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A risk communication intervention aimed at enhancing help-seeking behavior and reducing stress symptoms in healthcare workers: a pilot study with a process evaluation

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Abstract

Background Healthcare workers (HCWs) are at risk for work-related stress, but interventions to support early help-seeking are often limited. This study aims to evaluate a risk communication intervention designed to promote help-seeking behavior and reduce stress symptoms. The risk communication intervention provides personal feedback on stress symptoms, risk factors and focuses on creating awareness of the potential disconnect between values assigned to healthy working and the effort devoted to it, based on the Disconnected Values Model.

Methods The study employed a pre-post, single-arm design. Recruitment, reach, dose delivered and received were assessed with data of the digital intervention, and participant satisfaction with questionnaires. Help-seeking behavior was measured with two items: one assessing whether action had been taken or was intended and one identifying specific actions taken. Stress symptoms were assessed using the distress screener subscale of the four-dimensional symptom questionnaire on a five-point Likert scale. Higher scores on this screener indicate more stress symptoms. The intention to seek help was evaluated six weeks after the intervention with descriptive statistics and stress symptoms pre- and post-intervention with a paired t-test.

Results Two out of three organizations were recruited, encompassing 660 HCWs. The intervention's reach was 12% (HCWs starting the intervention), dose delivered 100% (all components of the intervention were delivered) and dose received was 6% (number HCWs completing the intervention). Participant satisfaction averaged 6 (range 1–10). All HCWs who recognized a discrepancy between their values and behavior, and did not accept it, were prepared to take action. No changes were observed in stress symptoms, with mean scores of 2.0 (SD = 1.1) pre-intervention and 2.17 (SD = 0.77) post-intervention ($p = 0.50$) or help-seeking behavior.

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Conclusion The risk communication intervention contributes to the intention to change behavior, HCWs who recognized a discrepancy between their values and behavior and did not accept it were prepared to take action. Intention to change behavior is the first step towards actual behavior change, making the intervention promising. While the intervention is promising and warrants further testing to prevent work-related stress in HCWs, intervention and implementation challenges likely contributed to the lack of reduction in stress symptoms and improvement in help-seeking behavior.

Keywords Health communication, Early Intervention, Educational, Burnout, Psychological, Occupational Stress, Health Personnel

Introduction

With the aging population in many countries and ongoing staff shortages in healthcare, healthcare workers (HCWs) are facing increased work demands, often leading to work-related stress. Work-related stress is defined by the European Agency for Safety and Health at Work as: a negative emotional and physiological response occurring when the demands of the work environment exceed the worker's ability to cope [1]. This makes it important to prioritize their health and sustainability in the workplace [2–4]. On the individual level work-related stress is associated with health adversities such as burnout and depression and on the organizational level with increased absenteeism and medical errors [4–8]. Preventive interventions are essential to mitigate the adverse effects of work-related stress, especially when symptoms are mild and risk factors manageable among HCWs [9].

Help-seeking behavior is mostly a first step towards early prevention when experiencing work-related stress [10]. This type of prevention, referred to as secondary prevention, aims to detect early signs of stress and intervene before these develop into more severe psychological or occupational health problems, such as burnout.

The detection of risk factors and stress symptoms, paired with personalized feedback and access to preventive measures, can support HCWs in managing their stress more effectively [2, 11]. Personalized feedback is particularly relevant as it informs HCWs about their specific risks and suggests appropriate preventive actions, including seeking help [12, 13]. However, research indicates that prevention through screening and feedback can face certain challenges. For instance, these interventions may not consistently reach all intended individuals, and even when they do, motivating at-risk HCWs to take action and enhance their help-seeking behavior can be difficult [11, 14]. To address these issues and encourage help-seeking among HCWs, personalized risk communication may serve as a helpful intervention, as it connects the feedback to actionable steps HCWs can consider.

Risk communication plays a key role in encouraging preventive behaviors by offering clear, accurate, and understandable information about potential health risks to specific target groups [9]. When risk communication

considers how individuals perceive risks, it has been shown to effectively motivate people to take action to protect their health [15]. Risk perception, which is a subjective assessment of health risks, involves factors such as personal values, past experiences, and beliefs. These factors influence how individuals perceive and process information, and consequently, their behavior [9, 16, 17]. Research suggests that higher levels of risk perception can lead to changes in preventive behavior [17–20]. For example, individuals who perceive a higher risk of salmonella are more likely to adopt preventive measures due to their increased concern for health risks [21–23].

Values, which are a key component of risk perception, play an important role in behavioral change, as they can motivate individuals to seek help to prevent health deterioration [24]. A model addressing values is the Disconnected Values Model (DVM) which suggests that behavior change is more likely when individuals recognize their personal values [25]. The DVM is based on the cognitive dissonance theory and motivational interviewing, highlighting that discrepancies between actual and ideal states can motivate individuals to change their behaviors [24, 25]. Perceiving a discrepancy between personal values and behaviors can trigger cognitive dissonance, motivating individuals to adjust their behavior to align with their values and reduce this dissonance [25, 26]. Studies have shown that the DVM can improve mental well-being and increase the intention to change behavior, making it a valuable addition to preventive interventions [2, 24, 25, 27, 28]. By combining risk communication—particularly the aspects that involve risk perception—with the DVM, it may be possible to enhance help-seeking behavior and reduce stress symptoms among HCWs.

We aim to conduct a pilot study and evaluate the process of this intervention to get insight into its feasibility and guiding future refinements and improvements [29].

The objective of this pilot study is twofold. First, we aim to conduct a process evaluation to assess the intervention in terms of its reach, recruitment, delivery, uptake, and participant satisfaction. Second, we aim to explore the potential of the intervention to support help-seeking behavior and reduce stress symptoms in HCWs by

providing personalized feedback on stress, risk factors, and value-behavior discrepancies.

To address these objectives, we formulated the following research questions:

1. What is the reach, recruitment, dose delivered, dose received, and participant satisfaction of the risk communication intervention?
2. Does providing feedback on potential discrepancies between personal values and behaviors contribute to help-seeking behavior and a reduction in stress symptoms?

Methods

The methods employed in this study adhere to the guidelines outlined in the Consolidated Standards of Reporting Trials – extension feasibility study (CONSORT) [30]. These guidelines were followed to ensure transparent and comprehensive reporting of the study design, methods and intervention. The study protocol followed the principles of the Declaration of Helsinki (2013). The study did not need approval by the Medical Ethics Committee of the Academic Medical Centre, Amsterdam, The Netherlands which issued formal exemption (2023.0536). Informed consent was obtained from all participants prior to the study.

Trial design

This pilot study adopts a multi-center pre-post design with a single arm. The inclusion of the HCWs was performed from December 2023 until February 2024.

Participants

HCWs were recruited from three departments across three different healthcare institutions: an academic hospital, a large teaching hospital, and a nursing home. Our goal was to include at least twenty HCWs from each department. The inclusion criteria for participation were HCWs who provide direct patient care, work either part-time or full-time, and are able to read and write in Dutch to complete the questionnaires. Recruitment was conducted through newsletters and posters displayed in their departments, as well as small flyers distributed at an individual level, which included QR codes for easy registration to participate in the study.

Intervention

We developed a risk communication intervention for work-related stress, called Stress. Check. ACT! This intervention is informed by the DVM and a mental model approach that targets discrepancies by making HCWs aware of how their current behaviors may conflict with their professional and personal values. By also addressing their personal level of stress symptoms and risk factors,

the intervention may enhance their help-seeking behavior and reduce stress symptoms.

The digital intervention Stress. Check. ACT! consisted of a screening part (part 1), followed by tailored risk communication (part 2) providing personalized feedback on discrepancies between values and behavior, risk perception, stress symptoms and risk factors and tailored direction to preventive measures their employer offered.

Part 1. Screening values and behavior, risk perception, stress symptoms and risk factors

The screening component included 29 questions in total.

Eight questions assessing value-behavior discrepancies across four domains (mental health, work functioning, private life functioning, and work-life balance), using 11-point Likert scales (0–10) for both importance and effort, followed by closed-ended follow-up questions on discrepancy perception, acceptance, and willingness to act. More specifically: HCWs were asked to evaluate their values and behaviors across four domains: 1) the importance of their mental health, 2) work functioning, 3) their ability to function well in their private lives, and 4) their work-life balance, as detailed in supplementary file 1. They were then asked to reflect on the time and effort they had dedicated to each of these values over the past six weeks. HCWs received immediate feedback on their responses to both questions for all values. If there was a higher score on a value compared to the time and effort they had dedicated to that value, for example, rating the importance of mental health with an 8 and the time and effort invested with a 7, they were asked if they perceived a discrepancy in those scores. Following this, HCWs were asked whether they found the discrepancy acceptable and if they were willing to address this discrepancy. These options were offered for each of the four values (see Supplementary file 1).

After addressing values and behaviors, HCWs were asked about their risk perception (5-point Likert scale) with one question, along with their actual stress symptoms, three items from the validated distress screener subscale of the Four-Dimensional Symptom Questionnaire, using 5-point Likert scales (1 = never to 5 = constantly); ([31] and 17 items from subscales of the Copenhagen Psychosocial Questionnaire (COPSOQ), measuring psychosocial risk factors using 5-point Likert scales.

All questions were closed-ended [32]. The full questionnaire and structure are available in Supplementary File 1.

Part 2. Tailored personal risk communication

The digital screening to HCWs was fully automated, based on predefined algorithms within the digital platform. and provided tailored risk communication to

HCWs based on their screening results. The tailoring included: 1) personal screening results, 2) personal risk communication 3) preventive measures. So, the tailored communication included screening results regarding risk factors, values and behavior, risk perception, stress symptoms, and the preventive measures offered by their organization. Examples of the offered employers' preventive measures are mindfulness or consultation with an occupational physician. In total, HCWs could receive one of eight predefined risk communication profiles.

The pathway determining which type of risk communication a HCW received, is detailed descriptions in Supplementary File 2. In short, the predefined risk communications are:

- Risk communication 1 and 2: HCWs with a discrepancy on one or more domains, accepted this and has high risk perception received risk communication 1. HCWs with a low-risk perception received risk communication 2
- Risk communication 3 and 4: offered was offered to HCWs who recognized a discrepancy, did not accept it and were willing to address it. Those with a high-risk perception received risk communication 3, while those with a low-risk perception received communication 4.
- Risk communication 5 and 6: was offered to HCWs who identified a discrepancy, did not accept it, and were not willing to address it. Those with a high-risk perception received communication 5; those with a low-risk perception received communication 6.
- Risk communication 7 and 8: was assigned to HCWs who did not perceive any discrepancy between their values and behaviors. Those with a high-risk perception received communication 7; those with a low-risk perception received communication 8.

Process evaluation (objective 1)

A process evaluation was conducted using the Linnan & Steckler framework [33]. We evaluated the process indicators recruitment, reach, dose received, dose delivered and participant satisfaction. Definitions, objectives, items, descriptions and measurement instruments for these process indicators are detailed in Table 1.

Value and behavior discrepancy, help-seeking behavior and stress symptoms (objective 2)

We investigated whether providing feedback on potential discrepancies between personal values and behaviors in HCWs contributed to help-seeking behavior and stress symptom reduction. We explored the following aspects: frequency and descriptives of a discrepancy between one or more values, acceptance of discrepancy,

willingness to address discrepancy, help seeking behavior and reduction of stress symptoms.

Help seeking behavior, was measured with two items: "Have you taken action based on the results of the intervention or do you intend to do so?" The answer options are (0) yes, I have already taken action, (1) no, I have not taken any action yet, but I intend to, (2) no, I have not taken any action and do not intend to and (3) I am not sure yet if I will take action. The second item is "What actions have you taken? (multiple answers possible)". The answering options are the preventive measures offered in tailored risk communication.

The level of stress symptoms was assessed with the distress screener subscale of the four-dimensional symptom questionnaire [31]. The distress screener has been validated in workers and has adequate measurement properties. This screener consists of three items: during the past week, did you suffer from worry? During the past week, did you suffer from listlessness? During the past week, did you feel tense? The answering options are on a five Likert-scale from (1) no, sometimes, regularly, often, (5) very often or constantly [31]. The answers are added and divided by the number of questions, cut-off value above four was considered high level of stress symptoms.

Statistical analyses

Statistical analyses were conducted using SPSS software, version 28. In the process evaluation of recruitment, reach, dosage delivered, and dose received, both absolute numbers and percentages were reported. Participant satisfaction levels were analyzed by calculating the average satisfaction score and identifying the percentage of respondents scoring below 6 (objective 1). For HCWs recognizing discrepancies between their values and behaviors, we determined the proportion accepting these discrepancies and those willing to invest more time and effort into these values, using descriptive statistics. The intention to seek help was analyzed using responses from the T1 questionnaire. A paired t-test was utilized to compare stress symptoms at baseline and at T1 (after six weeks, objective 2). Continuous variables such as age and working hours were summarized using mean and standard deviation (SD). For categorical data, percentages were used to describe participant responses, with the number of respondents ('n') noted for context in each category.

Results

Process evaluation (objective 1)

Two out of three healthcare organizations participated, one healthcare organization decided just before the start of the recruitment of individual HCWs to terminate participation. This organization provided no reason for terminating participation. The two participating

Table 1 Overview of process evaluation: indicators definitions, objectives, questions, description of the process indicator and data-collection

Process indicator definitions	Objective	Process evaluation questions	Description of the process indicator	Data-collection	Described in
Recruitment is defined as the number of healthcare institutions and departments approached to participate in the study	To determine recruitment by assessing the number of healthcare institutions and departments approached and those that participated in the intervention	1. How many healthcare institutions and departments were approached for participation, and how many of these participated in the intervention?	Number of healthcare institutions	Not applicable	Process map 1
Reach is defined as the number of HCWs who started the intervention compared to the total number of HCWs working at the healthcare organization	To evaluate the reach of the intervention by comparing the number of individuals who started the intervention to the total number of individuals working at the healthcare organization	2. How many HCWs started the intervention compared to the total number of HCWs working at the healthcare organization?	Number and percentages of HCWs participated	Questionnaire	Process map 1
Dose delivered refers to the components of the intervention actually delivered	To determine whether the intervention was delivered as intended without technical issues, ensuring all HCWs could complete it	3. Were all components of the intervention delivered as intended?	Checklist with all components of the intervention	Questionnaire	Process map 1
Dose received is defined as the number of HCWs that completed the intervention compared to the number of individuals who started the intervention	To assess the dose received by comparing the number of HCWs who completed the intervention to the number of HCWs who started the intervention	4. How many HCWs completed the intervention?	Number and percentage of HCWs complete the intervention	Questionnaire	Process map 1 and Table 4
Participant satisfaction is the extent that the participants would recommend the intervention to others	To determine HCWs satisfaction with the intervention	5. On a scale of 0 to 10, how likely are you to recommend the intervention to others? 0 means not at all likely and 10 means extremely likely	Average score across all participants. The percentage and the number of respondents who scored below 6, indicating lower satisfaction. Reviewing and summarizing the open-ended responses	Questionnaire	Process map 1

departments of the two remaining organizations, had a total of 660 HCWs employed. Out of the 660 HCWs, 78 individuals entered the intervention, of which eleven of these individuals did not consent and were denied access to the digital intervention, resulting in a reach of 12%. Out of the remaining 67 HCWs, 29 did not complete the intervention, resulting in a dose received of 6%. The dose delivered was 100% as all components of the intervention were delivered as intended. The intervention received an average satisfaction score of 6.1 (SD= 2.2, min-max 1-10). Twelve HCWs (30%) scored the intervention lower than a six. Six HCWs offered comments, two of them highlighted the intervention's insights for stress management positively and planned to share the intervention with colleagues while four were negative, as they were unsure of the benefits, disagreed with the conclusions on work-related stress risk, or found the intervention uninformative (Fig. 1).

Pilot results on help-seeking behavior, stress symptoms, and values and behavior (objective 2)

The study involved 38 HCWs aged 26 to 63 years (mean = 42, SD = 9.7). The sample comprised medical specialists, residents, nurses and other healthcare professionals, with educational backgrounds ranging from middle school diplomas to PhDs. The majority held permanent contracts, with average weekly working hours of 37.9. Risk factors averaged between 2.5 (SD 1.8) and 3.3 (SD 0.7) and stress symptoms 2.1 (SD 1.0) (Table 2).

The mean score for stress symptoms at baseline was 2.00 and at follow-up, 2.17, *P*-value 0.50 (Table 3). Regarding help-seeking behavior, two participants did not seek help, but they intended to do so, four reported no intention or plans to seek help and four were unsure about taking any action. Nineteen HCWs (51%) reported that they are not at all worried about being sick-listed due to work-related stress, one was very worried, and one was

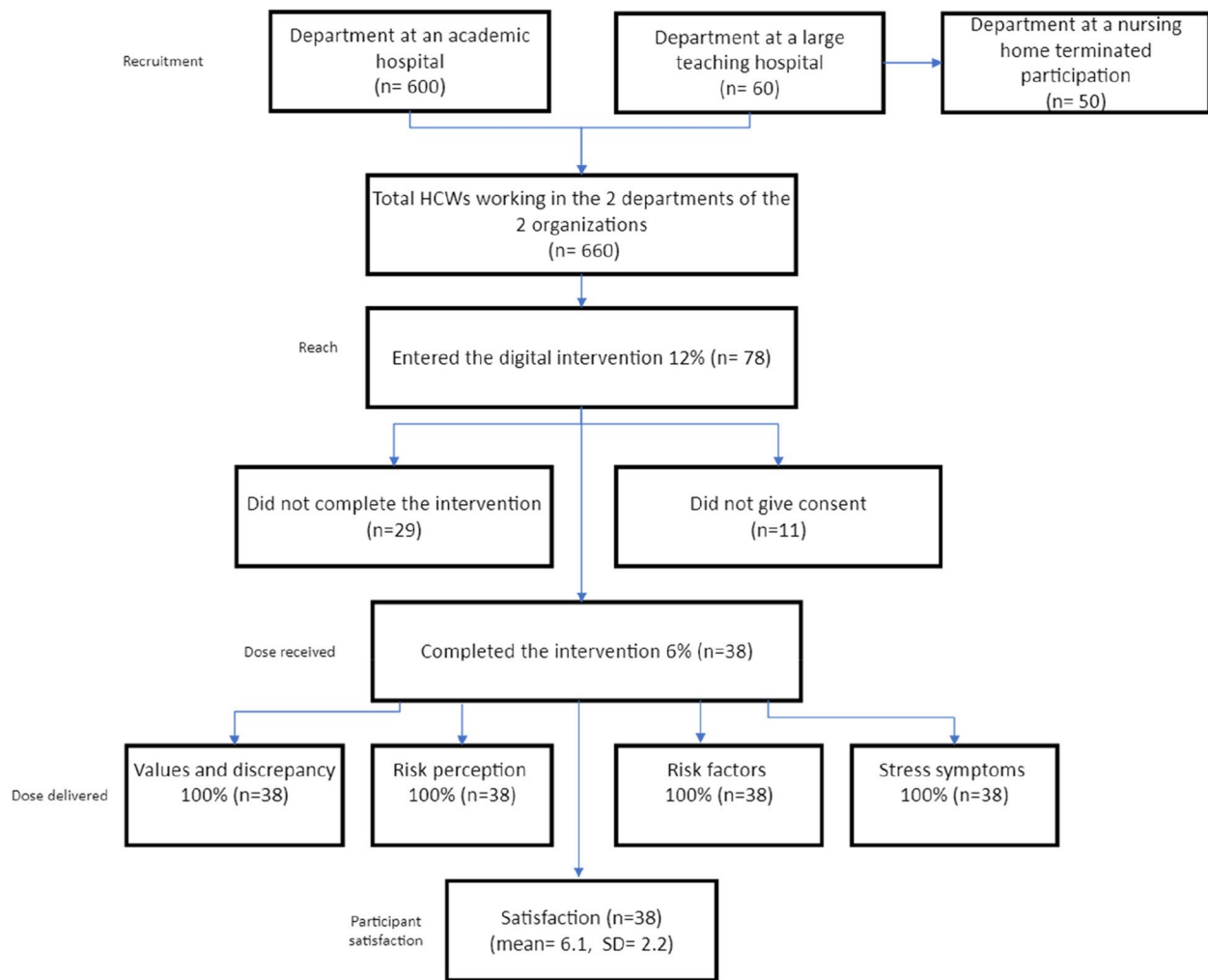


Fig. 1 Process map: process evaluation indicators recruitment, reach, dosage delivered and participation satisfaction

extremely worried. The most delivered risk communication was 3, 27 HCWs (10%). Risk communication 2 and risk communication 7 were delivered to 19 HCWs (7%) and 22 HCWs (8%), respectively. Risk communications 5 and 6 were not delivered to any HCWs (Table 4).

In Table 5, the results regarding values and behavior are described. HCWs rated the importance of mental health on average with an 8.8 (SD=0.8) and their behavior to maintain their mental health 6.5 (SD=1.8) of which 64% ($n=21$) actually indicated a discrepancy. Of these 21 HCWs, 67% ($n=14$) accepted the discrepancy and 33% ($n=7$) did not. All seven HCW who did not accept the discrepancy expressed the desire to dedicate more time and energy to it close this discrepancy (row 1, Table 5).

For work functioning, HCWs scored a mean score of 8.8 (SD=0.7), they rated their efforts to improve work functioning with a mean score of 7.4 (SD=1.7). Out of 38 HCWs, 11 (29%) were not asked about a discrepancy as their value and behavior scores matched. Of the remaining 27 HCWs, 6 (22%) answered yes to experiencing a

discrepancy between their values regarding work functioning and the amount of time, energy, and measures they devote to it and 21 (78%) stated no. All six HCWs (100%) accepted this discrepancy, therefore they did not receive the question about whether they wanted to dedicate more time and energy to their work functioning (row 2, Table 5).

The average score for functioning well in private life was 8.8 (SD=0.9), HCWs scored the time, effort and measures taken to maintain or improve their private life functioning at an average of 7.2 (SD=1.7). Among the HCWs, 18 (64%) identified a discrepancy between their values and the actual time, energy and measures they allocate to functioning well in private life. Of the 18 HCWs, 10 (56%) accepted the discrepancy, while eight (44%) did not. All of these eight HCWs (100%) indicated a wish to devote more time and energy to their private life functioning (row 3, Table 5).

Regarding work-life balance, HCWs rated its importance with a mean score of 8.6 (SD=1.1) and time, effort,

Table 2 Characteristics and demographic, stress symptoms and risk factors of HCWs participating in the intervention ($n=38$)

		n/(%)	Mean	SD	Min-max
Demographics HCWs	Age		42.2	9.7	26–63
	Women	17 (45)			
	Occupation	Medical specialist	19 (50)		
		Resident physician	2 (5)		
		Non resident physician	3 (8)		
		Physical therapist	1 (3)		
		Nurse	4 (11)		
		Other	9 (24)		
	Educational level	Secondary education with a diploma	3 (8)		
		Higher vocational education/technical university-level education	7 (19)		
		University Bachelor's degree	1 (3)		
		University Master's degree	13 (34)		
		PhD (Doctorate)	14 (37)		
	Employment contract	Permanent contract	23 (60)		
		Temporary contract	11 (29)		
		Independently physician in a partnership	4 (11)		
	Working hours		37.9	8.6	16–55
Stress symptoms ¹	Stress symptoms scale (1–5)		2.11	1.0	1.0–4.7
Risk factors ¹	Work demands scale (1–5)		2.9	0.5	2.0–4.3
	Work pace scale (1–5)		3.3	0.7	1.7–5.0
	Emotional job demands scale (1–5)		3.2	0.8	1.3–5.0
	Influence at work scale (1–5)		2.9	0.6	1.7–3.8
	Social support supervisor scale (1–5)		2.5	1.8	0.0–4.7
	Social support colleagues scale (1–5)		3.3	1.0	0.0–4.7
	Organizational injustice scale (1–5)		3.2	0.7	1.0–4.7
	Work-life balance scale (1–5)		2.7	0.9	1.0–4.7

¹A higher score on stress symptoms, work demands, work pace, emotional job demands, influence at work and work-life balance indicates an unfavorable situation. A higher score on organizational justice, social support from colleagues and supervisors indicates a favorable situation

Table 3 Paired T-Test analysis of stress symptoms: comparing baseline with six weeks post-intervention (T1)

	Baseline			Follow-up six weeks T1			P-value
	Mean	SD	n	Mean	SD	n	
Stress symptoms	2.00	1.1	10	2.17	0.77	10	0.50

Table 4 Descriptive statistics of HCWs' risk perception, help-seeking behavior and risk communication delivery

		n/%
Risk perception:	Not at all	51 (19)
	To what extent are	
	you worried about	
	getting sick listed due	
	to work-related stress	
symptoms?	Moderately	14 (5)
	Very	3 (1)
	Extremely	3 (1)
Help-seeking behavior	No but I intend to	11 (1)
	No and I do not intend to	44 (4)
	I am not sure if I will take action	44 (4)
Which risk communica-	Risk communication 1	16 (6)
	Risk communication 2	19 (7)
	Risk communication 3	27 (10)
	Risk communication 4	11 (4)
	Risk communication 5	0 (0)
	Risk communication 6	0 (0)
	Risk communication 7	22 (8)
	Risk communication 8	5 (2)

and measures taken to maintain it with a mean score of 6.3 (SD = 1.9). Nineteen HCWs (59%) reported experiencing a discrepancy between their values and the time, energy, and measures devoted to work-life balance. Those reporting a discrepancy ($n=19$) were asked if they accepted this discrepancy. Six HCWs (32%) accepted the discrepancy, while 13 (68%) did not. All 13 HCWs who did not accept the discrepancy (100%) expressed a desire to dedicate more time and energy to it (row 4, Table 5).

Discussion

Main findings and interpretation

The objective of this pilot study was to evaluate a risk communication intervention designed to enhance help-seeking behavior and reduce stress symptoms among HCWs. We found that the intervention contributes to the intention to change behavior which aligns with the DVM theory. Notably, work functioning was the domain with the least reported discrepancy between its importance

Table 5 Discrepancy between values and behavior in HCWs and motivation to take action

	Mean/ SD (n)	Min- max	Mean/ SD (n)	Min- max	Yes n (%)	No n (%)	Total n	Yes n (%)	No n (%)	Total n	Yes n (%)	No n (%)	Total n				
1. Value: Importance of mental health	8.8/0.8 (38)	8–10	Behavior: Amount of time, energy and effort spent on mental health	6.5/1.8 (38)	2–10	Discrepancy between value and behavior	21 (64)	4 (12)	33	Accepting the discrepan- cy between time, energy, effort and importance of mental health	14 (67)	7 (33)	21	Not accepting but willing to dedicate more time and atten- tion on mental health	7 (100)	0	7
2. Value: Importance of work functioning	8.8/0.7 (38)	8–10	Behavior: Amount of time, energy and effort spent on work functioning	7.4/1.7 (38)	2–10	Discrepancy between value on work functioning and behavior	6 (22)	21 (78)	27	Accepting the discrepan- cy between time, energy effort and importance on work functioning	6 (100)	0	6	Not accepting but willing to dedicate more time and at- tention on their work functioning	*NA	*NA	*NA
3. Value: Importance of functioning well in private life	8.8/0.9 (38)	7–10	Behavior: Amount of time, energy and effort spent on functioning well in private life	7.2/1.7 (38)	2–10	Discrepancy between value functioning well in private life and behavior	18 (64)	10 (36)	28	Accepting the discrepan- cy between time, energy, effort and importance on functioning well in private life	10 (56)	8 (44)	18	Not accepting but willing to dedicate more time and atten- tion on functioning well in private life	8 (100)	0	8
4. Value: Importance of work-life balance	8.6/1.1 (38)	4–10	Behavior: Amount of time, energy and effort spent on work-life balance	6.3/1.9 (38)	1–9	Discrepancy between value work-life balance and behavior	19 (60)	13 (40)	32	Accepting the discrep- ancy between time, effort and importance on work- life balance	6 (32)	13 (34)	19	Not accepting but willing to dedicate more time and at- tention on work-life balance	12 (100)	0	13

and the time and effort spent on it, while the greatest discrepancy was observed in mental health and work-life balance.

In our study we observed that the DVM approach initiates intention to change behavior but does not lead to reducing stress symptoms or enhancing help-seeking behavior. HCWs who experienced a discrepancy between one of the value domains and the time and effort they devote on it, and who did not accept this discrepancy, were willing to take action to close the gap between their values and behavior. These results are aligned with other studies that have demonstrated that the DVM increases intentions to change behavior [24, 25]. However, the DVM alone may not be sufficient to induce behavioral change. Integrating it into comprehensive preventive occupational interventions, such as workers' health surveillance programs, holds promise as it can serve as an initial step toward behavior change, such as help-seeking.

The results concerning work functioning are notable; HCWs reported most discrepancies in the domain of mental health and work-life balance and least in the domain of work functioning. This might suggest that HCWs are more likely to put effort and energy into their work functioning rather than their mental health and work-life balance. This finding aligns with a study showing that work functioning is a value that is considered important for HCWs, even more so than their mental health [34]. Consequently, HCWs may deprioritize or ignore seeking help for their mental health, potentially exacerbating work-related stress [35]. According to risk communication studies and the DVM, values that are important are more likely to lead to behavioral changes, such as taking action to protect one's health [25, 36]. Therefore, future interventions may need to focus more on work functioning, as it is a significant value for HCW.

Another finding regarding the intervention are the types of feedback on risk communication. None of the HCWs received risk communication five or six. Thus, all of the HCWs who reported a discrepancy between the value domains and their behavior and did not accept this discrepancy were willing to address it. This suggests that recognizing and *not* accepting such a discrepancy is sufficient to motivate action. This highlights the potential of the DVM by raising awareness about the discrepancy between important values and misaligned behavior—and confronting individuals with this discrepancy—can motivate people to take action to close the gap and thus drive behavior change [25].

The low and selected reach of HCWs combined with the short intervention duration may explain the absence of a reduction in stress symptoms and help-seeking behavior. The reach was limited to 12% and participating HCWs reported and perceived low risk factors and stress symptoms. These results suggest that HCWs at higher

risk for work-related stress may not have felt specifically targeted or considered participation necessary, potentially leading to biased outcomes. Thus, the intervention may be less suitable for HCWs experiencing high levels of stress, as it requires cognitive engagement to reflect on their values and behaviors—an approach that can be challenging when someone is under severe stress. This highlights the importance of designing interventions that are not only inclusive and far-reaching but also tailored to address the specific needs of those most at risk [37].

Strengths and limitations

This study has several strengths. The intervention is noteworthy for its comprehensive approach, aligning with risk communication literature by addressing the causes, consequences and preventive measures of work-related stress. Moreover, it incorporates the values of HCWs, an element often overlooked in other preventive interventions in HCWs [9]. To our knowledge, this is the first study to explore the combination of risk communication and the DVM in an intervention targeting HCWs. The process evaluation also suggests that all intervention components could be successfully delivered, indicating technical feasibility.

However, the study does have several limitations. Participant satisfaction varied and HCWs reported different reasons for their levels of satisfaction. For example, one HCW mentioned that the intervention did not contribute to new learnings, while another HCW mentioned that the intervention was useful to gain insight into their stress levels. This disparity may indicate that the intervention did not uniformly address all HCWs' needs, potentially affecting the intervention's acceptability. Another limitation is that the intervention solely focused on preventive measures offered by employers. This approach does not account for whether these measures align with HCWs' actual needs. However, we did provide various preventive measures at both the individual and organizational levels, ensuring that HCWs were informed about them and had access to a comprehensive list of measures offered by their employer. Furthermore, the intervention primarily focuses on individual responsibility for stress management. While it includes elements aimed at modifying workplace factors, this may not fully address organizational or systemic contributors to work-related stress. As such, there is a risk also recognized in the broader literature on stress interventions that such approaches may (however unintentionally) shift the burden of managing stress onto the individual HCW, potentially reinforcing a form of victim-blaming if organizational factors remain unaddressed. Also, the cutoff values used to determine the allocation of risk communication were arbitrary, which could have affected participant satisfaction and therefore the outcome of the intervention.

Implication and future recommendation for science and practice

The study highlights the need for additional evaluation to further explore and refine the intervention and its implementation. Integrating the intervention into comprehensive workers' health surveillance programs could provide a potential to enhance help-seeking behavior and prevent work-related stress in HCWs. Additionally, rather than only communicating preventive measures, interventions could more proactively offer actionable support and incorporate organizational-level strategies to address systemic contributors to work-related stress. These approaches could not only complement but also counterbalance individual-level efforts, helping to avoid placing the responsibility for stress management solely on HCWs. Future interventions might benefit from being designed with this risk in mind, ensuring that both organizational and individual factors are addressed. Future interventions should place greater emphasis on the importance of stress on work functioning, by focusing on values directly related to job performance, there may be more improvements in specific health behaviors, such as seeking support, when needed. Furthermore, future research should aim to include a larger and more diverse sample of HCWs, extend the follow-up period to better capture long-term changes and implement strategies to improve response rates, such as enhanced engagement efforts or incentives. Furthermore, refining the cutoff points for risk communication and ensuring that intervention content is both relevant and well-received is important.

Conclusion

The risk communication intervention in this pilot study contributes to the intention to change behavior. HCWs who recognized a discrepancy between their values and behavior and did not accept this discrepancy were more prepared to take action. Intention to change behavior is the first step towards actual behavior change, therefore, the intervention seems promising and should be further evaluated and improved in preventing work-related stress in HCWs. However, likely due to intervention and implementation challenges, we did not observe changes in stress symptoms and help-seeking behavior.

Abbreviations

HCW(s)	Healthcare worker(s)
DVM	Disconnected values model
CONSORT	Consolidated standards of reporting trials
SD	Standard deviation
SPSS	Statistical package for the social sciences
COPSOQ	Copenhagen psychosocial questionnaire
RCT	Randomized controlled trial
PhD	Doctor of philosophy
ORCID	Open researcher and contributor ID
UMC	Universitair Medisch Centrum

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

Supplementary Material 3.

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Not applicable

Authors' contributions

The study conception and design was initiated by author's LME, SJT, SK, FGS, HvdM. Author LME collected the data, conducted the statistical analyses and wrote the first draft of the manuscript. The authors SJT, SK, AB, DRT, FGS, HvdM read, commented on and approved the final manuscript.

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Data availability

Upon reasonable request, the first author can provide the data to researchers.

Declarations

Ethics approval and consent to participate

The study protocol followed the principles of the Declaration of Helsinki (2013). The study did not require approval by the Medical Ethics Committee of the Academic Medical Centre (2023.0536), Amsterdam, The Netherlands, which issued formal exemption.

Consent for publication

All participants signed an informed consent form in which they were informed that their data would be used for scientific research and publication, and they provided consent for this.

Competing interests

The authors declare no competing interests.

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