement. If the sample had more health care professionals with high stress levels this could have reduced the likelihood of a ceiling effect. Future research with should be with a larger and more diverse sample.

The second limitation is the adherence to the intervention. The adherence is based on the pre-posttest and not on the actual use of the TiP-app. It is not visual for the researcher to see what participants did in the app. So, we actually do not know the true adherence of the intervention. With system use data it would have been possible to capture how often the TiP-app was used (Perski et al., 2016). Having an objective measure, like monitoring, can provide more accurate and reliable adherence data compared to self-report measures which are subject to recall bias and socially

desirable answers. The reliability of the adherence data is crucial for making valid conclusions and assessing the effectiveness of the intervention. The intervention did include program features like progress tracking and feedback, notifications and reminders to impact the participants adherence.

The third limitation is that the study was retrospective. Retrospective research is limited by the quality and completeness of the available data. It is also susceptible to recall bias, as participants may not accurately remember past events of behavior (Althubaitia, 2016). The results relied on the participants memories of the intervention. The posttest (T1) and the interview were conducted as close to finishing the intervention as possible, therefore minimizing the time gap. Most of the participants had difficulties remembering the different exercises and elements of the intervention. During the interview memory aids and prompts were provided by means of pictures and by recalling the themes and exercises. Also, by asking participants to interpret and elaborate on the questions.

Final limitation was the dual aim of this research. The adoption of using this positive psychology intervention for patients, may be mediated by their personal use of this intervention. The health care professional's perspectives on the usefulness of this intervention for their patients can be based on their own experiences, training and beliefs. Health care professionals who embrace a more holistic approach to patient care may recognize that this intervention can complement their treatment and value this intervention more than health care professionals who might be skeptical or biased towards positive psychology interventions. This may lead to improper testing of the intervention as seen in this research.

Conclusion

This study provided valuable information about the adherence, appreciation, perceived impact of the intervention by health care professionals in general as well as for specific elements and features. Future research may include health care professionals in all stages of the intervention development so all components of the intervention are tailored specifically to their needs before implementation

and therefore increasing adherence. For further research I suggest that a larger sample size is needed. More research needs to be done on how to further improve or adjust the intervention to a proper use by patients. Finally, this information can also be of interest for further development of app-based interventions in general.

References

Akinnusotu, O., Bhatti, A., Doubeni, C.A., & Williams, M. (2023). Supporting Mental Health and Psychology Resilience Among the Health Care Workforce: Gaps in the Evidence and Urgency for Action. *The Annuals of Family Medicine, 21*(2), S100-S102. DOI: 10.1370/afm.2933.

Alqahtani, F., & Orji, R., (2019). Usability Issues in Mental Health Applications. In Proceedings of UMAP '19: *26th Conference on User Modeling, Adaptation and Personalization, June 09-12, Larnaca,* Cyprus. ACM, New York, NY, USA. 6 pages. https://doi.org/10.1145/3314183.3323676

Althubaiti, A. (2016). Information bias in health research: definition, pitfalls, and adjustment methods. *J Multidiscip Healthc., 201 4*;9:2. doi: 10.2147/JMDH.S104807. PMID: 27217764; PMCID: PMC4862344.

Batterham, P.J., Calear, A.L., Sunderland, M., Kay-Lambkin, F., Farrer, L.M., Christensen, H., & Gulliver, A. (2021). A Brief Intervention to Increase Uptake and Adherence of an Internet-Based Program for Depression and Anxiety (Enhancing Engagement With Psychosocial Interventions): Randomized Controlled Trial. *J Med Internet Res., 27;23*(7). doi: 10.2196/23029.

Blake, H., Bermingham, F., Graham, J., Tabner, A. (2020). Mitigating the psychological impact of covid-19 on healthcare workers: A digital learning package. *International Journal of Environmental Research and Public Health, 17*(9). Doi: 10.3390/ijerph17092997

Bolier, L., Haverman, M., Kramer, J., Westerhof, G.J., Riper, H., Walburg, J.A., Boon, B., & Bohlmeijer, E. (2013a). An internet-Based intervention to promote mental fitness for mildly depressed adults: Randomized controlled trial. *J. Med. Internet Res.,15(9).* doi: http://dx.doi.org/10.2196/jmir.2603.

Bolier, L., Haverman, M., Westerhof, G.J., Riper, H., Smit, F., & Bohlmeijer, E., (2013b). Positive psychology interventions: a meta-analysis of randomized controlled studies. *BMC Public Health, 13(1).* doi:http://dx.doi.org/10.1186/1471-2458- 13-119.

Bolier, L., Ketelaar, S.M., Nieuwenhuijsen, K., Smeets, O., Gärtner, F.R., & Sluiter J.K. (2014). Workplace mental health promotion online to enhance well-being of nurses and allied health professionals: A cluster-randomized controlled trial. *Internet Interventions, 1*(4), Pages 196-204. https://doi.org/10.1016/j.invent.2014.10.002.

Burns, R.A., Windsor, T., Butterworth, P., & Anstey, K.J. (2022). The protective effects of wellbeing and flourishing on long-term mental health risk, *SSM - Mental Health*, *2*, 100052. https://doi.org/10.1016/j.ssmmh.2021.100052.

Çam, O. & Büyükbayram, A. (2017). Nurses' resilience and effective factors. *The Journal of Psychiatric Nursing*, *8*(2), 118–126. https://doi.org/10.14744/phd.2017.75436 (Original work published in Turkish)

Cavanagh, K., Strauss, C., Forder, L., & Jones, F. (2014). Can mindfulness and acceptance be learnt by self-help?: a systematic review and meta-analysis of mindfulness and acceptance-based self-help interventions. *Clinical Psychology Review*, *34*, 118–129. DOI: 10.1016/j.cpr.2014.01.001

Cimiotti, J.P., Aiken, L.H., Sloane, D.M., & Wu, E.S., (2012). Nurse staffing, burnout, and health care-associated infection, *American Journal of Infection Control,* 40(6), 486 – 490. Https://doi.org/10.1016/j.ajic.2012.02.029

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior, 24*(4), 385-396.

Crane, P.J. & Ward, S.F., (2016). Self-healing and self-care for nurses. *AORN J. 104* (5), 386–400. doi:http://dx.doi.org/10.1016/j.aorn.2016.09.007

Denborough, D. (2014). *Retelling the stories of our lives: Everyday narrative therapy to draw inspiration and transform experience*. New York, NY: Norton.

DeTore, N.R., Sylvia, L., Park, E.R., Burke, A., Levison, J.H., Shannon, K,…Holt, D.J., (2022). Promoting resilience in healthcare workers during the COVID-19 pandemic with a brief

online intervention, *Journal of Psychiatric Research, 6*, Pages 228-233.
https://doi.org/10.1016/j.jpsychires.2021.11.011.

Duarte, J. & Pinto-Gouveia, J., (2016). Effectiveness of a mindfulness-based intervention on
oncology nurses' burnout and compassion fatigue symptoms: a non-randomized study. *Int.
J. Nurs. Stud. 64,* 98–107. doi:http://dx.doi.org/10.1016/j. ijnurstu.2016.10.002.

Eisenstadt, M., Liverpool, S., Infanti, E., Ciuvat, R.M. & Carlsson, C, (2021). Mobile apps that
promote emotion regulation, positive mental health, and well-being in the general population:
Systematic review and meta-analysis, *JMIR Ment Health, 8*(11). doi:10.2196/31170

Fairburn, C.G., Patel, V. (2014). The global dissemination of psychological treatments: a road map
for research and practice. *American Journal of Psychiatry, 171*, 495–498.
DOI: 10.1176/appi.ajp.2013.13111546

Fredrickson, B.L., (2001). The role of positive emotions in positive psychology: the broaden-and-
Build theory of positive emotions perspectives on emotions and affect. NIH public access.
Am. Psychol. 56 (3), 218–226. doi:http://dx.doi.org/ 10.1037//0003-066x.56.3.218.

Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with
data saturation and variability. *Field Methods, 18*(1):59–82.
https://doi.org/10.1177%2F1525822X05279903

Gilbert, E., Foulk, T. & Bono, J., (2018). Building personal resources through interventions: an
integrative review. J. *Organ. Behav. 39 (2),* 214–228. doi: http://dx.doi.org/10.1002/job.2198.

Golden, E., Zweig, M., Danieletto, M., Landell, K., Nadkarni, G., Bottinger, E.,…Charney D.
(2021). A Resilience-Building App to Support the Mental Health of Health Care Workers in
the COVID-19 Era: Design Process, Distribution, and Evaluation. *JMIR Form Res, 5*(5).
DOI: 10.2196/26590

Graber, R., Pichon, F., & Carabine, E. (2015). Psychological resilience*: State of knowledge and
research agendas* (working paper). Overseas Development Institute. Retrieved
from: https://www.odi.org/publications/9596-psychological-resilience-state-knowledge-
future-research-agendas

Guest, G., Bunce, A., & Johnson, L. (2006). How Many Interviews Are Enough? *Field Methods - FIELD METHOD, 18,* 59-82. 10.1177/1525822X05279903

Gulliver, A., Griffiths, K. M., & Christensen, H. (2010). Perceived barriers and facilitators to mental health help-seeking in young people: a systematic review. *BMC psychiatry, 10,* 113. https://doi.org/10.1186/1471-244X-10-113

Hendriks, T., Schotanus-Dijkstra, M., Hassankhan, A., de Jong, J., & Bohlmeijer, E. (2019). The Efficacy of Multi-component Positive Psychology Interventions: A Systematic Review and Meta-analysis of Randomized Controlled Trials. *Journal of Happiness Studies, 21*(1), 357–390. Https://doi.org/10.1007/s10902-019-00082-1

Hyrynsalmi, S., Smed, J., & Kimppa, K. K. (2017). The dark side of gamification: How we should stop worrying and study also the negative impacts of bringing game design elements to everywhere. Paper presented at the Proceedings of the 1st International GamiFIN Conference.

Jones, D.J., Anton, M., Gonzalez, M., Honeycutt, A., Khavjou, O., Forehand, R., & Parent, J. (2015). Incorporating Mobile Phone Technologies to Expand Evidence-Based Care. *Cognitive and Behavioral Practice, 22*(3), 281-90. doi: 10.1016/j.cbpra.2014.06.002.

Karabulak, H., & Kaya, F. (2021). The relationship between psychological resilience and stress perception in nurses in Turkey during the COVID-19 pandemic. *The Journal of Nursing Research, 29*(6), Article e175. https://doi.org/10.1097/jnr.0000000000000454

Kelders, S. M., Kok, R. N., Ossebaard, H. C. & Van Gemert-Pijnen, J. E. (2012). Persuasive System Design Does Matter: a Systematic Review of Adherence to Web-based Interventions. *Journal of Medical Internet Research*, *14*(6), e152. https://doi.org/10.2196/jmir.2104

Kelders, S. M. (2015). Involvement as a Working Mechanism for Persuasive Technology. In Persuasive Technology (pp. 3–14): Springer International Publishing.

Kelders, S. M., Sommers-Spijkerman, M., & Goldberg, J. (2018). Investigating the direct impact of a gamified versus non-gamified well-being intervention: *An exploratory experiment. Journal of Medical Internet Research, 20*(7).

Kelders, S.M. (2019). Design for Engagement of Online Positive Psychology Interventions. In: Van Zyl, L., Rothmann Sr., S. (eds) Positive Psychological Intervention Design and Protocols for Multi-Cultural Contexts. Springer, Cham. https://doi.org/10.1007/978-3-030-20020-6_13

Khasawneh, A., Malkawi, H., Ababneh, S., Al-Araidah, O. & Kremer, G. O. (2021). Empirical study on mental stress among healthcare staffs and the influencing workplace stressors. *Engineering Management in Production and Services, 13*(2), 54–67. https://doi.org/10.2478/emj-2021-0012

Kip, H., & van Gemert-Pijnen, L.J., (2018). Holistic development of eHealth technology. eHealth Research, Theory and Development. Routledge, London, pp. 151–186.

Kloos, N, Drossaert, C. H.C., Bohlmeijer, E.T. & Westerhof, G.J, (2019). Online positive psychology intervention for nursing home staff: A cluster-randomized controlled feasibility trial of effectiveness and acceptability. *International Journal of Nursing Studies, 98*, pages 48-56. https://doi.org/10.1016/j.ijnurstu.2019.06.004

Krebs, P., & Duncan, D. T. (2015). Health App Use Among US Mobile Phone Owners: A National Survey. *JMIR mHealth and uHealth*, *3*(4), e101. https://doi.org/10.2196/mhealth.4924

Letvak, S. A., Ruhm, C. J., & Gupta, S. N. (2012). Nurses' presenteeism and its effects on self-reported quality of care and costs. *The American journal of nursing, 112*(2), 30–39. https://doi.org/10.1097/01.NAJ.0000411176.15696.f9

Linardon, J. (2020). Can Acceptance, Mindfulness, and Self-Compassion Be Learned by Smartphone Apps? A Systematic and Meta-Analytic Review of Randomized Controlled Trials. *Behavior Therapy, 51*(4), 646-58. doi: https://doi.org/10.1016/j.beth.2019.10.002.

Ludden, G. D., Kelders, S. M., & Snippert, B. H. (2014). This is your life! Paper presented at the International Conference on Persuasive Technology.

Lyubomirsky, S., Dickerhoof, R., Boehm, J. K., & Sheldon, K. M. (2011). Becoming happier takes both a will and a proper way: an experimental longitudinal intervention to boost well-being. *Emotion (Washington, D.C.), 11*(2), 391–402. https://doi.org/10.1037/a0022575

Maunder, R.G., Lancee, W.J., Mae, R., Vincent, L., Peladeau, N., Beduz, M.A., Hunter, J.J. & Leszcz, M. (2010). Computer-assisted resilience training to prepare healthcare workers for pandemic influenza: a randomized trial of the optimal dose of training. *BMC Health Serv Res, 10*(72). https://doi.org/10.1186/1472-6963-10-72

Ouweneel, E., Le Blanc, P.M., & Schaufeli, W.B., (2013). Do-it-yourself: an online positive psychology intervention to promote positive emotions, self-efficacy, and engagement at work. *Career Dev. Int., 18*(2), 173–195. doi:http://dx.doi.org/ 10.1108/CDI-10-2012-0102.

Parks, A. C., & Biswas-Diener, R. (2013). Positive interventions: Past, present, and future. In T. B. Kashdan & J. Ciarrochi (Eds.), *Mindfulness, acceptance, and positive psychology: The seven foundations of well-being* (pp. 140–165). New Harbinger Publications, Inc.

Perski, O., Blandford, A.,West, R., & Michie, S. (2016). Conceptualising engagement with digital behaviour change interventions: A systematic review using principles from critical interpretive synthesis. Translational Behavioral Medicine.

Pollock, A., Campbell, P., Cheyne, J., Cowie, J., Davis, B., McCallum, J.,…Maxwell, M., (2020). Interventions to support the resilience and mental health of frontline health and social care professionals during and after a disease outbreak, epidemic or pandemic: a mixed methods systematic review. *The Cochrane database of systematic reviews*, *11*(11). https://doi.org/10.1002/14651858.CD013779

Raes, F., Pommier, E., Neff, K.D., & Van Gucht, D., (2011). Construction and factorial validation of a short form of the Self-Compassion Scale. *Clinical Psychology & Psychotherapy, 18*, 250-255.

Rusk, R. D., & Waters, L. E. (2013). Tracing the size, reach, impact, and breadth of positive psychology. *The Journal of Positive Psychology, 8*(3), 207–221. https://doi.org/10.1080/17439760.2013.777766

Ryan, C., Bergin, M., & Wells, J. S. (2018). Theoretical Perspectives of Adherence to Web-Based Interventions: a Scoping Review. *International journal of behavioral medicine, 25*(1), 17–29. https://doi.org/10.1007/s12529-017-9678-8

Schotanus-Dijkstra, M, Drossaert C.H., Pieterse M.E., Walburg, J.A. & Bolhmeijer, E.T., (2015). Efficacy of a multicomponent positive psychology self-help intervention: study protocol of a randomized controlled trial. *JMIR Res. Protoc. 4*(3), e105. Doi:http://dx.doi.org/10.2196/resprot.4162.

Schotanus-Dijkstra, M., Drossaert, C. H., Pieterse, M. E., Boon, B., Walburg, J. A. & Bohlmeijer, E. T., (2017). An early intervention to promote well-being and flourishing and reduce anxiety and depression: A randomized controlled trial. *Internet Interventions, 9*, 15–24. https://doi.org/10.1016/j.invent.2017.04.002

Schueller, S.M., & Parks, A.C. (2014). The science of self-help: Translating positive psychology research into individual happiness. *European Psychologist, 19,* 145-155. https://doi.org/10.1027/1016-9040/a000181

Seligman, M.E.P., & Csikszentmihalyi, M., (2000). Positive psychology: an introduction. *American Psychologist, 55*(1), 5-14. doi:http://dx.doi.org/10.1037/0003-066X.55.1.5.

Seligman, M. E. P., Steen, T. A., Park, N., & Peterson, C. (2005). Positive Psychology Progress: Empirical Validation of Interventions. *American Psychologist, 60*(5), 410–421. Https://doi.org/10.1037/0003-066x.60.5.410

Seligman, M.E.P., (2018): PERMA and the building blocks of well-being. *The Journal of Positive Psychology,* 13(4), 333-335. DOI: 10.1080/17439760.2018.1437466

Serrano-Ripoll, M. J., Zamanillo-Campos, R., Fiol-DeRoque, M. A., Castro, A., & Ricci-Cabello, I. (2022). Impact of Smartphone App–Based Psychological Interventions for Reducing Depressive Symptoms in People With Depression: Systematic Literature Review and Meta-analysis of Randomized Controlled Trials. *JMIR mHealth and uHealth, 10*(1), e29621. Https://doi.org/10.2196/29621

Sheldon, K. M., & Lyubomirsky, S. (2006). How to increase and sustain positive emotion: The effects of expressing gratitude and visualizing best possible selves. *The Journal of Positive Psychology, 1*(2), 73-82.

Sieverink, F., Kelders, S.M., & van Gemert-Pijnen, J. E. (2017). Clarifying the concept of adherence to eHealth technology: Systematic review on when usage becomes adherence. *Journal of Medical Internet Research, 19*(12).

Sin, N. L., & Lyubomirsky, S. (2009). Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: A practice-friendly meta-analysis. *Journal of Clinical Psychology, 65*(5), 467-487.

Smith, B. W., Dalen, J., Wiggins, K., Tooley, E., Christopher, P., & Bernard, J. (2008). The brief resilience scale: assessing the ability to bounce back. *International journal of behavioral medicine, 15*(3), 194-200.

Sovold, L.E., Naslund, J.A., Kousoulis, A.A., Saxena S., Qoronfleh, M.W., Grobler,C. & Münter, L. (2021). Prioritizing the Mental Health and Well-Being of Healthcare Workers: An Urgent Global Public Health Priority. *Front. Public Health (9)*, 679397. doi: 10.3389/fpubh.2021.679397

Sulosaari, V., Unal, E., & Cinar, F. I. (2022). The effectiveness of mindfulness-based interventions on the psychological well-being of nurses: A systematic review. *Applied Nursing Research, 64*. https://doi.org/10.1016/j.apnr.2022.151565

Tabur, A., Elkefi, S., Emhan, A., Mengenci, C., Bez, Y., & Asan, O. (2022). Anxiety, Burnout and Depression, Psychological Well-Being as Predictor of Healthcare Professionals' Turnover during the COVID-19 Pandemic: Study in a Pandemic Hospital. *Healthcare, 10*(3), 525. https://doi.org/10.3390/healthcare10030525

Trompetter, H.R., de Kleine, E. & Bohlmeijer, E.T., (2017). Why Does Positive Mental Health Buffer Against Psychopathology? An Exploratory Study on Self-Compassion as a Resilience Mechanism and Adaptive Emotion Regulation Strategy. *Cogn Ther Res 41*, 459–468. https://doi.org/10.1007/s10608-016-9774-0

United Nations Department of Economic and Social Affairs, Population Division (2022). World
Population Prospects 2022: Summary of Results. UN DESA/POP/2022/TR/NO. 3.
https://www.un.org/development/desa/pd/sites/www.un.org.development.desa.pd/files/wpp20
22_summary_of_results.pdf

Vandelanotte, C., Müller, A. M., Short, C. E., Hingle, M., Nathan, N., Williams, S. L., Lopez, M. L.,
Parekh, S., & Maher, C. A. (2016). Past, Present, and Future of eHealth and mHealth
Research to Improve Physical Activity and Dietary Behaviors. *Journal of nutrition education
and behavior, 48*(3), 219–228.e1. https://doi.org/10.1016/j.jneb.2015.12.006

World Health Organization, (2022). Mental Health factsheet. Retrieved from:
https://www.who.int/news-room/fact-sheets/detail/mental-health-strengthening-our-response.

World Health Organization, (2016). Working for Health and Growth: Investing in the Health
Workforce. Report of the High-Level Commission on Health Employment and Economic
Growth. Retrieved from: http://apps.who.int/iris/bitstream/10665/250047/1/9789241511308-
eng

World Health Organization, (2013). A Universal Truth: No Health Without a Workforce. Retrieved
from. Forum Report Third Global Forum on Human Resources for Health. Retrieved from:
https://www.researchgate.net/publication/270561476_A_Universal_Truth_No_Health_Witho
ut_a_Workforce

Yepes-Baldó, M., Romeo, M., Westerberg, K., Nordin, M., (2018). Job crafting, employee well-
being, and quality of care. *West. J. Nurs. Res. 40* (1), 52–66. doi:http://dx.
doi.org/10.1177/0193945916680614.