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A Meta-Analysis on the Effectiveness of Stress Management Interventions for Nurses: Capturing 14 Years of Research

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Nurses are considered to have one of the most demanding professions and are at risk of developing stress-related outcomes. As a result, many stress management interventions (SMIs) have been published in the literature, but there is a lack of a systematic quantitative approach to assess their effectiveness. The present study uses meta-analytic techniques to evaluate their overall effectiveness and potential moderators related to greater intervention success. Databases were searched for articles published between 2007 and 2020, measuring stress-related outcomes before and after the SMI and including a control group. Based on 85 publications (83 SMIs), a combined medium effect (Hedges' $g = 0.42$) was found. Person-directed interventions yielded larger effects than organization-directed or multilevel interventions, but this could only be concluded regarding their short-term effectiveness. For person-directed interventions, higher exposure and a homogeneous sample of nurses were related to greater effectiveness, whereas the type (cognitive behavioral, relaxation, work skills, or a mix), the length of the intervention, target group (primary or secondary), and type of control group used were not. In addition, person-directed interventions were more effective on current stress levels (e.g., work-related stress) than on outcomes indicating strain (e.g., burnout). As all organization-directed interventions used a participatory approach, this process variable could not be examined as potential moderator. To conclude, SMIs can effectively prevent and reduce stress-related outcomes in nurses. To further evaluate factors contributing to their effectiveness, more detailed reporting in publications is necessary. Furthermore, especially for person-directed interventions, long-term measurements are needed to determine the longevity of their effects.

Keywords: nurse, health care professional, burnout, stress management intervention, meta-analysis

Supplemental materials: https://doi.org/10.1037/str0000169.supp

Background

It is well known that nursing is a stressful profession. Nurses are exposed to a wide range of work-related stressors including heavy workload, rotating schedules and night work, confrontation with loss, grief, and suffering in patients, and aggression/conflict situations with patients and/or their accompanies (Liu et al., 2019; McVicar, 2016). In addition, they often have limited resources to deal with these demands, including limited decision authority and staffing shortages (McVicar, 2016). High stress levels in nurses can have serious consequences. First of all, it has been related to a range of mental health problems and physical complaints (Roberts & Grubb, 2014). Not surprisingly, stress-related outcomes are highly prevalent in this occupational group, with one out of three nurses reporting symptoms of burnout (Monsalve-Reyes et al., 2018). Furthermore, high workload can cause nurses to miss important changes in their patient (McHugh et al., 2011), leading to a rise of 7% in mortality rates with every patient added per nurse (Aiken et al., 2002). Finally, high stress levels in nurses are related to decreased job satisfaction, more absenteeism, and higher turnover intentions (Roberts & Grubb, 2014). Scholars predict that stress levels in nurses will only rise in the future as the number of patients increases with the aging population and less people are choosing for the nursing profession (Aiken et al., 2002; McVicar, 2016). As such, effective interventions to reduce stress in nurses are imperative.

Stress Management Interventions

According to the transactional model of stress, stress arises in the judgment that environmental demands exceed individual psychological or physical resources (Lazarus, 1995). This judgment is based on two consecutive processes. During the primary appraisal process, meaning is given to the event as the person judges the

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This meta-analysis provides an up-to-date overview on the effectiveness of stress management interventions for nurses, extending previous reviews by using meta-analytic techniques and by examining potential moderators of effectiveness. Results show that these interventions successfully reduce and/or prevent stress-related outcomes in nurses. However, better reporting is necessary to identify factors contributing to effectiveness and provide directions for intervention design.

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situation as harmful, threatening, or challenging. During the second appraisal process, available coping resources to deal with the event are evaluated. As such, the resulting stress response depends upon the interpretation of the event given by the person (primary appraisal) and his or her coping resources (secondary appraisal; Lazarus, 1995). Strong stress responses (e.g., due to a traumatic event) or enduring stress responses (e.g., due to continuous exposure to high job demands) can lead to a depletion of coping resources, deregulate the sympathetic nervous system, and eventually result in stress-related outcomes (e.g., anxiety, symptoms of burnout, depression, or posttraumatic stress; Heaney & van Ryn, 1990). To prevent and/or reduce the negative impact of work stress on employee well-being, many organizations have adopted stress management interventions (SMIs), which can be defined as "(. . .) any activity, or program, or opportunity initiated by an organization, which focuses on reducing the presence of work-related stressors or on assisting individuals to minimize the negative outcomes of exposure to these stressors" (Ivancevich et al., 1990, p. 252). In the literature, these interventions are commonly categorized into person-directed and organization-directed interventions.

Person-directed interventions aim to enhance employees' skills to manage, cope, and reduce stress (Holman et al., 2018). Two types of person-directed interventions that are extensively reported in the literature include interventions based on cognitive behavioral techniques and relaxation interventions. In line with the transactional model of stress, cognitive behavioral interventions focus on the interpretation of the stressor (primary appraisal process) as well as enhancing available coping resources (secondary appraisal process) and thereby aim to prevent and/or reduce a stress response. Within these interventions, maladaptive thoughts are challenged and changed into more helpful ones and/or problem-solving skills are learned (Beck & Dozois, 2011).

Relaxation interventions, including both mental (e.g., meditation) and physical relaxation techniques (e.g., progressive muscle relaxation), aim to prevent stress reactions to endure and become pathological by using breathing exercises, autogenic training, or progressive muscle relaxation. In addition, practicing relaxation on a regular basis can increase available coping resources (secondary appraisals) to deal with potentially threatening events. The effectiveness of these interventions is generally based on the assumption that stress and relaxation are opposite poles on the same continuum, which implies that relaxation equals less stress (Holman et al., 2018).

A second type of SMIs focusses on the working environment and has been labeled as organization-directed interventions (Ivancevich et al., 1990). Most organization-directed interventions are based on the Job Demands–Resources Model which postulates that work stress mainly occurs in poorly designed working environments referring to a combination of high job demands (e.g., work time demands, emotional demands) and limited job resources (e.g., social support, autonomy, and feedback; Bakker & Demerouti, 2017). Examples of organization-directed interventions include the implementation of rostering fitting to the circadian rhythm of employees, optimizing workflow, and changes in leadership style (e.g., from transactional to transformational leadership). An important difference between person-directed and organization-directed interventions is that the first focuses on preventing and/or reducing the stress response, whereas the latter addresses the contextual causes of stress by reducing job demands and/or enhancing job resources. As such, organization-directed interventions often work preventative.

Finally, multilevel interventions intervene at both the organizational and the individual level. The advantage of a multilevel approach is that it can reduce the causes of stress as well as help those employees that are at risk of or already experiencing stress-related outcomes (Holman et al., 2018). Not surprisingly, the implementation of multilevel interventions is often advocated by scholars in the field (Lamontagne et al., 2007; McVicar, 2016; Murphy, 1996; Semmer, 2006).

Stress Management Interventions for Nurses

Concerns over stress levels and their consequences have made nurses a popular target group for SMIs. In the past, multiple (systematic) reviews have summarized the effectiveness of these interventions (Henry, 2014; Mimura & Griffiths, 2003; Westermann et al., 2014). The first documented review on SMIs for nurses was performed by Mimura and Griffiths in 2003 and included seven randomized controlled and three quasi-experimental studies. Overall, positive effects were reported of SMIs on stress-related outcomes. However, due to the limited amount and low quality of the included studies, no conclusions could be drawn concerning what approach (e.g., implementing a person-directed or organization-directed intervention) would be most effective. Reviews after Mimura and Griffiths (2003) focused on a specific group of nurses (e.g., mental health nurses, Edwards & Burnard, 2003; oncology nurses, Henry, 2014; Wentzel & Brysiewicz, 2017; and nurses working in the inpatient elderly and geriatric long-term care, Westermann et al., 2014) and on specific stress-related outcomes (burnout or compassion fatigue). Although the focus on a specific group of nurses has several benefits (e.g., taking into account the various settings in which nurses work), it often leads to a small amount of studies to be included. Since studies are likely to differ in terms of the type of intervention implemented and how the effect is measured, this makes it difficult to reach conclusions regarding effective elements or assess the generalizability of the overall results (Richardson & Rothstein, 2008). Furthermore, although burnout and compassion fatigue are highly prevalent among nurses and insight in SMIs to prevent and reduce these outcomes is warranted, the focus on a limited number of stress-related outcomes does not capture the full potential of SMIs in this setting. For example, some interventions might not be very effective in reducing burnout levels but are able to reduce milder stress symptoms such as psychological distress. Finally, none of these reviews used meta-analytic techniques to quantify the effectiveness of SMIs and thus provide little insight regarding *how* effective these interventions are.

As a result, most insight in the effectiveness of SMIs comes from a meta-analysis by Ruotsalainen et al. (2015), which focused on health care professionals in general but included a number of studies conducted in the nursing population. Based on 58 publications, published up to and including 2013, they found moderate effects of person-directed interventions on the reduction of stress levels and limited evidence for the effectiveness of organization-directed interventions. Given the rise in popularity of SMIs for the nursing population, and the changing health care sector, an up-to-date overview including more recent studies is warranted.

The Present Study

The current meta-analysis focusses on the following research question: How effective are SMIs in reducing and/or preventing stress-related outcomes in the nursing population and what factors relate to greater effectiveness? It aims to provide an update to previous (systematic) reviews and a better understanding regarding the effectiveness of SMIs for the nursing population by including a wide range of SMIs and stress-related outcomes, using a meta-analytic approach and assessing the potential moderating effects of intervention characteristics and the process by which these are implemented (i.e., a participatory approach). In addition, potential biasing effects regarding the study design and quality will be evaluated. To be able to compare interventions adequately, we aim for a homogeneous population, including studies with a sample of at least 50% registered nurses working in a hospital setting.

Level of the Intervention

As mentioned, the meta-analysis of Ruotsalainen et al. (2015) found more evidence for the effectiveness of person-directed interventions than of organization-directed interventions on stress-related outcomes. The effectiveness of a multilevel approach was however not assessed. Person-directed interventions can be very effective in relieving stress-related outcomes, but if a highly demanding working environment is not improved, these effects are likely to be of short or medium term only (van Wyk & Pillay-Van Wyk, 2010). In contrast, a solely organization-directed approach works mainly preventative and is unlikely to be sufficient to ameliorate outcomes in nurses experiencing severe stress-related symptoms. This might also explain the limited effects found for these interventions in the meta-analysis of Ruotsalainen et al. (2015). In line with the recommendations of McVicar (2016), we expect that an approach focused on improving the working environment as well as individual coping is most effective in reducing and preventing stress-related outcomes in the nursing population. The following hypothesis will be tested:

> *Hypothesis 1:* Multilevel interventions are more effective in preventing and reducing stress-related outcomes in the nursing population compared to an intervention solely on the organizational level or the individual level.

Identifying Moderating Factors

Since person-directed and organization-directed interventions are based on different theories and thus different mechanisms are at play, we aim to identify moderating factors for each of these types of interventions separately. For person-directed interventions, we will first assess the effect of the *type of intervention* (e.g., cognitive behavioral vs. relaxation). Since cognitive behavioral interventions intervene on primary as well as secondary appraisals, their effectiveness is expected to be greater than, for example, relaxation interventions which focus on reducing the stress reaction but do not change the interpretation of the event. In line with this, previous meta-analyses regarding SMIs for the working population in general consistently find higher effects for cognitive behavioral interventions compared to other person-directed interventions (Richardson & Rothstein, 2008; van der Klink et al., 2001). Furthermore, one of the elements that makes nursing a stressful profession is the exposure to high emotional demands, such as suffering in patients, grief, and death. According to research on loss and grief, these kind of stressors can change a persons' fundamental idea of the world being a safe place in which they have some control over their own faith (Beder, 2016). Inability to reappraise these events in a more bearable way can lead to feelings of helplessness and depression (Beder, 2016). As such, cognitive behavioral interventions might be particularly beneficial to nurses.

Second, we will examine the influence of *the length of the intervention* and *exposure* to the sessions (i.e., attending the majority of the planned sessions). Although positive effects have been found for brief SMIs (e.g., Gilmartin et al., 2017), there is a lack of studies comparing their effectiveness to those with a longer intervention time period. Person-directed interventions include learning new skills and as such require changes in thought patterns and/or behavior. For these changes to occur and be integrated in daily working life, repetition and practice is necessary (Lally & Gardner, 2013). As such, it is possible that longer interventions are more effective than shorter interventions and that studies in which participants attended more sessions (i.e., have greater *exposure to the intervention*) will reach greater effects in comparison to those with lower attendance.

Finally, the *target group* of the intervention could be a potential moderator in the effectiveness of person-directed interventions. Secondary interventions (aimed at nurses already experiencing high stress-related symptoms) are likely to reach greater effect sizes compared to primary interventions (aimed to prevent stress and stress-related outcomes), simply as there is more to gain in terms of stress reduction.

For organization-directed interventions, it has been argued that the process through which the intervention is designed and implemented is a crucial factor determining its effectiveness (Nielsen & Noblet, 2018; Nielsen & Randall, 2013). In this meta-analysis, we will examine the *participatory approach*, the involvement of employees in the design and/or implementation of the intervention, as a potential moderating factor. As described by Nielsen et al. (2013) a participatory approach is one of the most important process-related factors and may contribute to the success of organization-directed interventions due to four reasons: (a) It can optimize the fit of the intervention to the organizations' culture and context by making use of employees' expertise and knowledge. (b) It can increase exposure of employees to the intervention and create employee commitment and ownership. (c) It can work as an intervention on its own by empowering employees to make changes to their working environment. (d) It can enhance a better understanding between managers and employees as they actively have to work together.

Study Design and Quality

Finally, we will assess potential biasing effects regarding the study design and quality. For person-directed interventions, we will assess the impact of the study sample and the type of control group used. This was done for the following reasons: *Study sample* (only nurses vs. a mixed sample of at least 50% registered nurses) will be assessed to ensure that the inclusion criteria regarding a sample did not influence the effects. The *type of control group* will be assessed since the reported effect of an intervention may be smaller when compared to a minimal intervention (e.g., education) than to standard care or a wait-list control group (Karlsson & Bergmark, 2015).

Furthermore, for all interventions (person-directed, organization-directed, and multilevel), we will assess the potential biasing effect of the study quality (including whether or not participants were randomly allocated to the intervention and control group).

Relevance of the Present Study

The current meta-analysis adds to the literature in multiple ways. First of all, it is the first meta-analysis focusing on the effectiveness of SMIs in nurses working in the hospital setting including the full range of person- and organization-directed interventions and examining a broad variety of stress-related outcomes. By studying potentially moderating factors (regarding intervention characteristics, the use of a participatory approach, and the study design and quality), it provides a more comprehensive insight in the effectiveness of SMIs for the nursing population compared to previous reviews (Henry, 2014; Mimura & Griffiths, 2003; Wentzel & Brysiewicz, 2017; Westermann et al., 2014). This insight will yield practical recommendations for the design and implementation of effective interventions. Second, in comparison to previous reviews (Henry, 2014; Mimura & Griffiths, 2003; Wentzel & Brysiewicz, 2017; Westermann et al., 2014), the present meta-analysis will not only indicate *whether* SMIs are effective but by quantifying the effects also indicate *how* effective SMIs are for the nursing population. Third, compared to the meta-analysis of Ruotsalainen et al. (2015) on health care professionals, the focus on a specific setting and specific population increases homogeneity of the studies and as such enables better comparison regarding the effectiveness of the interventions. Finally, this study answers to the plea of researchers to include process variables in evaluating the effectiveness of organization-directed interventions (Nielsen & Noblet, 2018; Nielsen & Randall, 2012; Semmer, 2006). Interventions that have great potential but receive far less attention in the literature and are often, perhaps unjustified, regarded as the least effective approach (e.g., Richardson & Rothstein, 2008; van der Klink et al., 2001).

Method

This meta-analysis is performed in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009).

Search Strategy

A search strategy was developed based on the technique described by van der Ploeg et al. (2017), by starting with a basic search strategy covering the most important subsets [TS = (nurse*) AND TS = (intervention) AND TS = (burnout)] and adding synonyms to each subset [e.g., TS = (nurse*) AND TS = (intervention) AND TS = (burnout OR "emotional exhaustion")]. The relevance of each synonym was assessed by subtracting the articles found with the old strategy from the articles found with the new strategy using the NOT function. Relevant search terms were kept in the search string and irrelevant search terms were disposed (see Supplemental Tables 1–3 for the final search strategy). Next, the databases PubMed, Web of Science, and PsycInfo were systematically searched for articles published between January 2007 up till and including December 2020. PubMed provides access to approximately 7,000 journals in the field of biomedical and life sciences. It includes records from PubMed Central, MEDLINE, and other National Library of Medicine resources (e.g., in process citations, citations to articles that are out-of-scope from certain MEDLINE journals, and the National Center for Biotechnology Information [NCBI] bookshelf) and is one of the most popular databases in the field (Ossom Williamson & Minter, 2019). Web of Science covers over 8,700 journals in the field of social sciences, health sciences, life sciences, technology, arts, and humanities (Falagas et al., 2008). Finally, the American Psychological Associations' PsycInfo was included as a more specialized database. PsycInfo covers 2,300 peer-reviewed journals and includes 5 million records (e.g., articles, book chapters, abstracts, dissertations) in the field of behavioral science and mental health (see http://www.apa.org/psycinfo). Although these databases overlap, they complement each other in terms of different disciplinary bases. Reference lists of all included studies and relevant reviews and meta-analyses in the field were screened for additional studies.

Eligibility Criteria

Studies were included based on the following inclusion criteria: (a) evaluating the effectiveness of an intervention to reduce and/or prevent stress in comparison to a control group, (b) including a pre- and a postmeasurement of an outcome representing stress-related outcomes (e.g., stress, burnout symptoms, anxiety, depression, or posttraumatic stress symptoms), (c) including a sample consisting of at least 50% registered nurses working in a hospital setting, (d) reporting statistics that can be calculated to effect sizes, and (e) written in English. No criteria about randomization were set, as for studies evaluating the effectiveness of an organization-directed intervention this is often not feasible.

Selection of Studies

Duplicates of studies found in PubMed, Web of Science, and PsycInfo were removed. Titles and abstracts were screened for eligibility. Two reviewers independently read the full texts of eligible articles to assess whether they met the inclusion criteria. Interventions that relied on ergonomics or physical processes rather than psychological processes were excluded. Examples of these studies are the use of zinc supplementation (Gholipour Baradari et al., 2018), aromatherapy (Chen et al., 2015), acupuncture (Kurebayashi & da Silva, 2015), and the use of special glasses during the nightshift (Boivin et al., 2012).

Data Extraction and Management

Two researchers independently coded the articles by means of a standard coding form. Disagreements were discussed until consensus was found. In case of no consensus, the second author of this article was consulted. For the calculation of the effect sizes, means and standard deviations of the experimental and control group(s) were obtained from the studies. Missing standard deviations were calculated based on the reported standard errors or confidence intervals. In case of any other missing data, authors were contacted via email. Since only a few authors replied to our request, it was chosen to calculate effect sizes for the remaining studies based on the data that were available. For four studies (Moody et al., 2013; Nooryan et al., 2012; Udo et al., 2013; Villani et al., 2013), we

calculated the effect size based on the available posttest data, which could be justified as intervention and control group did not differ on the outcome(s) under study at pretest. For another four studies (Fang & Li, 2015; Ketelaar et al., 2013; Koivu et al., 2012; Mealer et al., 2014), we used the percentage of the study population that scored above the cutoff for high stress levels before and after the intervention to calculate an effect size. This data is less refined as it includes the change from one group (high stress) to another (low stress) instead of the change in stress-related outcomes on a continuous scale. As a result, only three studies (Duchemin et al., 2015; Leão et al., 2017; Romig et al., 2012) needed to be excluded due to missing data.

Data Items

In line with other reviews on SMIs (Richardson & Rothstein, 2008; van der Klink et al., 2001), we first categorized interventions into person-directed, organization-directed, and multilevel interventions. Next, in line with Ruotsalainen et al. (2015), we further divided the person-directed interventions into two subcategories, the first focusing on cognitive behavioral techniques (changing the way one thinks/interprets stressors and consequently act) and the second focusing on mental and/or physical relaxation (e.g., mindfulness, progressive muscle relaxation). During the coding process, some studies did not fit any of the above-mentioned categories or fitted both categories. Therefore, two additional subgroups of person-directed interventions were created. The first included interventions that aim to improve work skills and/or focus on professional development (e.g., assertiveness training, communication training). This category was considered person-directed as it focusses on increasing personal resources to help cope better with the demands at work, while no changes were made to the working environment. The second category included programs in which different person-directed interventions were combined (e.g., combining a cognitive behavioral training and relaxation).

For person-directed studies, we coded the intervention length (number of weeks of the intervention program), exposure to the intervention (<80% of the sample attended all sessions vs. ≥80% of the sample attended all sessions), whether it was a primary (preventative) or secondary (aimed at nurses with high stress levels/stress complaints) intervention, the sample (only nurses vs. a mixed sample), and the control group used (minimal intervention, standard care, or wait-list control). For organization-directed interventions (both solely and when implemented in combination with a person-directed intervention), we coded the use of a participatory approach.

Solutions for Multiplicity

Studies with multiple experimental groups were treated as follows: When the experimental groups received interventions of the same category (e.g., two types of relaxation interventions), we averaged the effect sizes. When interventions of two different categories (e.g., a cognitive behavioral intervention and a relaxation intervention) were reported, we treated them as two independent intervention studies. In that case, the N of the control group was divided by the number of experimental groups (Higgins et al., 2011). In case of a cross-over design, only the results after the implementation of the intervention were used in comparison to the wait-list control.

Outcome measures that were studied belong to one of the following categories: burnout, psychological distress, depression, anxiety, work-related stress, fatigue, or symptoms of posttraumatic stress (including secondary traumatic stress). Studies focusing on occupational stressors (e.g., role ambiguity, job demands, lack of job control) rather than stress as an outcome were excluded. For studies reporting stress outcomes of the same category, the effect size of the most reliable instrument or the most comparable to other studies was included (e.g., anxiety measured on the Becks' Anxiety Inventory rather than measured on a visual scale, emotional exhaustion as opposed to the total burnout scale). When both state as well as trait anxiety was reported, only state anxiety was included as this indicates the intensity of anxiety symptoms during a specific period rather than one's general anxiety-proneness (Spielberger et al., 1971). For the main analysis, we averaged effect sizes of studies that reported outcomes in different categories (e.g., anxiety as well as burnout symptoms), to avoid double counting.

When the effectiveness was assessed on multiple time points, we used the first time point available (posttest). In addition, we reported the effect sizes for each stress outcome and time point measured (measured <1 week postintervention, 1 week to ≤1 month postintervention, >1 month to ≤6 months postintervention, or >6 months postintervention) to investigate whether this influenced the effectiveness. Studies that included multiple outcomes and/or measurements were represented more than once in this analysis.

Assessment of Risk of Bias in Included Studies

The Cochrane Risk of Bias tool was used to assess the amount of bias in each study (Higgins et al., 2011). RevMan was used to visualize the risk of bias in the included studies (Review Manager [RevMan], Version 5.3, 2014]. To examine the presence of potential publication bias, a funnel plot was made. Furthermore, Eggers' test of the intercept (Egger et al., 1997) and Duval and Tweedie's trim-and-fill analysis were conducted (Duval & Tweedie, 2000).

Analyses

We calculated the standardized mean difference (Hedges g) for each study including its 95% confidence level. A random-effects model was used to assess the overall effect of the included studies, as we did not expect studies to be functionally equivalent (Borenstein et al., 2009). The significance of the effect sizes was determined by the Q-test with a p value of below .05 considered a significant effect. The I^2 static was used as an indication of heterogeneity between the studies. In line with the meta-analysis of Ruotsalainen et al. (2015), we used an intra-cluster correlation of .10 for studies using a cluster-randomized design, when none was reported in the study.

Moderator analyses were performed for the intervention level (person-directed, organization-directed, or multilevel) and the quality of the studies (lower quality studies vs. higher quality studies, based on the risk of bias assessment). For person-directed interventions, moderator analyses regarding the type of intervention (cognitive behavioral, relaxation, work skills, or a mix of person-directed interventions), the length of the intervention, exposure to the intervention (<80% of the sample attended all sessions vs. ≥80% of the sample attended all sessions), the target group (primary vs. secondary interventions), the sample (only nurses vs. a mixed sample), and the control group used (minimal intervention, standard

care, wait-list control). For organization-directed interventions, we aimed to perform a moderator analysis on the use of a participatory approach.

All moderator analyses were done using mixed-model analyses in which the random-effects model was used to combine studies in one subgroup and a fixed-effects model was used to compare across subgroups (Borenstein et al., 2009). For the mixed-effects model, the study-to-study variance (tau-squared) was assumed to be the same for all subgroups. This value was computed within subgroups and then pooled across subgroups. All analyses were carried out using Comprehensive Meta-Analysis Software v.3 (Borenstein et al., 2013).

Results

Selection of Studies

A total of 12,987 unique references were retrieved from the search in the electronic databases. On the basis of title and abstract, 396 publications were selected for potential inclusion. In addition, 12 publications were identified based on screening of relevant reviews and reference lists of the included studies. After full-text examination, 85 publications fulfilled all eligibility criteria and were included in the current meta-analysis (see Figure 1).

Study Characteristics

An overview of all included publications can be found in Table 4 of the Supplemental Material. Most publications were from Asia (k = 42), followed by Europe (k = 22), North America (k = 19), Australia (k = 1), and one study was performed on multiple continents. More than half of the publications (k = 56, 65%) included a homogeneous sample of only registered nurses, the remainder included a mixed sample of at least 50% registered nurses. From the 85 publications found, three (Becker et al., 2020; Bourbonnais et al., 2011; Sampson et al., 2020) reported follow-up data of previously published studies (Becker et al., 2017; Bourbonnais et al., 2006; Sampson et al., 2019). To avoid double counting in assessing the effectiveness of the interventions, the data from these publications were combined. In addition, four publications reported studies including multiple experimental groups (Günüşen & Ustün, 2010; Onishi et al., 2016; Poulin et al., 2008; Sajadi et al., 2017). From these studies, one included two experimental groups of two different intervention categories and was therefore included as two separate interventions (Günüşen & Ustün, 2010). As a result, 83 interventions were included. Most comprised relaxation interventions (k = 35), followed by a mix of person-directed interventions (k = 17), cognitive behavioral interventions (k = 12), work skills interventions (k = 10), multilevel interventions (k = 5), and organization-directed interventions (k = 4).

Quality of the Included Studies

See Figures 1 and 2 in the Supplemental Material for a visualization of the risk of bias assessment. Out of the 83 included interventions, the effectiveness of 58 interventions was assessed by the use of a randomized controlled trial. As for organization-directed interventions, individual randomization is often not feasible, randomization on the department or hospital level was considered as "low bias" in the quality assessment. Most articles did not report any information on the allocation process apart from stating that it was performed randomly, leading to an unclear bias for a number of interventions on this criterion. Furthermore, some interventions were labeled "high bias" as employees were assigned to the intervention and control group based on employees' interest. Concerning selective reporting: Only 10 articles reported that the study was registered and the protocol was available online. For these articles, we checked whether all intended measurements and measurement time points were reported. If no protocol was available (or the reported registration number did not work), the intervention received the label "unclear bias" on selective reporting. For some of these articles, time points or outcomes mentioned in the Method section were not reported in the Results section and as such received the label "high bias" on selective reporting. Finally, blinding is almost impossible for the type of interventions that were assessed, and was therefore not included as quality assessment criterion.

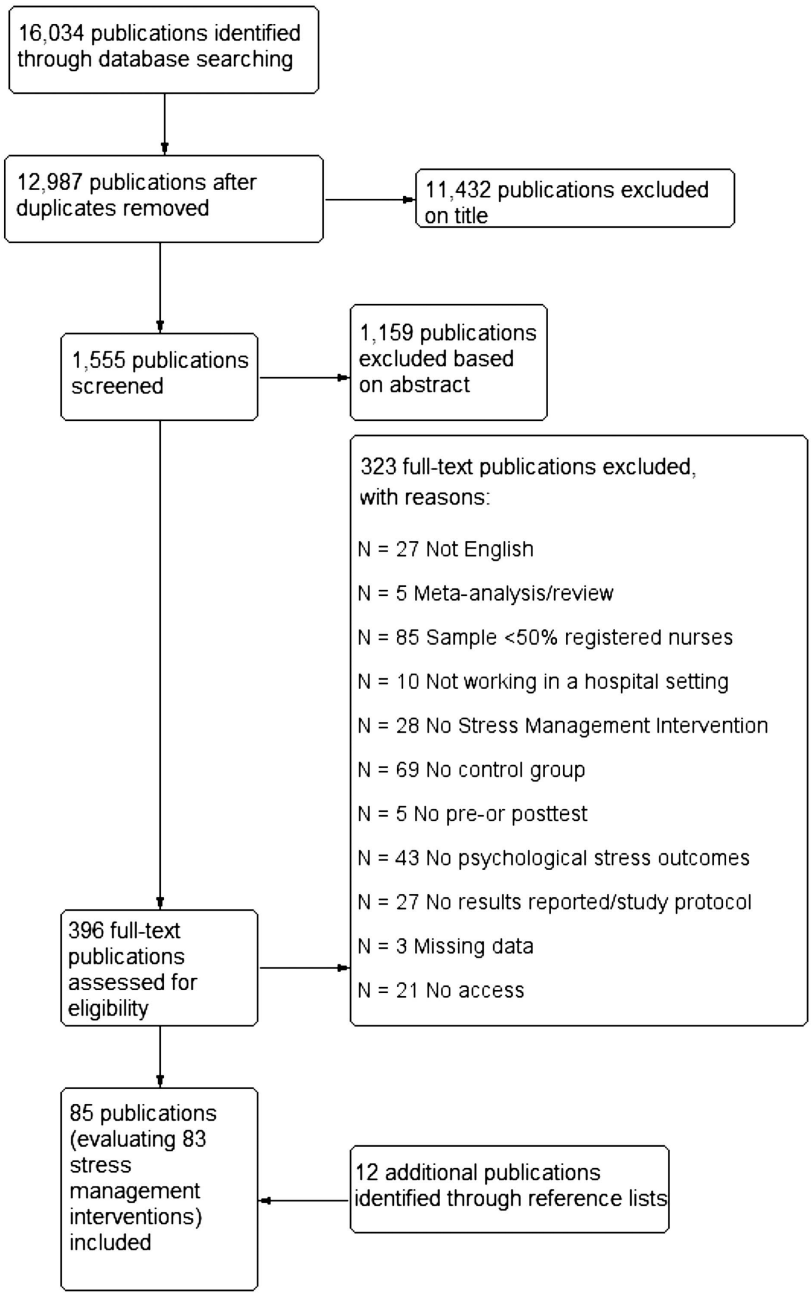
Overall, we found evidence that interventions of low quality (one or more domains at high risk or no domain at low risk) deflated the effect of SMIs. The moderator analysis indicated that interventions of low quality reported lower effect sizes, g = 0.33, 95% CI [0.23–0.43], k = 46, compared to interventions of moderate to high quality, g = 0.54, 95% CI [0.39–0.69], k = 37 (Q = 5.62, p = .018). When comparting the quality of the intervention per intervention level, we found no significant difference between person-directed interventions of low quality, g = 0.39, 95% CI [0.26–0.52], k = 38, compared to person-directed interventions of moderate to high quality, g = 0.55, 95% CI [0.40–0.71], k = 36 (Q = 2.46, p = .117). Similar, we found no difference between low-quality organization-directed interventions, g = 0.20, 95% CI [0.04–0.37], k = 4, versus the one publication of moderate to high quality, g = 0.31, 95% CI [−0.08 to 0.69], k = 1 (Q = 0.23, p = .635). All five multilevel interventions were coded low quality, which was mainly due to high dropout in these studies and/or a lack of randomization.

Intervention Effectiveness

The SMIs had an overall medium effect on stress outcomes in comparison to control, Hedges' g = 0.42, 95% CI [0.34–0.51], p < .001, k = 83 (Cohen, 1992). Most studies included a measurement directly after the intervention (k = 58) and/or between 1 and 6 months after the intervention (k = 30). Only seven studies included a measurement more than 6 months after the intervention. A calculation of the overall effect size based on the last point of measurement indicating long-term effectiveness led to a similar effect size, g = 0.42, 95% CI [0.33–0.50], p < .001.

Table 1 shows the overall effect sizes for each intervention level and time point of measurement. Organization-directed and multilevel interventions mainly focused on the outcomes burnout and psychological distress. Organization-directed interventions seemed little effective directly after the intervention, but (based on one study) a small significant effect was found in a follow-up measurement of more than 6 months after implementation. Multilevel interventions reached significant small effects on stress-related outcomes directly after the intervention, but insignificant effects more than 1 month after implementation. Person-directed interventions yielded large effect sizes on work-related stress (g = 0.89), followed by anxiety (g = 0.53) and smaller effect sizes for burnout symptoms, psychological distress, depression, fatigue, and symptoms of post-traumatic stress disorder (respectively, g = 0.30, g = 0.39, g = 0.31,

Figure 1
Flowchart of Study Inclusion and Exclusion



$g = 0.22$, $g = 0.26$). Moderate to large effect sizes were found up till 1 month after the intervention, which seemed to decrease after this and led to an insignificant effect in the few studies ($k = 6$) measuring the effect 6 months after the intervention. To gain better understanding regarding the long-term effectiveness of person-directed interventions, we performed the analysis again including only person-directed interventions reporting a follow-up effect ($k = 25$). This resulted in a post effect of $g = 0.38$, 95% CI [0.24–0.52], $p < .01$ ($k = 25$), a follow-up effect of $g = 0.38$, 95% CI [0.19–0.58], $p < .01$ ($k = 25$), and a second follow-up effect of $g = 0.35$, 95% CI [0.16–0.54], $p < .01$ ($k = 6$). Although this suggests that the effects of person-directed interventions remain stable over time, the time points of these follow-ups differed largely between studies (from within a month to over a year after the intervention), and thus this finding should be interpreted carefully. In addition, with only one out of three person-directed interventions reporting a follow-up measurement, it is also possible that this effect is the result of publication bias. Studies that already find positive effects on the posttest might be less likely to conduct follow-up measurements.

Table 1
Overall Analysis and Analysis Separately for Each Intervention Level, Each Outcome, and Time Point of Measurement

Effect size of	Overall ($k = 83$) Hedges g, 95% CI	Person-directed ($k = 74$) Hedges g, 95% CI	Organization-directed ($k = 4$) Hedges g, 95% CI	Multilevel ($k = 5$) Hedges g, 95% CI
Overall effect	0.42** [0.34–0.51]	0.47** [0.37–0.57]	0.12* [0.02–0.23]	0.22** [0.07–0.37]
Heterogeneity test	$Q = 269.21$**	$Q = 230.81$**	$Q = 5.10$	$Q = 0.94$
	$I^2 = 70\%$	$I^2 = 68\%$	$I^2 = 41\%$	$I^2 = 0\%$
Outcome[a]				
Burnout	0.27** [0.18–0.35] (39)	0.30** [0.19–0.41] (33)	0.14 [0.01–0.27] (3)	0.25** [0.07–0.43] (3)
Psych. distr.	0.34** [0.24–0.44] (32)	0.39** [0.27–0.49] (28)	0.15 [−0.01–0.31] (1)	0.12 [−0.14–0.37] (3)
Depression	0.29** [0.13–0.45] (25)	0.31** [0.14–0.47] (24)	0.03 [−0.19–0.25] (1)	N/A
Anxiety	0.53** [0.29–0.76] (24)	0.53** [0.29–0.76] (24)	N/A	N/A
Work rel. stress	0.85** [0.49–1.22] (15)	0.89** [0.50–1.29] (14)	N/A	0.42* [0.03–0.80] (1)
Fatigue	0.22** [0.06–0.38] (10)	0.22** [0.06–0.38] (10)	N/A	N/A
PTSD symptoms	0.26* [0.01–0.53] (6)	0.26* [0.01–0.52] (6)	N/A	N/A
Time point of measurement[a]				
<1 week after intervention	0.40** [0.31–0.51] (58)	0.46** [0.35–0.56] (51)	0.09 [−0.06–0.24] (3)	0.20* [0.04–0.36] (4)
1 week to ≤1 month	0.75** [0.50–1.00] (12)	0.75** [0.50–1.00] (12)	N/A	N/A
>1 to ≤6 months	0.35** [0.20–0.50] (30)	0.37** [0.20–0.53] (28)	N/A	0.16 [0.06–0.38] (2)
>6 months	0.22* [0.03–0.40] (7)	0.23 [−0.05–0.51] (6)	0.18** [0.06–0.29] (1)	N/A

Note. CI = confidence interval; N/A = not applicable; Psych. distr. = psychological distress; Work rel. stress = work-related stress; PTSD symptoms = symptoms of posttraumatic stress disorder. Number of studies between parentheses.
[a] Studies included multiple times.
* $p < .05$. ** $p < .01$.

Moderator Analyses

Level of the Intervention

Based on the first time point of measurement, person-directed interventions had an overall medium effect on stress outcomes, $g = 0.47$, 95% CI [0.37–0.57], $p < .001$, whereas organization-directed and multilevel interventions reached small effects, respectively, $g = 0.12$, 95% CI [0.02–0.23], $p = .025$, and $g = 0.22$, 95% CI [0.07–0.37], $p < .01$. Moderator analysis showed that person-directed interventions were significantly more effective than organization-directed and multilevel interventions on stress-related outcomes ($Q = 23.1$, $p < .001$).

Moderators for Person-Directed Interventions

Within the group of person-directed studies ($k = 75$), we found no significant difference between the type of intervention (cognitive behavioral, relaxation, work skills, mix of person-directed interventions; $Q = 3.15$, $p = .370$). Similarly, we found no evidence for a moderation effect of the length of the intervention, the target group (primary or secondary intervention), or the type of control group used (see Table 2). However, interventions in which the sample was exposed to the majority of the planned sessions reached greater effect sizes compared to interventions in which the exposure to the intervention/attendance to the planned sessions was lower ($Q = 7.50$, $p = .006$). In addition, interventions implemented in a sample of solely registered nurses reached greater effect sizes compared to interventions conducted in a mixed sample of at least 50% registered nurses ($Q = 5.57$, $p = .018$). The latter was mainly the case for cognitive behavioral interventions and work skills interventions, which showed significant effect sizes for studies conducted in a sample of registered nurses and nonsignificant effect sizes for studies conducted in a mixed sample.

The I^2 suggested moderate to substantial heterogeneity in all subgroups [cognitive behavioral interventions (I2 = 86%), relaxation interventions (I2 = 53%), the group of work skills interventions (I2 = 50%), and the group including a mix of person-directed interventions (I2 = 71%)]. To provide further insight, it was decided to repeat the moderator analyses for each type of person-directed intervention (see Table 2). This resulted in one significant effect. The exposure to the intervention was a significant moderator in *relaxation interventions*: Interventions in which participants attended 80% or more of the scheduled sessions were more effective than interventions where participants attended less than 80% of the scheduled sessions ($Q = 5.43$, $p = .02$). Overall, there was a lot of missing data leading to a small amount of studies per subgroup, therefore, the results regarding the moderation analyses per type of intervention should be interpreted with caution.

Moderators for Organization-Directed Interventions

There was moderate heterogeneity in the group of organization-directed interventions ($I^2 = 41\%$), whereas the group of multilevel interventions suggested an absence of heterogeneity ($I^2 = 0\%$) and therefore an absence of moderators. However, the I^2 can be biased and should be interpreted with care, especially in small meta-analyses (e.g., less than seven studies; von Hippel, 2015). In addition, based on the small number of interventions, it was decided to use a descriptive method rather than a moderation analysis to provide further insight in the effect of a participative approach. A closer look revealed that all organization-directed interventions (whether or not part of a multilevel approach) included their employees in the design and/or implementation of the intervention. Three studies were based on participative action research in which employees were empowered to find potential (psychosocial) stressors in the current working situation and develop and initiate solutions for these (Bourbonnais et al., 2011; Le Blanc et al., 2007; Uchiyama et al., 2013). One study included an intervention

Table 2
Moderators of Intervention Effectiveness of Person-Directed Interventions

Effect size of	All PD interventions ($k = 74$) Hedges g, 95% CI	Cognitive behavioral ($k = 12$) Hedges g, 95% CI	Relaxation ($k = 35$) Hedges g, 95% CI	Work skills ($k = 10$) Hedges g, 95% CI	Mix of PD interventions ($k = 17$) Hedges g, 95% CI
Overall effect	0.47** [0.37–0.57]	0.51** [0.15–0.86]	0.49** [0.37–0.61]	0.27* [0.04–0.50]	0.52** [0.31–0.73]
Heterogeneity test	$Q = 230.81$, $p < .01$ $I^2 = 68\%$	$Q = 80.8$, $p < .01$ $I^2 = 86\%$	$Q = 71.9$, $p < .01$ $I^2 = 53\%$	$Q = 17.82$, $p = .02$ $I^2 = 50\%$	$Q = 54.9$, $p < .01$ $I^2 = 71\%$
Length of intervention					
≤1 week	0.40** [0.18–0.62] (8)	N/A	0.53** [0.16–0.89] (5)	0.25 [−0.02–0.51] (3)	N/A
2–4 weeks	0.48** [0.24–0.71] (11)	0.33 [−0.05–0.72] (2)	0.51** [0.28–0.73] (5)	0.06 [−0.34–0.46] (1)	0.70 [−0.08–1.49] (3)
5–8 weeks	0.49** [0.32–0.66] (31)	0.42 [−0.10–0.94] (6)	0.53** [0.30–0.75] (16)	0.12 [−0.36–0.60] (1)	0.54** [0.30–0.78] (8)
9–12 weeks	0.44** [0.17–0.70] (9)	N/A	0.34* [0.02–0.67] (2)	0.25 [−0.24–0.75] (3)	0.84** [0.48–0.70] (3)
>12 weeks	0.62** [0.21–1.03] (9)	1.16 [−0.82–3.13] (2)	0.56* [0.12–1.00] (4)	0.39 [−0.85–1.62] (2)	0.14 [−0.23–0.52] (1)
Q for difference	$Q = .99$, $p = .910$	$Q = 0.99$, $p = .800$	$Q = 1.07$, $p = .900$	$Q = 0.85$, $p = .930$	$Q = 7.05$, $p = .070$
Not reported	0.20** [0.06–0.34] (6)	0.40* [0.17–0.63] (2)	0.29 [−0.01–0.58] (3)	N/A	0.12 [−0.05–0.29] (2)
Exposure to intervention					
High (≥80% sessions attended)	0.39** [0.27–0.52] (24)	0.47 [−0.01–0.95] (1)	0.46** [0.34–0.59] (14)	0.22 [−0.02–0.46] (4)	0.38 [−0.10–0.85] (5)
Low (<80% sessions attended)	0.15** [0.04–0.27] (12)	0.23 [−0.04–0.51] (4)	0.19 [−0.01–0.38] (5)	0.06 [−0.34–0.46] (1)	0.17 [−0.32–0.66] (2)
Q for difference	**$Q = 7.50$, $p = .006$**	$Q = 0.74$, $p = .390$	**$Q = 5.43$, $p = .020$**	$Q = 0.780$, $p = .677$	$Q = 0.349$, $p = .555$
Not reported	0.61** [0.44–0.77] (38)	0.65 [−0.03–1.33] (7)	0.635** [0.40–0.87] (16)	0.33 [−0.17–0.83] (5)	0.631** [0.42–0.84] (10)
Target group					
Primary interventions	0.44 [0.33–0.55] (59)	0.61* [0.13–1.09] (9)	0.44** [0.32–0.55] (28)	0.29*[0.03–0.55] (9)	0.45** [0.22–0.68] (13)
Secondary interventions	0.60 [0.33–0.86] (15)	0.07 [−0.12–0.26] (3)	0.76** [0.33–1.18] (7)	0.12 [−0.36–0.60] (1)	0.77** [0.36–0.72] (4)
Q for difference	$Q = 1.18$, $p = .277$	$Q = 1.60$, $p = .110$	$Q = 2.07$, $p = .150$	$Q = 0.38$, $p = .539$	$Q = 1.83$, $p = .175$
Sample					
Sample 100% RN	0.54** [0.41–0.68] (51)	0.69* [0.04–1.34] (7)	0.55** [0.39–0.71] (23)	0.36** [0.09–0.63] (7)	0.55** [0.30–0.80] (14)
Mixed sample >50% RN	0.32** [0.19–0.45] (23)	0.24 [−0.01–0.48] (5)	0.39** [0.20–0.57] (12)	0.02 [−0.38–0.42] (3)	0.40* [0.02–0.78] (3)
Q for difference	**$Q = 5.57$, $p = .018$**	$Q = 1.65$, $p = .200$	$Q = 1.70$, $p = .190$	$Q = 1.90$, $p = .170$	$Q = 0.425$, $p = .514$
Control group					
Minimal intervention	0.50** [0.34–0.66] (22)	0.61 [−0.18–1.39] (4)	0.45** [0.30–0.61] (11)	0.60 [0.04–1.15] (3)	0.46** [0.18–0.74] (4)
Standard care	0.49** [0.32–0.66] (36)	0.59 [−0.11–1.28] (5)	0.53** [0.28–0.79] (15)	0.14 [−0.07–0.35] (6)	0.62** [0.27–0.97] (10)
Wait-list control	0.28** [0.13–0.44] (12)	0.02 [−0.18–0.23] (1)	0.41** [0.23–0.60] (8)	0.19 [−0.24–0.62] (1)	0.19 [−0.12–0.50] (2)
Q for difference	$Q = 4.64$, $p = .099$	$Q = 4.067$, $p = .131$	$Q = 0.597$, $p = .740$	$Q = 2.24$, $p = .326$	$Q = 3.41$, $p = .182$
Not reported	0.54** [0.29–0.78] (4)	0.47* [0.09–0.85] (2)	0.60** [0.20–1.00] (1)	N/A	0.55 [−0.02–1.13] (1)

Note. PD = person-directed; N/A = not applicable; RN = registered nurses. Number of interventions between parentheses. p-values in bold are significant at the $p < .05$ level.
* $p < .05$. ** $p < .01$.

based upon lean principles (e.g., a process in which the workflow is optimized to reduce waste of resources). This was implemented during a transformational process from a hierarchical hospital setting to one including a participative management style in which decisions were made in consultation with the employees (Van Bogaert et al., 2014). Two other studies included job crafting which is by content an intervention in which the employee is empowered to make changes in his or her work and/or working environment (Gordon et al., 2018; Müller et al., 2016). One study included a web-based intervention in which employees were particularly involved during the developmental phase by the use of focus groups (Hersch et al., 2016). Finally, one study included a team-based civility training for employees. Which, although this was most likely initiated by management considering the content of the intervention, the intervention itself included a participative approach; nurses identified problems regarding incivility among employees, and developed and implemented actions (Leiter et al., 2011).

Publication Bias

A visual examination of the funnel plot suggested asymmetry in the found effect sizes which was confirmed by Egger's test of the intercept, intercept 1.69, 95% CI [0.93–2.45], $t(81) = 4.43$, $p < .001$. Duval and Tweedie's trim-and-fill analysis indicated a potential lack of 14 studies with higher effect sizes (see Supplemental Figure S3). After statistical imputation of these studies, the adjusted effect size would still include a medium effect, from $g = 0.42$, 95% CI [0.34–0.51] to $g = 0.52$, 95% CI [0.42–0.61]. The trim-and-fill analysis indicated no absence of studies with lower effect sizes. As such, we can conclude that potential publication bias may have resulted in the reported results regarding effectiveness being slightly conservative.

Discussion

The current meta-analysis aims to assess the effectiveness of stress management interventions (SMIs) for registered nurses working in a hospital setting and to identify moderating factors concerning interventions characteristics and the use of a participatory approach (i.e., involvement of employees in designing and/or implementing the intervention). In addition, potentially biasing effects regarding the study design and quality were assessed. Based on 85 publications including 83 interventions, an overall medium effect of SMIs on stress-related outcomes was found, Hedges' $g = 0.42$, 95% CI [0.34–0.51], $p < .001$. This result confirms and quantifies findings of previous (systematic) reviews that SMIs can effectively prevent and/or reduce stress-related outcomes in the nursing population (Henry, 2014; Mimura & Griffiths, 2003; Wentzel & Brysiewicz, 2017).

Concerning the level of the intervention, the results show that person-directed, organization-directed, and multilevel interventions can all effectively reduce stress-related outcomes compared to a control group. However, against our expectations, multilevel interventions did not reach greater effect sizes compared to the other approaches. Instead, a solely person-directed approach was significantly more effective than either a solely organization-directed or multilevel approach. Two issues can explain this finding.

First of all, methodological difficulties in assessing the effect of an organization-directed intervention (with or without a person-directed intervention) could have led to an underestimation of their effectiveness (Nielsen & Noblet, 2018). For example, in organization-directed and multilevel studies, the effect is often based on whether an intervention was implemented in the department/organization rather than who received the intervention. Since it is unlikely that all employees in the department/organization were equally exposed to the intervention, this might lead to small effect sizes (Nielsen & Noblet, 2018; Randall et al., 2005). It has been suggested that comparing the exposed to the unexposed employees gives a better grasp of the intervention effectiveness in these studies than the comparison of an intervention with a control group (Randall et al., 2005). Furthermore, in contrast to person-directed interventions, studies evaluating an organization-directed or multilevel intervention often use department-based or hospital-based allocation to create control and intervention groups, which makes it more difficult to control for possible confounding variables (e.g., management style or organizational culture; Nielsen & Noblet, 2018).

Second, due to differences in follow-up data collection across the studies, we can only conclude that person-directed interventions are more effective directly after the intervention. Yet, organization-directed interventions often work preventative and their effectiveness is more likely to appear over time (Randall et al., 2005). In comparison, person-directed interventions can yield high effect sizes on the short term, but these effects might wear off if the newly acquired skills are not practiced regularly and integrated into the daily routine (van Wyk & Pillay-Van Wyk, 2010). Indeed, we found moderate to large effect sizes for person-directed interventions up till and including 1 month after the intervention, but the few studies including a follow-up measurement after 6 months, showed no significant effects at all. In comparison, for organization-directed interventions, the first significant effect size was reported 6 months or longer after the intervention. Similar findings, including short-term effectiveness for person-directed and long-term effectiveness for organization-directed interventions, have been reported in narrative reviews on burnout interventions (Awa et al., 2010; Westermann et al., 2014). Finally, it must be noted that only a small amount (8%) of the person-directed interventions in the current meta-analysis included a follow-up measurement longer than 6 months after the intervention. For an adequate comparison of the long-term effectiveness of person-directed and organization-directed interventions, long-term follow-up measurements are necessary.

Next to the level of the intervention, the current meta-analysis assessed moderators regarding intervention characteristics, study design for person-directed interventions, and the effect of a participatory approach for organization-directed interventions. For person-directed interventions, moderating effects were found regarding exposure to the intervention and the sample (registered nurses only vs. a mixed sample) but not for the type of intervention (cognitive behavioral, relaxation, work skills, or a mix), the length of the intervention, the target group (primary vs. secondary), or the control group used. For organization-directed interventions, all studies included some form of employee involvement and therefore the effect of a participatory approach could not be assessed. The findings are discussed in more detail below.

In line with previous meta-analyses regarding SMIs for the working population in general (Richardson & Rothstein, 2008; van der Klink et al., 2001), it was expected that cognitive behavioral interventions would yield greater effect sizes than other person-directed interventions. However, no significant moderating effect regarding the type of intervention implemented was found in the

present study. This result is similar to the findings of the meta-analysis of Ruotsalainen et al. (2015) regarding SMIs for health care professionals, in which cognitive behavioral interventions and relaxation interventions yielded comparable effect sizes. It is possible that the nursing profession (and perhaps health care in general) attracts and retains people with better coping and problem-solving skills. In addition, there is increased attention for the development of "soft skills" (including problem-solving skills) in nursing education programs (Ng, 2020). As such, cognitive behavioral interventions might focus on enhancing skills that are (at least up to a certain level) present in this population and thus not necessarily lead to greater effects on stress levels than other person-directed interventions.

Second, as person-directed interventions include learning new skills, and as such require changes in thought patterns and/or behavior, we expected that the effects of these interventions would be stronger in case of longer interventions and when nurses attended the majority of the planned sessions (i.e., had greater exposure to the intervention). Although the results showed no moderating effect for the length of the intervention, exposure to the sessions (i.e., interventions in which the sample attended the majority of the planned sessions) was related to greater effect sizes. This may also explain why previous meta-analyses regarding SMIs for the general working population have found limited evidence that the length of the intervention mattered in the overall effect (Richardson & Rothstein, 2008; van der Klink et al., 2001) and suggests that brief interventions may be just as effective as longer interventions as long as participants attend the sessions. These findings are important in terms of practical implications. For example, considering the busy schedules of nurses, brief person-directed interventions can be considered to (at least on the short term) relieve stress-related symptoms. In addition, when conducting person-directed interventions, special care should be taken to increase adherence. This could, for example, be achieved by implementing the intervention at work and/or during worktime. Nevertheless, it must be noted that many studies ($k = 38$) did not evaluate attendance to the sessions and thus this finding should be interpreted carefully.

Another moderating effect was found for the sample; person-directed interventions were more effective in a sample of solely registered nurses compared to a mixed sample in which the majority were registered nurses. This seemed mainly the case for cognitive behavioral interventions and work skills interventions. A potential explanation is that these interventions are more occupation specific including discussing cases and practicing coping and/or work skills to deal more effectively with these situations in the future. As such, it is possible that the content of these interventions was fitted to the majority of the sample (i.e., the nursing population) and thus appealed less to other health care professionals also joining the intervention. In comparison, relaxation interventions will less likely include the content of work and rather focus on reducing the stress response. This finding may also indicate that tailoring the content of cognitive behavioral or work skills interventions to different target populations could increase the effectiveness of person-directed interventions. Nevertheless, to understand if tailoring indeed played a role, better reporting is necessary regarding the content by which the interventions were designed and implemented.

Finally, the current results suggest a possible moderation effect of the type of outcome used in the study. For example, we found the largest effect size on work-related stress, followed by anxiety, whereas effect sizes for burnout symptoms, psychological distress, symptoms of depression, fatigue, and posttraumatic stress symptoms were smaller. A potential explanation is that work-related stress and to a certain level anxiety indicate levels of experienced stress rather than stress-related outcomes or strain and thus may be more sensitive to change. For example, work-related stress was mainly measured with the Nursing Stress Scale, which asks nurses to indicate how stressful they experience certain work situations. In addition, anxiety in the present study mainly reflects "state anxiety" (i.e., reactions directly related to certain situations) rather than more stable levels of anxiety. Overall, it is possible that person-directed interventions are very effective in reducing stress levels, whereas more intensive interventions (e.g., therapy sessions with a psychologist) are necessary to reduce the more severe stress reactions (e.g., symptoms of burnout and posttraumatic stress). Another possibility is that it takes more time until effects of SMIs are reflected in stress reactions that are less sensitive to change. To understand the effectiveness of SMIs on different stress-related outcomes over different time frames, as mentioned previously, more long-term follow-up measurements are necessary in intervention evaluation studies.

Concerning organization-directed interventions (with or without a person-directed intervention), we mainly focused on one success factor: the use of a participatory approach in the design and implementation of the intervention (Nielsen & Randall, 2012). However, only a few studies including an organization-directed intervention were found and all studies involved their employees in the design and/or implementation of the intervention, at least to a certain extend. This indicates that the importance of employee involvement is not only recognized by scholars in the field but also seems to have become the norm for organization-directed interventions. Yet, the overall effect size for this type of interventions was rather small and few studies reported on other success factors (readiness for change, management support) or barriers encountered (budget cuts, other interventions implemented during the study period). In fact, only one of the included studies performed and reported the effects of a process evaluation (Uchiyama et al., 2013), which led to an informative list of obstacles and success factors that might have influenced the intervention effectiveness. Standard incorporation of process evaluations is warranted to fully understand and improve the effectiveness of this type of interventions. Further guidance on how to pursue such evaluations can be found in publications by Abildgaard et al. (2016) and Nielsen and Noblet (2018).

Limitations

As with all meta-analyses, publication bias might have affected the current findings. However, the statistical techniques used indicated that in case of any publication bias, the current results are more likely to be conservative rather than an overestimation of the effects. Second, we could only include a small number of organization-directed and multilevel interventions. This seems to be a common problem of meta-analyses on SMIs and can be explained in various ways. First, studies including organization-directed interventions might be performed less often as it is more difficult for researchers to convince organizations to take part in an intervention that would involve changes to work processes or the working environment. Second, some studies might have been excluded from the current meta-analysis as the criterion of a control group is more difficult to

meet for these types of studies (Nielsen & Miraglia, 2017). Although there is no strict rule regarding the minimum number of studies within a meta-analysis (Sterne et al., 2000), our results concerning the effectiveness of organization-directed and multilevel interventions might be less reliable.

Finally, the current meta-analysis was limited by suboptimal reporting in the intervention studies. First of all, some studies could not be included as important statistical information was missing. Second, incomplete reporting in the included studies made it difficult to assess the quality of the study and adequately examine moderating factors. A number of possible moderators were considered but had to be omitted due to limited reporting (e.g., the place of intervening (in the work setting, an external setting or at home), when the intervention took place (during work time, during leisure time), the qualification of the instructor (qualified, not qualified, self-instructed), the delivery of the intervention (group based, individual based), and the involvement of employees in the design and implementation of person-directed interventions). Third, it is possible that cultural values moderated the uptake of SMIs (Kotera et al., 2020). However, cultural values are hardly reported in SMI studies and determining cultural values (e.g., collectivistic vs. individualistic cultures) based on the country of study is strongly discouraged (Sawang et al., 2016). It was therefore decided not to perform such an analysis. Finally, future meta-analyses might consider the possible moderating effects of other contextual factors including starting conditions of the intervention (e.g., intervention fatigue among employees, informal social norms), changes during the intervention (e.g., downsizing, budget cuts, restructuring of the organization; NytrØ et al., 2000; Nielsen & Miraglia, 2017), and whether or not the implemented intervention fits the current causes of work stress (e.g., was the intervention based on a risk assessment; Nielsen & Randall, 2013). Nevertheless, to conduct these moderation analyses, improved reporting is necessary. We therefore strongly encourage the use of reporting guidelines such as the "template for intervention description and replication (TIDieR)" checklist (Hoffmann et al., 2014) and the incorporation of process evaluations (Abildgaard et al., 2016; Nielsen & Noblet, 2018) in future studies.

Finally, as the present study also includes interventions aimed at improving the working environment, it was decided to focus on one specific setting, namely the hospital setting. As such, we cannot be certain about the generalizability of the current findings to other care contexts (e.g., nursing homes, mental health institutions, ambulatory care). Still, as there are some similarities regarding the tasks of nurses working in different settings (e.g., in all settings, nurses face emotional demands), this is mainly a concern regarding the results of organization-directed and multilevel interventions and less for the results of person-directed interventions.

Concluding Remarks

In conclusion, the current meta-analysis shows that stress management interventions can effectively reduce and/or prevent stress-related outcomes in nurses working in a hospital setting. Although person-directed interventions were more effective than organization-directed and multilevel interventions, we can only conclude this in terms of short-term effectiveness. Concerning person-directed interventions, the results indicate that interventions conducted in a sample of solely registered nurses, in which attendance was high and the effect was measured on stress-related outcomes that are more sensitive to change, are more likely to yield larger (short-term) effects. Concerning organization-directed interventions, the importance of involving employees in the development and/or implementation of interventions seems highly recognized. Still effect sizes for these interventions remain rather low. To further understand factors that contribute to the effectiveness of SMIs for the nursing population, better reporting on intervention characteristics, and the process of design and implementation is necessary. Furthermore, to determine the longevity of their effects, long-term measurements especially for person-directed interventions are needed.

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