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The effects of mindfulness training for emergency department and intermediate care unit nurses

Marja Mäkinen [a,*], Eeva Jaakonsalo [b], Reetta Saarivainio [a], Jarkko Koskiniemi [a], Marja Renholm [c]

[a] Department of Emergency Medicine and Services, Helsinki University Hospital and University of Helsinki, Helsinki, Finland
[b] Andas Ltd, Helsinki, Finland
[c] Management of the Joint Authority, Nursing Management, Helsinki University Hospital and University of Helsinki, Helsinki, Finland

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ABSTRACT

Aim: The aim of this study was to determine the effects of mindfulness and self-compassion skills on the experienced stress and work satisfaction of emergency department (ED) and intermediate care unit employees.
Methods: All ED and intermediate care unit employees in the study hospital were invited to participate in an introductory lecture about mindfulness, compassion, and the intervention in January 2020. After the lecture, it was possible to enroll in training. This training was postponed due to Covid-19 and started in October 2020.
Results: The most important findings of this study are that instructor-led mindfulness training, and the regular use of a smartphone mindfulness application can significantly reduce stress and burnout and promote mindfulness and well-being of ED and intermediate care unit personnel.
Conclusions: This study shows that compact mindfulness training via innovative digital technology has a positive effect in reducing ED and intermediate care unit employees stress and burnout, while improving mindfulness and well-being, and this is consistent with the wider literature.
Key findings: The regular practice of smartphone-guided mindfulness can reduce stress and burnout, as well as promote mindfulness and well-being among ED and intermediate care unit employees.

1. Background of the study

Compassion, which literally means "to suffer together", can be defined as consisting of five elements: recognizing suffering, understanding the universality of human suffering, feeling for the person suffering, tolerating uncomfortable feelings, and motivation to act/acting to alleviate suffering (Strauss et al., 2016).

Compassion is a skill that reduces health care professionals' burnout, while increasing loyalty and respect for clients, which leads to a meaningful and satisfying working environment (Bodini et al., 2022; Jemal et al., 2021). Additionally, in caring professions such as nursing, professionals can suffer from compassion fatigue – the emotional strain of exposure to constantly working with people who suffer.

On top of compassion fatigue, organizational system fatigue can also affect both mental well-being and work satisfaction. Shortage of resources, as well as frustration towards management or leadership, can lead to lowered levels of compassion and commitment. That is why self-compassion is as important as compassion towards others. Unless we treat ourselves with love and compassion, we cannot reflect the same on others. According to Neff, self-compassion consists of three elements: (1) self-kindness vs. self-judgement; (2) common humanity vs. isolation; and (3) mindfulness vs. over-identification. Both compassion and self-compassion are skills that can be increased through learning and training (Neff, 2003; Neff & Germer, 2022).

In previous studies, nurses in emergency clinics have demonstrated higher-than-average levels of compassion fatigue and lower-than-average levels of compassion satisfaction. In acute care, working in a hurry and doing many things at the same time keeps the body and brain in constant state of stress (Healy & Tyrrell, 2011; Hooper et al., 2010; Von Rueden et al., 2010). Work matters continue to bother the mind even after working hours, and recovery from the workday slows down and may also have effects on sleep. Efficiency, creativity, and ability to learn new things decreases, and these might have negative effects on work results (Boyle, 2011).

It is important to have an increased awareness of potential compassion fatigue and increased prevention support to improve nurse

* Corresponding author at: HUS Akuutti, PL 340, 00029 HUS, Haartmaninkatu 4, Helsinki, Finland.
E-mail address: marja.makinen@hus.fi (M. Mäkinen).

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job satisfaction, while at the same time increasing the quality of patient care (Portnoy, 2011). Understanding the concepts of compassion satisfaction and- fatigue and burnout and the symptoms of those will help nurses to maintain caring attitudes with patients (Hooper et al., 2010). Mindfulness-based interventions for health care professionals in earlier studies have been shown to reduce stress and burnout symptoms and increase general health and self-compassion (Burton et al., 2017; Fraiman et al., 2022; Santamaría-Peláez et al., 2021; Sarazine et al., 2021; Trygg Lycke et al., 2022; Xu et al., 2020). There are specific studies conducted in emergency departments that show how effective both individual or organizational educational or mindfulness interventions are in decreasing burnout and stress at work. The prevalence of burnout and occupational stress among emergency department employees needs urgent attention (Xu et al., 2022).

This mindfulness intervention study was carried out in the ED and intermediate care units of one university hospital. The target population was selected for the study since ED and intermediate care unit personnel have to work in stressful conditions for a long time. Currently, the workload of the ED and intermediate care units is at its peak. The work is heavy, fast-paced, and demanding shift work, which especially tests the ability of staff to cope.

The aim of this study was to determine the effects of mindfulness and self-compassion skills on the experienced stress and work satisfaction of ED and intermediate care unit employees. And assess whether it is possible to implement the training program during working hours.

2. Methods

This pre- and post-intervention study was carried out in one university hospital's emergency department and its Intermediate Care Unit in Uusimaa, Finland, between January 2020 and January 2021. In January 2020, all ED ($n = 92$) and intermediate care unit ($n = 78$) staff ($N = 170$) in the study hospital (the hospital has 317 beds and 1450 employees) were invited to participate in an introductory lecture about mindfulness, compassion, and the intervention. After the lecture, it was possible to enroll in the training. Written information about the study was handed to the participants thus participation was voluntary and based on informed choice.

This occupational well-being project was a targeted management decision aimed at one university hospital's ED and this ED's Intermediate Care Unit. The ED treats unexpected illnesses and injuries, as well as mental health issues that require immediate attention. Patients requiring round-the-clock observation are treated at the ED's Intermediate Care 29 bed Unit, which is close to the ED. Patients who arrive there do not require admission but require treatment that extends beyond the initial examination and management provided in an emergency care setting. A great deal of ED patients who require a longer observation time are treated there. Most patients seen on this facility are discharged within 24 h.

2.1. Intervention

The intervention was a training consisting of two parallel paths: individual mindfulness training exercises and in-class lectures (Andas Life, n.d.). The participants were encouraged to participate in both (Fig. 1). The daily individual exercises were done with a mobile training application. The in-class program consisted of six two-hour group meetings led by an instructor. The instructor was a licensed coach (Associated Certified Coach by International Coach Federation), mindfulness instructor (Advanced Teacher Training), and emotional intelligence coach.

The two paths of the intervention (individual training with the mobile application and group teaching as in-class sessions) were run in parallel. Combining classroom teaching with digital tools and individual practice aimed at learning in three dimensions: (1) rational learning through receiving new information, (2) experiential learning through practice, and (3) deep learning through reflection; observing one's own experiences and insights.

2.2. Individual mindfulness training exercises

The participants trained on their own with Andas Life, a mobile mindfulness training application which they were encouraged to use daily throughout the duration of the program (Andas Life, n.d.). The program was built around themes touching on different areas of our well-being based on Mindfulness-Based Stress Reduction (MBSR) (Brown et al., 2007; Neff & Germer, 2013) and Mindfulness-Based Cognitive Therapy (MBCT) (de Silva, 2020; Kabat-Zinn, 1982). The themes were as follows: introduction to the mind, managing stress, difficult situations, and self- compassion (Andas Life, n.d.) (Fig. 1).

The mobile program consisted of a main introductory survey before the training starts, daily meditation exercises, informative videos, pulse surveys at the beginning of each module, and a main closing survey at the end of the program. The daily meditation exercises take approximately 15 min a day, 5–7 days a week. The mobile program instructs the user to do the daily exercises and to watch learning videos. It sends notifications and material for further reading. An instructor is available via e-mail throughout the process.

2.3. In-class sessions

The class sessions provided an opportunity for more in-depth discussion of themes. Each class session followed a similar structure: introductory meditation, presentation of the session's theoretical framework, exercises (instructor-led, done individually, usually meditation + written self-reflection), discussion, homework for next time,

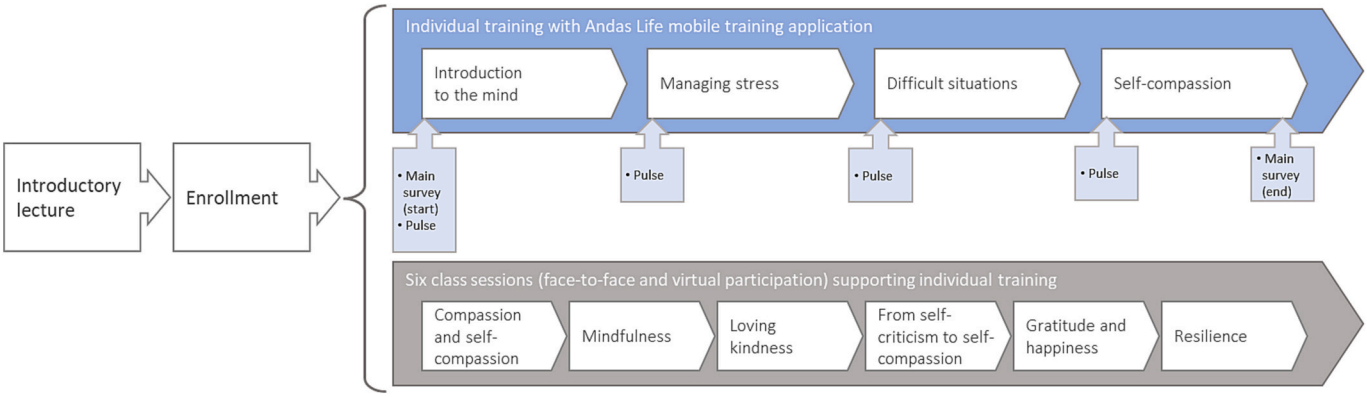


Fig. 1. Outline of the program.

and closing meditation. Additionally, the participants received a handbook containing self-reflection exercises. The sessions were held during regularly scheduled work time. The in-class training sessions were based on Christopher Germer and Kirstin Neff's "Teaching the Mindful Self-Compassion Program" (Neff & Germer, 2013) (Fig. 1) (Appendix 1).

2.4. Data collection

Survey data were collected via the Andas Life application at the beginning and end of the mobile training to measure both pre- and post-intervention effects with the help of two different types of surveys – main survey and pulse surveys Data collection consisted of a main starting survey at the beginning of the program, three to six pulse surveys at the beginning of each application module, and a closing survey at the end of the program (Fig. 1).

The main survey questions were modified from Mindfulness-Based Stress Reduction (MBSR) (Kabat-Zinn, 1982), Mindfulness-Based Cognitive Therapy (MBCT) (de Silva, 2020), the Maslach Burnout Inventory (MBI) (Portoghese et al., 2018), and the Perceived Stress Scale (PSS) (Cohen et al., 1983). The main survey consisted of 30 questions representing different training themes. In the application, the questions were presented in random order. The scale for the answers was 1–5 (1 = never or very rarely, 2 = rarely, 3 = sometimes, 4 = quite often, 5 = very often or always) (Appendix 2).

The pulse survey was a shorter, quick questionnaire that presented at the beginning of each 10-day module. It consists of eight questions. The pulse is answered by rating own feelings on a 0.5-to-5-star scale, where one star = do not agree and five stars = agree. The scale corresponding to star ratings was numerical 1-10 (Appendix 3).

2.5. Data analysis

Descriptive statistics were used in presenting demographic information on the survey respondents. Categorical variables were expressed as percentages. The Mann–Whitney *U* test was used to compare means between groups before vs. after the training. Mean changes were shown for each category together with medians and interquartile ranges (IQR), and changes were tested using Mann–Whitney *U* tests. The changes were also visualized using box plots. The analyses were done using R 4.1.3 and the plots were produced using the package ggplot2. *P* values $< .05$ were considered significant.

3. Results

The introductory lecture was held in January 2020, but the actual training was postponed due to Covid-19 and started in October 2020. Of the entire personnel, 128/170 (75 %) signed up for the training.

Among the introductory lecture participants, there were more women (84 %) than men (16 %), and the majority (91 %) were nurses. Over two thirds (67.6 %) of the participants were under the age of 45, 22.2 % were aged 45–54 and 10.1 % were aged 55 or older. The most common job titles were nurse (RN) (90.9 %), assistant nurse manager (ANM) (6.1 %) and nurse assistant (NA) (3 %). Regarding workplace, 69.7 % of participants worked in the ED and 30.3 % in the Intermediate care unit, and 73.5 % were in permanent employment and 26.5 % worked part-time; additionally, 33 % of them had worked for their current employer for more than ten years and 8 % of them for >30 years. Of these 128, 96 (77 %) activated mobile applications, of whom 70 did at least one exercise. Completion of the program requires a minimum of 60 min individual training with the application, and the number of these users of the application (called "active users" with total training time minimum 60 min) was 49.

The survey results are presented as a comparison between introductory survey and closing survey, showing the average results of active respondents. Overall, the results show positive changes for all application users and even more so for active users (Fig. 1). In general, learning to acknowledge and accept one's own thoughts and emotions has a positive impact on self-esteem and life quality (Table 1). This effect can be seen in all the answers. For active users, there is, additionally, an even stronger change in the areas of difficult situations, welcome to your mind (self-esteem), and quality of life.

Those who were using the application felt significantly less often that they did not pay attention to what they were doing ($p < .049$) or that they were not really present in the current moment ($p < .019$). After the training, they also paid more attention to the person they were communicating with ($p < .003$). The application training had a positive effect on participants' thoughts about quality of life ($p < .011$) and the desire to take care of themselves and others ($p < .000$).

Use of the application also reduced participants' feelings of inadequacy ($p < .028$) and difficulty concentrating ($p < .004$) at work and increased their feeling of energy after the workday ($p < .001$). They felt less inadequate at work ($p < .004$) and less often irritated with customers or other people with whom they work ($p < .000$). Changes were also associated with use of the application; users were more able to detect mistakes or difficulties without judging them ($p < .002$) and were kinder to themselves after a failure ($p < .000$). Users also reported that they experienced moments of inner peace and ease more often, even if things were hectic and stressful ($p < .000$).

The pulse survey mapped the participants' immediate experiences of (1) ability to focus (I can concentrate on one thing at a time; I can stay focused despite disturbances or desires), (2) everyday presence (I notice when I am going on autopilot; I am present in discussions and really hear what is being said), (3) quality of sleep (I fall asleep easily; My sleep is deep and refreshing), and ability to manage stress (I feel that my life is in balance; If I am stressed, I still feel that I have control over things).

The strongest positive effects of the coaching were on the feeling of stress control and the ability to concentrate. The participants also more often felt that life is balanced, and sleep is refreshing and deep (Fig. 2).

Fig. 3 shows the mean changes in each question category. All the changes were statistically significant. The median (IQR) increase in compassion was 0.4 (0; 0.8) with a *p*-value $< .001$ while all other categories decreased by −0.4 (−0.6; −0.2) and had *p*-values ranging from 0.001 to <0.001.

4. Discussion

Overall, the results of this study show positive changes for all active application users. In general, learning to acknowledge and accept one's own thoughts and emotions has a positive impact on self-awareness and self-compassion.

Based on previous studies, it is known that nurses' well-being at work affects the quality of patient care (Kumar et al., 2019) and the efficiency of the healthcare system (Alomari et al., 2020; Kumar et al., 2019). ED and intermediate care unit work is stressful, and the staff in this setting work under pressure every day. Stress causes burnout, which weakens quality of life and work motivation. Work-related stress is caused by organizational factors and the demands of work, as well as the imbalance of social support (Caponnetto et al., 2018). According to the working condition barometer (2697 respondents) conducted by the Nurses' Association, dissatisfaction is aimed e.g., the salary, on the planning of activities that support well-being at work, career development opportunities, work supervision, transparency of decision-making, and the number of personnel and professional structure corresponding to the demands of the work. According to the study, the nurses working in intensive care, monitoring and observation departments, and emergency care were most unsatisfied with their work (Nurses' working condition barometer, 2020).

In earlier studies the different impacts of mindfulness and compassion training seem to have led to increased feelings of overall better quality of life (Burton et al., 2017; Goktas et al., 2022; Santamaría-Peláez et al., 2021; Sarazine et al., 2021). Then most common reasons for not following the mindfulness intervention may have included

Table 1
The average results of all respondents between introductory survey and closing survey.

Category	Question	The time of the survey	1 Never or very rarely	2 Rarely	3 Sometimes	4 Quite often	5 Very often or always	p
1 Welcome to your mind (Self-awareness)	I am going on autopilot, without actually paying attention to what I'm doing	Start	3 (7 %)	7 (16 %)	19 (42 %)	15 (33 %)	1 (2 %)	0.049
		End	3 (7 %)	11 (24 %)	21 (47 %)	9 (20 %)	1 (2 %)	
	My mind goes through past or future things, and I am not really present in the current moment	Start	4 (9 %)	4 (9 %)	13 (29 %)	20 (44 %)	4 (9 %)	0.019
		End	3 (7 %)	7 (16 %)	20 (44 %)	13 (29 %)	2 (4 %)	
	I notice that I am lost in thought and not really paying attention to the person I am communicating with	Start	2 (4 %)	7 (16 %)	19 (42 %)	13 (29 %)	4 (9 %)	0.003
		End	4 (9 %)	10 (22 %)	23 (51 %)	6 (13 %)	2 (4 %)	
	It feels that the quality of my life is not quite on the level I would like it to be	Start	3 (7 %)	5 (11 %)	16 (36 %)	16 (36 %)	5 (11 %)	0.011
		End	5 (11 %)	8 (18 %)	17 (38 %)	13 (29 %)	2 (4 %)	
	I don't have time to take care of myself and/or the people I care for	Start	1 (2 %)	2 (4 %)	12 (27 %)	21 (47 %)	9 (20 %)	0.000
		End	2 (4 %)	6 (13 %)	23 (51 %)	11 (24 %)	3 (7 %)	
2 Managing stress	I feel insufficient at work	Start	1 (2 %)	11 (24 %)	16 (36 %)	14 (31 %)	3 (7 %)	0.028
		End	3 (7 %)	14 (31 %)	18 (40 %)	8 (18 %)	2 (4 %)	
	It's difficult to concentrate and I tend to forget things	Start	2 (4 %)	13 (29 %)	10 (22 %)	18 (40 %)	2 (4 %)	0.004
		End	4 (9 %)	14 (31 %)	18 (40 %)	9 (20 %)	0 (0 %)	
	I don't have the energy to meet my friends or go out after work	Start	4 (9 %)	8 (18 %)	13 (29 %)	13 (29 %)	7 (16 %)	0.001
		End	6 (13 %)	11 (24 %)	18 (40 %)	8 (18 %)	2 (4 %)	
	Even when I'm away from work, my mind is occupied by work-related thoughts	Start	6 (13 %)	17 (38 %)	13 (29 %)	7 (16 %)	2 (4 %)	0.931
		End	4 (9 %)	19 (42 %)	13 (29 %)	8 (18 %)	1 (2 %)	
	After I leave work, I still keep on processing work issues in my mind, over and over again	Start	4 (9 %)	14 (31 %)	18 (40 %)	6 (13 %)	3 (7 %)	0.046
		End	6 (13 %)	16 (36 %)	16 (36 %)	6 (13 %)	1 (2 %)	
3 Difficult situations	Going to work feels uncomfortable or distressing	Start	3 (7 %)	17 (38 %)	18 (40 %)	4 (9 %)	3 (7 %)	0.293
		End	5 (11 %)	17 (38 %)	17 (38 %)	5 (11 %)	1 (2 %)	
	I question my own professional ability and my self-esteem at work is low	Start	1 (2 %)	11 (24 %)	18 (40 %)	14 (31 %)	1 (2 %)	0.227
		End	2 (4 %)	16 (36 %)	13 (29 %)	11 (24 %)	3 (7 %)	
	There are situations at my work that I experience as distressing or unpleasant	Start	4 (9 %)	4 (9 %)	24 (53 %)	13 (29 %)	0 (0 %)	0.061
		End	3 (7 %)	13 (29 %)	21 (47 %)	6 (13 %)	2 (4 %)	
	I feel inadequate at work	Start	2 (4 %)	5 (11 %)	20 (44 %)	12 (27 %)	6 (13 %)	0.004
		End	3 (7 %)	9 (20 %)	22 (49 %)	8 (18 %)	3 (7 %)	
	I become irritated at clients or other persons that I'm working with	Start	3 (7 %)	10 (22 %)	21 (47 %)	11 (24 %)	0 (0 %)	0.000
		End	5 (11 %)	23 (51 %)	15 (33 %)	2 (4 %)	0 (0 %)	
4 Compassion	I can accept unpleasant situations or difficult experiences	Start	1 (2 %)	8 (18 %)	17 (38 %)	17 (38 %)	2 (4 %)	0.458
		End	2 (4 %)	4 (9 %)	20 (44 %)	16 (36 %)	3 (7 %)	
	I can observe my mistakes or difficulties without judging them	Start	5 (11 %)	16 (36 %)	17 (38 %)	7 (16 %)	0 (0 %)	0.002
		End	2 (4 %)	11 (24 %)	19 (42 %)	13 (29 %)	0 (0 %)	
	If things go wrong, if I for example make a mistake or fail, I'm still friendly with myself	Start	5 (11 %)	21 (47 %)	15 (33 %)	4 (9 %)	0 (0 %)	0.000
		End	2 (4 %)	8 (18 %)	23 (51 %)	12 (27 %)	0 (0 %)	
	I can experience moments of inner peace and ease, even when things get hectic and stressful.	Start	6 (13 %)	26 (58 %)	9 (20 %)	4 (9 %)	0 (0 %)	0.000
		End	4 (9 %)	7 (16 %)	22 (49 %)	12 (27 %)	0 (0 %)	
	Even if I'm stressed, I still feel that I'm in control of things and situations	Start	2 (4 %)	5 (11 %)	14 (31 %)	21 (47 %)	3 (7 %)	0.686
		End	3 (7 %)	4 (9 %)	12 (27 %)	23 (51 %)	3 (7 %)	

Comparisons done using Mann–Whitney U test.
1 = never or very rarely, 2 = rarely, 3 = sometimes, 4 = quite often, 5 = very often or always.

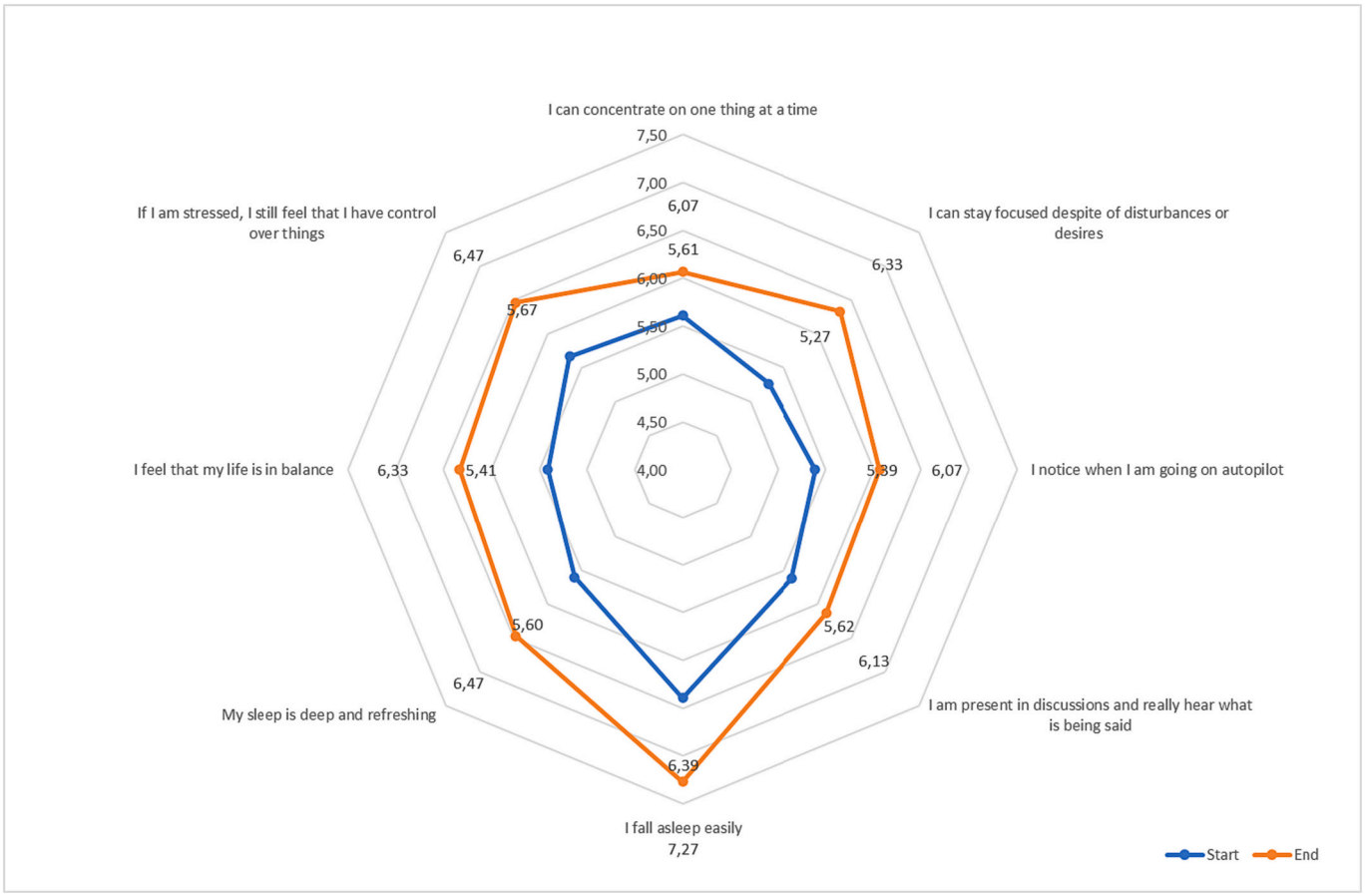


Fig. 2. The results of the participant pulse survey at the beginning and end of the program.
The pulse is answered by rating one's own feelings on a 0.5-to-5-star scale where one star = do not agree and five stars = agree (Appendix 2). The numerical scale was 1-10.

difficulties with the application and finding time and space to participate in coaching during working hours (Xu et al., 2022). Based on the results of this study, the intervention was helpful. In this intervention study of ED and intermediate care unit personnel experiences of mindfulness training intervention, we found that participants became more aware of their own situation and behavior. Previous literature has presented similar results (Burton et al., 2017; Fraiman et al., 2022; Santamaría-Peláez et al., 2021; Sarazine et al., 2021; Trygg Lycke et al., 2022; Xu et al., 2020; Xu et al., 2022). Not everyone was able to participate in coaching or use the app regularly, but those who could experience a change: improved concentration, an increase in energy, and improved attitude and behavior towards patients and colleagues. Some of the changes, especially improvements in attitude and behavior, are a benefit to both patients and the entire work community. The knowledge gained in the workshop regarding the scientific basis of mindfulness gave participants the confidence they needed to participate in mindfulness training.

The mindfulness method has been researched and shown to be effective and suitable as an aid to manage stress and support one's ability to work, as well as to improve satisfaction of both personnel and patients (Fraiman et al., 2022; Goktas et al., 2022; Janssen et al., 2018; McConville et al., 2017; Santamaría-Peláez et al., 2021; Trygg Lycke et al., 2022; Xu et al., 2020). The most important findings of this study are that mindfulness coaching, and the regular use of a self-paced mindfulness smartphone application can significantly reduce stress and burnout and promote mindfulness and well-being of ED and intermediate care unit personnel. This is an important finding when thinking of the hurried nature of work in acute care, which demands doing many things at the same time. Participants of this study felt that they had more resources afterwards for taking care of own well-being and experienced moments of inner peace and ease more often. Even if the surroundings or circumstances have not changed since the study, their attitude has, and as they are not switching to autopilot mode as often as before, they feel that they can now steer their attention consciously and be present in the moment. Results of this study are in line with those of previous studies (Burton et al., 2017; Fraiman et al., 2022; Santamaría-Peláez et al., 2021; Sarazine et al., 2021; Trygg Lycke et al., 2022; Xu et al., 2020; Xu et al., 2022).

Effective stress management of personnel can also have clinically significant effects on job retention, productivity, promotion of career duration, and impact on patient care. With the smartphone application, personnel can easily use mindfulness intervention. In the future, this simple, effective self-help tool can be used as part of a comprehensive support package for ED and intermediate care unit employees to increase individual resilience in managing stress (Trygg Lycke et al., 2022).

According to previous literature, mindfulness has been shown to be effective in reducing stress among health care workers, as well as among the general population (Janssen et al., 2018; McConville et al., 2017; Raab, 2014). Hospital leadership should consider dedicating resources to more intensive mindfulness activities to combat amplified burnout levels among ED and intermediate care unit personnel (Lopez et al., 2022). Even if the participants in this study may still experience stress or pressure, they have a developed experience of controlling their own stress. Experienced stress is now affecting their time off-work less than previously. The feeling of inadequacy, which often increases stress, has declined.

Future research in this area should focus on a larger study population

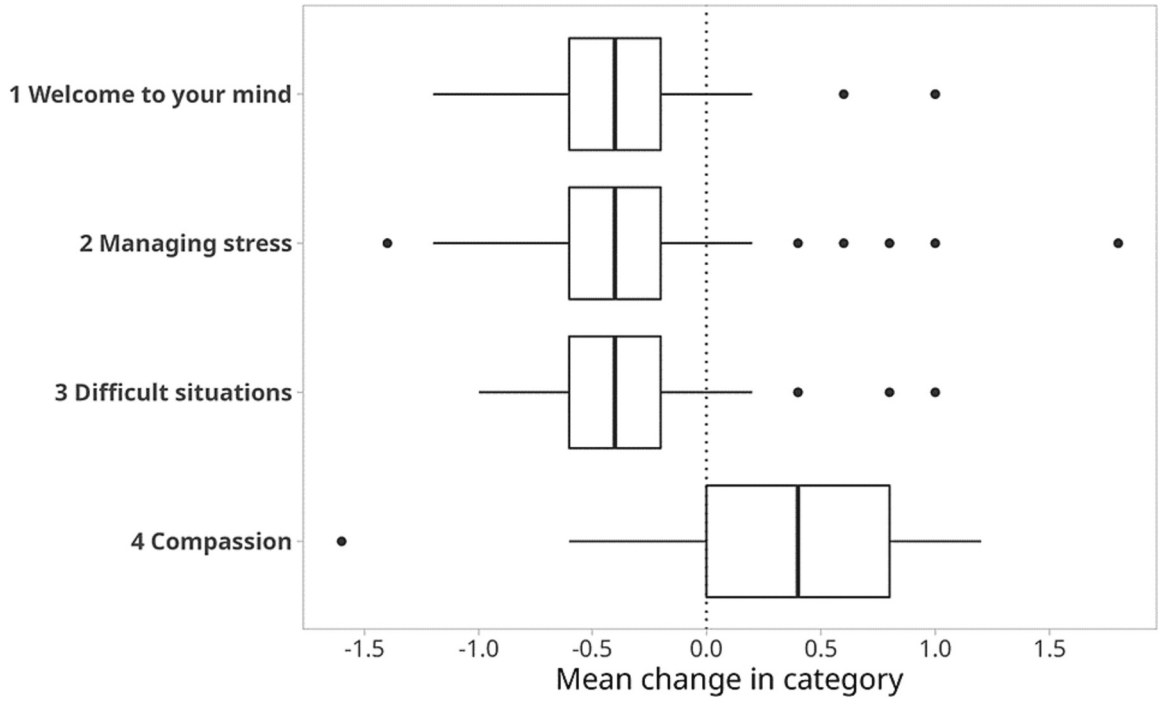


Fig. 3. The mean changes in each question category.

from different kind of departments, for example intensive care units and oncological units.

5. Strengths and limitations

5.1. Implications of Covid-19

The training was originally planned to be conducted in four pre-set groups, each attending four two-hour group sessions. However, the Covid-19 pandemic led to changing both the timetable and structure of the intervention, and the training was offered as six 1.5-hour open sessions that could be attended either physically or virtually.

Both the survey tool and the training program based on validated and empirical material were created by Andas Ltd., but they have not been used in this form before. The content of the survey tool and the training were designed according to the needs of the target group, and that is why these have not been validated before. However, they have been used in other academic research, showing reliable positive results. For further information, please see Ahlvik (2019). The Power of Awareness: Unlocking the Potential of Mindfulness in Organizations. Hanken School of Economics (Ahlvik, 2019; Urrila & Mäkelä, 2022). Be(com)ing other-oriented: The value of mindfulness for leaders and leadership development. University of Vaasa (Urrila & Mäkelä, 2022).

This modification of the training led to two major changes; firstly, the group formation changed from meeting to meeting (instead of having fixed groups), and secondly, as we applied physical distancing and wore masks, almost all pair and small group discussions, interactions and sharing were left out.

These changes had an impact on the training. Fixed groups normally create a trusting atmosphere, which enables supporting each other and showing vulnerability. Additionally, sharing in pairs or small groups deepens the learning process. In this case, these were lacking due to external circumstances. This was probably also the reason for very little sharing or commenting overall; the participants were rather quiet throughout the training. However, this may have been both a positive and a negative issue, depending on the participant. Previous training experience has shown that some people enjoy a tight group with in-depth discussions, whereas others prefer reflecting on their own and sharing less.

On the other hand, the pressure that the Covid-19 pandemic put on ED and intermediate care unit personnel may also have led to an increased need for self-care tools. Some participants may have been even more motivated to participate in the training, as they had become aware of the strain that the pandemic added to their work – life balance.

5.2. Limitations of the results

Participation in the training was voluntary based on informed consent, which may have affected the selection of participants. It is possible that those persons enrolling on the program had a more positive view on mental training and self-compassion than those that chose to opt out.

In this study, the number of active users (with total training time minimum of 60 min) was 49 (38 %), which is lower than average (58 %) when compared with all Andas Life application users. The comparison is, however, only referential, as this training was tailored (and re-tailored) to the organization's needs. It seems, nevertheless, that a large number of ED and intermediate care unit nurses were interested in the theme but did not manage to invest the time needed.

As the training consisted of both individual exercising and group sessions, the best results were probably gained when participating in both. However, participation in the group sessions was not mandatory. The application data cannot be matched with session participation data, so we do not have information on how in-class teaching affected the results. It is likely, however, that the more active participation in-class, the better the results.

The survey results are presented as a comparison between the introductory survey and closing survey, showing the average results of active respondents. Herein lies a restriction; typically, only participants who followed the program daily to the end took the closing survey (in this study these are called *active users*). They are thus most likely the persons who were motivated to do the meditation exercises and had a beneficial experience of the program. On the other hand, those participants who (a) did not do the exercises and/or (b) did not experience any benefits, were not motivated to complete the program and take the closing survey (in this study, the term *all users* refer to both active users and other users).

In other words, active users, who experienced the most positive effects of the program, were those most likely to take the ending survey. Whereas those persons who have not experienced specific effects did not take the survey, and thus the results show a positive outcome, possibly fewer answers of which the majority are positive.

The application data did not contain user information such as age, gender, or working years, so this study couldn't analyze whether these kinds of variables affect the results. Although the training program and survey were based on previously validated models and measures, they were not validated in the form presented in this study, which may affect the reliability of the results.

6. Conclusions

The result of the present study shows that compact mindfulness training via innovative digital technology has a positive effect in reducing ED and intermediate care unit employees stress and burnout, and improves mindfulness and well-being, and this is consistent with the wider literature. Mindfulness can be used to reduce the stress of nurse professionals working in EDs and intermediate care units. It would be useful to train the professionals to use this tool regularly for example in staff meetings and other trainings. Taking into account that participating in the lectures of the training program is challenging for many during working hours.

Ethical approval

The study was conducted in accordance with the Helsinki Declaration and was in accordance with ethical standards of the HUS Regional Committee on Medical Research Ethics.

Declaration of competing interest

All authors declare that they have no conflicts of interest.

Appendix 1

Appendix 1
Content of the training program.

Module	Content
1 Compassion and self-compassion	Theory: What is compassion and self-compassion • Self-kindness vs. self-judgement • Common humanity vs. isolation • Mindfulness vs. over-identification • Yin & Yang of self-compassion Exercises: • How would I treat a friend? • How self-compassionate am I? (Self-compassion scale) • Soothing touch Self-compassion break Home exercises: • Soothing touch, Self-compassion break • Andas Life mindfulness training program
2 Mindfulness	Theory: Mindfulness as a prerequisite for compassion • Noticing what you are experiencing while experiencing it • Autopilot mode, multitasking • Doing vs. being Exercises: • Resisting and accepting • Breathing anchor meditation Home exercises: • Andas Life mindfulness training program
3 Loving kindness	Theory: Loving kindness or benevolence • Mindfulness: I'm aware of my experience • Self-compassion: I hold myself in loving awareness • Loving kindness: We all are worthy of love and kindness Exercises: • Affectionate breathing • Loving kindness meditation • Metta meditation Home exercises: • What do I need to hear? • Andas Life mindfulness training program
4 From self-criticism to self-compassion	Theory: Discovering your self-compassionate voice • Fixed and growth mindset • Recognizing inner critic, choosing inner compassion • Compassion fatigue Exercises:

(*continued on next page*)

Appendix 1 (*continued*)

Module	Content
	• Loving kindness to myself • Inner critic or inner best friend • Recognizing own compassion fatigue Home exercises: • Compassionate letter to myself • Pay attention to what you pay attention to • Andas Life mindfulness training program
5 Gratitude and happiness	Theory: Compassion is a positive emotion • Neuroplasticity • Negativity bias • Savoring, gratitude, and self-appreciation Exercises: • Hourglass meditation • Small and big things • Recognizing own strengths Home exercises: • Gratitude diary • Andas Life mindfulness training program
6 Resilience	Theory: Compassion and resilience • Resilience and recovery • Adaptive and maladaptive coping strategies • Plate model for a healthy mind Exercises: • Coping and benefit finding • How self-compassionate am I? (Self-compassion scale) • What do I take with me?

Appendix 2

Appendix 2
Outline of the main survey questionnaire.

Theme 1 Welcome to your mind (Self-awareness)
I am going on autopilot, without actually paying attention to what I'm doing.
My mind goes through past or future things, and I am not really present in the current moment.
I notice that I am lost in thought and not really paying attention to the person I am communicating with.
It feels that the quality of my life is not quite on the level I would like it to be.
I don't have time to take care of myself and/or the people I care for.
Theme 2 Managing stress
I feel insufficient at work.
It's difficult to concentrate and I tend to forget things.
I don't have the energy to meet my friends or go out after work.
Even when I'm away from work, my mind is occupied by work-related thoughts.
After I leave work, I still keep on processing work issues in my mind, over and over again.
Theme 3 Sleep and recovery
I feel tired and unenthusiastic.
It takes a long time to fall asleep.
I wake up in the night, thinking about work or something else that causes stress to me.
I wake up too early in the morning, even if I could still sleep.
Sleeping problems affect my daytime activities (quality of work, concentration, memory, mood).
Theme 4 Living with pain or illness
I experience increased stomach problems/back problems/headaches/other health issues.
I feel that my working ability or coping has decreased due to pain, illness, or other health issue I'm experiencing.
It feels that my everyday life is a continuous battle with pain or illness.
The pain or illness I'm experiencing affects how I manage or perform at work.
Experiencing continuous pain makes me tired and/or anxious.
Theme 5 Difficult situations
Going to work feels uncomfortable or distressing.
I question my own professional ability and my self-esteem at work is low.
There are situations at my work that I experience as distressing or unpleasant.
I feel inadequate at work.
I become irritated at clients or other persons that I'm working with.
Theme 6 Compassion and resilience
I can accept unpleasant situations or difficult experiences.
I can observe my mistakes or difficulties without judging them.
If things go wrong, if I for example make a mistake or fail, I'm still friendly with myself.
I can experience moments of inner peace and ease, even when things get hectic and stressful.
Even if I'm stressed, I still feel that I'm in control of things and situations.

Appendix 3

Appendix 3
Outline of the pulse survey questionnaire.

Quality of sleep
• I fall asleep easily
• My sleep is deep and refreshing
Ability to focus
• I can concentrate on one thing at a time
• I can stay focused despite of disturbances or desires
Control over stress
• I feel that my life is in balance
• If I'm stressed, I still feel that I have control over things
Awareness in everyday life
• I notice when I'm going on autopilot
• I'm present in discussions and really hear what is being said

Appendix 4. Definition of key concepts

Mindfulness: As defined by Jon Kabat-Zinn, mindfulness means intentionally focusing one's attention on the experience occurring at the present moment in a non-judgmental and accepting way. In other words, it can be described as noticing what we are experiencing while experiencing it (Ludwig & Kabat-Zinn, 2008).

Stress: In this study, stress has been defined in terms of a misfit between a person's skills and abilities and demands of the job and/or a misfit in terms of a person's needs supplied by the job environment (Green & Kinchen, 2022).

Burnout: According to Maslach and Jackson, burnout is the result of chronic stress (at the workplace) which has not been successfully dealt with. It is characterized by exhaustion and depersonalization (negativism/cynicism) and is found predominantly in caring and social professions (e.g., social workers, teachers, nurses, doctors, dentists) (Maslach & Jackson, 1981).

Compassion: Goetz et al. define compassion as the feeling that arises in witnessing another's suffering and that motivates a subsequent desire to help (Goetz et al., 2010).

Compassion satisfaction: In his research, Figley found that some caregivers are exposed to enormous amounts of suffering when working with traumatized individuals, but they still retain their capacity for empathy and experience little compassion fatigue. Caregivers with this ability experience a sense of satisfaction and accomplishment in their ability to empathize and alleviate suffering without becoming emotionally overwhelmed (Sinclair & Hamill, 2007). According to Simon et al., compassion satisfaction, simply put, is the "ability to receive gratification from caregiving." (Simon et al., 2005).

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