2015

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Journal of Occupational and Organizational Psychology (2015)

The British Psychological Society

www.wileyonlinelibrary.com

Can resilience be developed at work? A meta-analytic review of resilience-building programme effectiveness

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Organizations have increasingly sought to adopt resilience-building programmes to prevent absenteeism, counterproductive work behaviour, and other stress-related issues. However, the effectiveness of these programmes remains unclear as a comprehensive review of existing primary evidence has not been undertaken. Using 42 independent samples across 37 studies, the present meta-analysis sought to address this limitation in the literature by summarizing the effectiveness of resilience-building programmes implemented in organizational contexts. Results demonstrated that the overall effect of such programmes was small ($d = 0.21$) and that programme effects diminish over time ($d_{proximal} = 0.26$ vs. $d_{distal} = 0.07$). Alternatively, moderator analyses revealed that programmes targeting individuals thought to be at greater risk of experiencing stress and lacking core protective factors showed the opposite effect over time. Programmes employing a one-on-one delivery format (e.g., coaching) were most effective, followed by the classroom-based group delivery format. Programmes using train-the-trainer and computer-based delivery formats were least effective. Finally, substantially stronger effects were observed among studies employing single-group within-participant designs, in comparison with studies utilizing between-participant designs. Taken together, these findings provide important theoretical and practical implications for advancing the study and use of resilience-building in the workplace.

Practitioner points

- Resilience-building programmes have had a modest effect in the workplace. The effect is weaker than that associated with secondary prevention techniques, but similar to those shown for other primary prevention techniques.
- Across primary studies, programme effects diminished substantially from proximal (≤1 month post-intervention) to distal time points (>1 month). However, among those at greater risk of experiencing stress or who lack protective resources, weak proximal effects became stronger when measured distally. To optimize the effectiveness of resilience-building programmes, developers should carefully conduct needs assessments, identifying individuals at elevated risk.

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DOI:10.1111/joop.12123

- Methodological decisions (i.e., the use of within- vs. between-participant designs) may have a substantial impact on the conclusions researchers draw regarding the effectiveness of resilience-building programmes. When evaluating the effectiveness of resilience-building programmes, researchers and practitioners should compare observed effects to estimates of mean effects across studies using similar evaluative designs.

Work experiences can empower individuals, increasing job satisfaction, commitment, and performance (e.g., Butts, Vandenberg, DeJoy, Schaffer, & Wilson, 2009). However, work can also be a considerable source of stress, the consequences of which (e.g., burnout, reduced performance, turnover, health symptoms) can lead to substantial costs to both individuals (Levi, 1996) and organizations (Goetzel *et al.*, 2004). To address these problems, researchers have sought to develop training programmes to prevent stress from becoming a burden on organizational effectiveness and employee health. Resilience has emerged as a central focus of many of these preventive interventions (Rutter, 2000). Resilience refers to the process of healthy functioning in the face of adversity (Bonanno, 2004; Luthar, Cicchetti, & Becker, 2000; O'Dougherty Wright, Masten, & Narayan, 2013; Zautra, Hall, & Murray, 2008), and resilience-building programmes aim to equip individuals with resources and skills to prevent the potentially negative effects of future exposure to stressors (Karoly, 2010; Masten, 2007). The emphasis on building resilience in the workplace has been at least partially due to renewed interest in promoting positive psychological functioning (Seligman & Csikszentmihalyi, 2000) and well-being (Diener, Suh, Lucas, & Smith, 1999; Ryff, 1995), as opposed to simply treating problems (Keyes, 2007).

As with many preventive programmes, the adage 'an ounce of prevention is worth a pound of cure' contextualizes the potential impact that even small increases in psychological resilience can have on health and performance outcomes. But while the potential of such programmes is recognized, their effectiveness, as a whole, remains unclear. Because the implementation of preventive interventions can involve considerable costs, it is imperative that researchers establish the relative worth of these programmes in terms of the effects on employee health and performance organizations can expect in return. Further, it is critical that researchers establish which characteristics optimize the effectiveness of resilience-building programmes with regard to these outcomes. For example, research has clearly demonstrated that the effects of training, in general, can diminish over time (Arthur, Bennett, Stanush, & McNelly, 1998). But, some meta-analytic evidence shows that resilience-building programmes may actually have the opposite effect among children (Brunwasser, Gillham, & Kim, 2009). It is yet to be seen how time influences the effects of resilience training programmes among adults. Additionally, it is well established that the presence of stressors or adversity is a prerequisite to demonstrating resilience. However, the number of sources and intensity of such adversity can vary greatly, which may affect resilience-building effectiveness. Finally, there are a number of practical considerations that must be made regarding programme and evaluative design. For instance, differences in the way programmes are delivered (e.g., classroom- vs. computer-based) may influence training transfer, and evaluative design characteristics (e.g., between- vs. within-participant designs and participant assignment) may influence the conclusions that evaluators ultimately draw regarding programme effectiveness. Fortunately, the resilience-building programmes included in the present meta-analysis differ greatly on a number of these factors, allowing us to speak to a wide range of theoretical and practical issues needing attention in order to move this fledgling literature forward.

This study has three specific aims. First, we determine the overall effectiveness of resilience-building programmes implemented within organizational settings, as well as establish separate estimates of their proximal and distal effects. Second, we examine the extent to which a series of potential moderating characteristics contribute to programme effectiveness. Third, we assess to what extent resilience-building programmes have differential effects on enhancing performance, enhancing well-being, and preventing psychological deficits among employees.

Resilience-building programmes in organizational settings

Development of resilience theory

The evolution of resilience, as a construct, has been characterized by four 'waves' of research (Masten, 2007; O'Dougherty Wright *et al.*, 2013; Richardson, 2002), with some of the most recent focus being on the development and evaluation of resilience-building programmes as a means of primary prevention. The study of resilience has held a prominent place in the child development literature for decades (Anthony, 1974; Werner & Smith, 1982). In comparison, resilience research has only recently gained momentum in the occupational literature (e.g., Luthans, Luthans, & Luthans, 2004). Concerns have been expressed over the generalizability of child development-driven models to occupational settings and adult populations, in general (e.g., Eidelson, Pilisuk, & Soldz, 2011). For example, Bonanno (2004) points out that resilience among children is often characterized in response to aversive life circumstances (e.g., neglectful parenting), while resilience among adults more often involves overcoming acute and/or traumatic stress, such as that brought upon by catastrophic events or major loss.

In line with Bonanno's assertion, organizational research has often studied occupational groups assumed to be at elevated risk for acute stress and trauma, such as firefighters (e.g., Freedman, 2004), police officers (e.g., Paton *et al.*, 2007; Peres *et al.*, 2011), and disaster relief personnel (e.g., Kendra & Wachtendorf, 2003; see Skeffington, Rees, & Kane, 2013). In particular, military organizations have been at the forefront of research on the subject of resilience, and there exist a number of narrative reviews that have served to characterize resilience in the military context, identify factors that contribute to resilience, and discuss resilience-promoting programmes and policies (see Bowles & Bates, 2010; see also Meredith *et al.*, 2011; Mulligan, Fear, Jones, Wessely, & Greenberg, 2011; Wald, Taylor, Asmundson, Jang, & Stapleton, 2006).

For individuals working in occupations associated with high risk for experiencing trauma, the importance of primary prevention through resilience-building is clear. But resilience may also be relevant in employment contexts where less acute forms of stress can accumulate over time (e.g., Masten, 2001). Such sources of stress have been identified in the organizational literature (e.g., work relationships, work overload, lack of control, lack of job security, lack of resources or communication, and work–life conflict; Faragher, Cooper, & Cartwright, 2004; Johnson & Cooper, 2003), and these can have important effects on both individual health and organizational functioning. For example, individuals working in education, social service, and customer service report particularly strong decrements to physical health, psychological well-being, and job satisfaction (Johnson *et al.*, 2005). Taken together, work-related stress, whether acute and traumatic or not, and its potentially detrimental effects have been well documented among a range of occupations. Programmes aimed at enhancing resilience may present a viable means to

preventing the negative psychosocial effects of work stress and enhancing well-being and performance.

Building resilience through the development of protective factors

Although resilience has been treated as an individual difference in some organizational research (e.g., Luthans, Youssef, & Avolio, 2007), resilience is typically seen as the process by which individuals successfully use capabilities and resources to protect themselves against the negative consequences associated with adverse experiences (see Luthar *et al.*, 2000; see also Masten, 2007; Richardson, 2002). These capabilities and resources are described as protective factors. A range of biological, psychological, social, and environmental protective factors have been shown to contribute to resilience (Meredith *et al.*, 2011; O'Dougherty Wright *et al.*, 2013). Resilience-building programmes have typically focused on the psychosocial factors believed to be amenable to development. Some of those most commonly emphasized include self-efficacy, optimism, social resources, and cognitive appraisal/coping. For example, for individuals to demonstrate competence in the face of potentially stressful environments, they must possess the belief that they are capable of doing so (e.g., Rutter, 1987). In addition, a positive outlook (e.g., Carver & Scheier, 2002) and social competence (e.g., Gardner, Rose, Mason, Tyler, & Cushway, 2005; see Garmezy, 1985; see also Masten & Coatsworth, 1998) serve as primary means of protecting against the negative effects of stress. Finally, a robust literature exists on stress appraisal and coping strategies and their effects on the primary and secondary prevention of stress (see Carver, Scheier, & Weintraub, 1989; see also Folkman, Lazarus, Gruen, & DeLongis, 1986; Lazarus & Folkman, 1984). Proactive strategies (positive cognitive appraisal and reappraisal, and active and problem-focused coping), along with spiritual coping, have been demonstrated to contribute to primary prevention, even among individuals in high-risk occupations (e.g., Bonanno, 2004; see Meredith *et al.*, 2011).

Resilience-based protective factors: Distinguishing between primary and secondary prevention. Resilience-building differs from stress management interventions (SMIs), which emphasize mitigating the negative effects of stress exposure (Murphy & Sauter, 2003). However, the protective factors developed as part of resilience-building programmes overlap somewhat with those trained through other types of interventions, such as SMIs. For example, cognitive reappraisal and coping strategies (Giga, Cooper, & Faragher, 2003) are often employed by both resilience-building and SMIs. As such, both types of programmes share many features, and it can be unclear whether a particular programme emphasizes resilience-building or stress management. The major distinction between these two types of programmes is in the difference between primary and secondary prevention. Resilience-building programmes are intended to be used as part of primary preventive efforts, which aim to promote wellness and competence in order to prevent the negative effects of some future stressor (Masten, 2007). SMIs, on the other hand, typically use a secondary prevention approach (Richardson & Rothstein, 2008), which emphasizes mitigating the severity of symptoms that emerge in response to a stressor (Murphy & Sauter, 2003).

This distinction is important to identifying relevant studies for this meta-analysis. Of course, it is important to recognize that it is not always clear what constitutes primary versus secondary interventions in relation to stress. That is, regardless of whether stress

accumulates over time or emerges suddenly, people are not blank slates. As described below, workers often targeted by resilience-building programmes are those who experience considerable stress and may benefit most from enhancing protective resources to better prevent the negative effects of such stress in the future. Moreover, resilience-building programmes often, wisely, supplement promoting primary preventive factors with efforts to also enhance individuals' ability to successfully mitigate the negative effects of stressors.

Main effect and moderators of resilience-building programme effectiveness

In the absence of meta-analytic data, the effectiveness of resilience-building programmes among adults is not clear. Similar types of interventions have been shown to be effective, thus providing suggestive evidence for the overall effectiveness of resilience-building programmes. For example, meta-analytic research has shown occupational SMIs to have had a moderate-to-strong effect on psychological health outcomes (Richardson & Rothstein, 2008). Weaker effects have been shown for primary prevention techniques in the workplace (Martin, Sanderson, Cocker, & Hons, 2009) and elsewhere (e.g., Horowitz & Garber, 2006; Sin & Lyubomirsky, 2009). Of particular relevance to the potential effects of occupational resilience-building programmes is the meta-analytic findings regarding the effectiveness of the Penn Resiliency Program (PRP) at preventing depressive symptoms among children (Brunwasser *et al.*, 2009). The study showed the programme to have a small effect (d = 0.11–0.21) and provides an important reference point for the present study. Based on the results of Brunwasser *et al.* (2009), we expect occupational resilience-building programmes to have had a statistically significant effect, similar in magnitude to that of other primary prevention interventions, across health and performance outcomes.

Hypothesis 1: Workplace resilience-building programmes have a statistically significant effect on health and performance scores across measurement time points.

It is also important to assess whether the effects of these programmes are sustained over time. The decay of training effects is an important issue with which organizations must contend (Hurlock & Montague, 1982), especially in high-risk occupations (Kluge, Sauer, Burkolter, & Ritzmann, 2010). Researchers have long understood this issue and identified a number of factors that contribute to deteriorated training effects over time (see Naylor & Briggs, 1961). Arguably, the most influential of these is the non-use of knowledge and skills learned during training, and meta-analytic evidence has shown non-use to quickly and dramatically diminish training effects (Arthur *et al.*, 1998).

In contrast, meta-analytic evidence regarding the effectiveness of resilience-building interventions conducted among children has shown increased training effects between post-intervention (d = 0.11) and 6- and 12-month follow-up (d = 0.21 and 0.20, respectively; Brunwasser *et al.*, 2009). In relation to the idea that training effects diminish with non-use, it is possible that the enhanced effects observed by Brunwasser *et al.* (2009) were the result of frequent and, consequently, increased proficiency in skill use. As described above, stress and adversity are ever present within a range of occupations. Unlike more situation-specific knowledge and skills organizations often seek to train, which may go unused for long periods of time, resilience-based protective factors

may have broad and frequent utility for dealing with stressors ranging from those mundane to traumatic in nature.

Hypothesis 2: The effects of workplace resilience-building programmes on health and performance scores increase over time.

Resilience-building programmes conducted in the workplace have differed considerably in terms of participant, programme design, and study methodology characteristics. These differences have likely contributed to the variability in effects found throughout the primary literature. We have identified six potential moderators of intervention effectiveness. Across all studies we assessed the effects of four moderators: Programme sample, occupational setting, delivery format, and whether a between- or within-participant evaluative design was employed. Across studies employing between participant designs, we assessed the effects of two additional moderators: whether a non-invention control group or active comparison group was employed and whether or not random assignment to study conditions was used. The second aim of this study was to evaluate the extent to which each of these factors influences the effects of resilience-building programmes in the workplace.

Programme sample. Existing theory suggests resilience is most relevant among populations at the greatest risk of experiencing stress or trauma (e.g., Bonanno, 2004; Mancini & Bonanno, 2010). This assumption is, at least implicitly, supported by a number of resource-based models from the stress literature (see Hobfoll, 2002). For example, conservation of resources theory (COR; Hobfoll, 1988, 1998) suggests that individuals rely upon psychological, social, and environmental resources to successfully overcome workplace stressors and prevent strain (Halbesleben, Neveu, Paustian-Underdahl, & Westman, 2014). However, resource-based theories also contend that adverse experiences can deplete resources. Thus, those at greater risk of experiencing stress and adversity likely require a larger reservoir of resources to overcome demands (Hobfoll, 2002). These resources are analogous to protective factors in the resilience literature, and the strengthening of these factors through resilience-building efforts is assumed to be particularly beneficial among those who face substantial stress and adversity.

Meta-analytic evidence has shown greater effects for resilience-building among children categorized as 'high-risk' for depression (Brunwasser *et al.*, 2009). However, positive effects were also observed among children classified as 'low-risk', which were not dissimilar from those observed among high-risk individuals (e.g., post-intervention $d_{\text{high-risk}} = 0.18$ vs. $d_{\text{low-risk}} = 0.13$; 12-month follow-up $d_{\text{high-risk}} = 0.27$ vs. $d_{\text{low-risk}} = 0.19$). Within organizational settings, resilience-building programmes have not typically differentiated between individual risk levels. The exception to this is a study conducted among soldiers returning from a year-long deployment in Iraq, in which researchers used combat exposure scores collected prior to the intervention to categorize soldiers as being at low, moderate, or high risk of developing mental health problems (Adler, Bliese, McGurk, Hoge, & Castro, 2009).

Rather than controlling for risk levels within study populations, researchers have more often targeted specific populations believed to experience greater levels of adversity or lack the skills and resources needed to prevent the negative consequences of stress exposure. This is in contrast to universal programmes which target entire populations, regardless of individuals' perceived stress levels or individual differences. Because

targeted programmes should contain higher rates of individuals at greater risk of adversity or lacking sufficient resources, one may assume that more individuals in these programmes, as opposed to universal programmes, will benefit from developing resilience-based protective factors.

Hypothesis 3: Targeted resilience-building programmes have stronger effects on health and performance scores than those implemented universally.

Occupational setting. Resource-based models of stress have also considered the role of fit between available resources and the types of stress and adversity experienced (e.g., French, Caplan, & Van Harrison, 1982; Halbesleben *et al.*, 2014). This suggests that certain protective factors may be more important than others to preventing the negative consequences associated with specific types of stress and adversity. Above, we noted the general concerns that have been raised regarding whether the relevance of protective factors identified within the child development literature generalizes to the types of adversity typically experienced among adult populations (Bonanno, 2004; Eidelson *et al.*, 2011). It is also plausible that the effects of resilience-building programmes differ as a function of specific occupational factors. For example, the most salient sources of stress among military personnel (e.g., prolonged absence from family due to training or deployment, the experience of combat) may differ from those among civilian workers (e.g., lack of autonomy, organizational downsizing/restructuring). That said, the daily stressors typical to most civilian occupations may also be those most salient among the majority of military personnel, as only a minority of those in military occupations likely participate in actual combat. Moreover, individuals who work in civilian occupations are also vulnerable to traumatic experiences, whether work-related or not. Although there is likely more similarity than difference in the typical stressors experienced between these two broad groups, it is plausible that military populations are generally at greater risk of experiencing substantial stress and adversity. If the nature of military and civilian occupations differs in ways that lead to differential effects of resilience-building programmes, there may be important implications for the generalizability of resilience-building programmes across these settings.

Hypothesis 4: Resilience-building programmes have stronger effects on health and performance scores among military than non-military populations.

Training delivery format. The vast majority of resilience-building programmes implemented in organizational settings have been administered at the group level in classroom settings (e.g., Bond & Bunce, 2000; Gardner *et al.*, 2005). These can be time- and cost-effective and may serve to enhance individuals' social resources within the workplace. Other forms of training delivered in organizational settings include individually administered training, with participants working directly with trainers or coaches (e.g., Sherlock-Storey, Moss, & Timson, 2013; Sood, Prasad, Schroeder, & Varkey, 2011), and train-the-trainer approaches, in which leaders receive resilience training and disseminate learned knowledge and skills to their subordinates (e.g., Lester, Harms, Herian, Krasikova, & Beal, 2011). The most commonly implemented alternative, however, has been computer-based delivery (e.g., Abbott, Klein, Hamilton, & Rosenthal, 2009). The primary distinction between this format and those described above is that computer-based training is self-guided, providing increased participant

control. Meta-analytic evidence has suggested that computer-based learning can be at least as effective as traditional face-to-face learning (Sitzmann, Kraiger, Stewart, & Wisher, 2006).

The question is, 'do these delivery formats all produce similar effects?' One may expect that they do not, a conclusion that has been supported with meta-analytic evidence (Arthur, Bennett, Edens, & Bell, 2003). Given the categories of delivery formats present in the occupational resilience-building literature, one important factor may be the directness with which training content is delivered. We theorize that the more direct contact trainers have with trainees, the better trainers are able to attend to trainee comprehension, identify trainee needs, and provide relevant feedback, all of which have been identified as important to effective training delivery (see Kraiger, 2003). One-on-one coaching provides the most direct delivery format, followed by the group-based classroom format, train-the-trainer format, and computer-based format.

Hypothesis 5: Resilience-building programmes delivered through one-on-one formats will be most effective, followed by group-based classroom formats, train-the-trainer formats, and computer-based formats.

Evaluation attributes. Researchers must make a number of decisions regarding methodological approaches to evaluating training programmes, and these decisions may have important consequences for the conclusions that are drawn regarding programme effectiveness. One such attribute is study design. Resilience-building programmes have typically been assessed through between-participant designs consisting of one or more training and control conditions. However, within-participant designs (i.e., single-group, pre- and post-test score change designs) have also been used (e.g., Hammermeister, Pickering, & Ohlson, 2009; Van Breda, 1999). Among studies employing between-participant designs, two additional methodological attributes are pertinent: The type of comparison group employed and the method of assigning participants to study conditions. Resilience-building programmes have been evaluated in comparison with both non-intervention control conditions (e.g., Arnetz, Nevedal, Lumley, Backman, & Lublin, 2009) and active comparison conditions (e.g., Adler *et al.*, 2009), where participants receive a reduced or alternative training intervention (e.g., information-only). Meta-analytic evidence among PRP interventions conducted among children demonstrated positive effects when compared to non-intervention control conditions, but non-significant effects when compared to active comparison groups (Brunwasser *et al.*, 2009). Both quasi-random (i.e., group-randomized; Castro, Adler, McGurk, & Bliese, 2012) and truly random (e.g., Cigrang, Todd, & Carbone, 2000) assignments have been used among primary studies. Taken together, these attributes reflect the rigour with which resilience-building programmes have been evaluated. Between-participant designs employing active comparison groups and random assignment represent those with the greatest rigour, yielding greater control over extraneous factors and increasing the likelihood that effects are actually attributable to the programme. As such, findings based on primary studies using these approaches should better reflect the true effect of resilience-building programmes. However, the majority of programmes have used less rigorous approaches, likely a consequence of practical limitations. The extent to which less rigorous designs have influenced the conclusions primary studies have drawn regarding the effectiveness of resilience-building programmes has important implications for interpreting findings and designing future programmes.

Hypothesis 6: Resilience-building programmes evaluated through within-participant designs produce stronger effects on health and performance scores than those evaluated through between-participant designs.

Hypothesis 7: Resilience-building programmes compared with non-intervention control groups produce stronger effects on health and performance scores than programmes compared with active comparison control groups.

Hypothesis 8: Resilience-building programmes evaluated using non-random assignment to study conditions produce stronger effects on health and performance scores than those using random assignment to study conditions.

Differential effects across outcomes

Depressive symptoms have been the most commonly studied outcome in the organizational literature on resilience-building (e.g., Abbott *et al.*, 2009; Adler *et al.*, 2009; Brouwers, Tiemens, Terluin, & Verhaak, 2006; Grime, 2004; Litz, Engel, Bryant, & Papa, 2007). Beyond depressive symptoms, there has been little continuity with regard to the outcomes that have been employed across studies. A wide range of symptomologies and maladaptive behavioural outcomes have been examined: Anxiety (e.g., Grime, 2004), distress and poor general health (Jones, Perkins, Cook, & Ong, 2008), fatigue and sleep difficulty (Adler *et al.*, 2009; Sood *et al.*, 2011), ineffective coping strategies (Harms, Herian, Krasikova, Vanhove, & Lester, 2013), and post-traumatic stress disorder (PTSD; e.g., Sharpley, Fear, Greenberg, Jones, & Wessely, 2008). Programme effects have also been assessed with regard to a wide range of outcomes reflecting well-being – for example, job satisfaction (e.g., Bond & Bunce, 2000), psychological capital (Luthans, Avey, Avolio, & Peterson, 2010), and purpose in life (e.g., Waite & Richardson, 2004) – and performance (e.g., manager-rated performance; Hodges, 2010). The wide range of outcomes tested across primary studies suggest the need for a parsimonious classification scheme for organizing outcomes into more specific, yet admittedly still broad, categories. Therefore, we focus on three broad categories of outcomes: (1) well-being (e.g., life/job satisfaction, optimism); (2) deficits in psychosocial functioning (e.g., anxiety, depression, negative attribution styles); and (3) job performance (e.g., manager-rated performance, successful task completion).

Resilience-building programmes are aimed at developing positive psychological health as a means of primary prevention (Karoly, 2010; Masten, 2007); thus, resilience-building programmes should have the strongest effect on outcomes indicative of well-being. It is through improved well-being that psychosocial deficits are thought to be prevented and performance is thought to be enhanced. Because psychosocial deficits and performance are more distal outcomes in the theoretical model, weaker effects on these categories of outcomes may be expected. The third aim of this study was to test this assumption by assessing whether resilience-building programmes differentially affect categories of outcomes.

Hypothesis 9: Resilience-building programmes have a stronger effect on increasing well-being than on preventing psychological deficits or increasing performance.

Method

Literature search

Techniques described in Hedges and Olkin (1985), Hunter, Schmidt, and Jackson (1982), and Rosenthal (1984) were used to compile primary studies for this meta-analysis. We performed a systematic review of the literature contained in the PsycINFO and Google Scholar electronic databases. Combinations of three sets of search terms were used. The first set of search terms included 'resilience' and 'resiliency'; the second included 'intervention', 'program', and 'training'; and the third included 'work', 'organization', and 'employee'. The electronic database search returned a total of 1,411 articles. These searches were further supplemented with secondary search techniques. First, we examined the reference sections of the relevant primary studies identified through electronic searches. Second, we obtained primary studies included in existing meta-analyses and reviews on preventive interventions among military personnel (Harms, Krasikova, Vanhove, Herian, & Lester, 2013; Meredith *et al.*, 2011; Mulligan *et al.*, 2011) and targeting post-traumatic stress disorder (Skeffington *et al.*, 2013), as well as those that have been categorized by others as workplace health promotion (Martin *et al.*, 2009), stress management (Richardson & Rothstein, 2008), or positive psychology and well-being interventions (Meyers, van Woerkom, & Bakker, 2013; Sin & Lyubomirsky, 2009). All search techniques were conducted among studies either published or made available through April 2014. Across primary and secondary searches, we identified a preliminary set of 129 studies that potentially met inclusion criteria as workplace resilience-building programmes.

Selection criteria and sample partitioning

Several criteria were used to select studies for inclusion. First, the training programmes being evaluated within primary studies were required to emphasize primary prevention techniques, whether exclusively or supplemented with secondary techniques. In addition to excluding SMIs (i.e., secondary techniques), this also excluded tertiary interventions or therapies such as stress debriefing, which aim to treat existing problems associated with specific past traumas or exposures to stress. Second, studies were required to evaluate programme effectiveness with regard to outcomes reflecting well-being, psychological deficits, or performance. This excluded studies employing programme reaction criteria (e.g., satisfaction with training experience). Third, studies had to emphasize modifiable psychosocial factors identified as contributing to resilience (see O'Dougherty Wright *et al.*, 2013; see also Earvolino-Ramirez, 2007). This eliminated health promotion interventions emphasizing, for example, physical fitness, changes to the workplace environment, and meditation. Fourth, studies had to provide data from which effect sizes could be calculated. Finally, studies had to provide data unique from those reported in studies already included. We did not require that manuscripts be published in English, but our search methods did not identify any non-English language programme evaluation studies conducted in the occupational context. We considered both published and unpublished studies, as well as studies using various quantitative methodologies (e.g., between- and within-participant designs; experimental and non-experimental designs).

Of the 129 studies initially identified for consideration, 55 studies (42.6%) evaluated secondary or tertiary prevention programmes (i.e., stress management or stress debriefing interventions); two studies (1.6%) reported reaction criteria only; 15 studies (11.6%)

evaluated primary prevention programmes, but did not promote resilience-based protective factors; 18 studies (14.0%) either reported no data or did not report sufficient data for calculating effect sizes; and two studies (1.6%) reported the same data as other studies already included. This resulted in the inclusion of 37 primary studies (28.7%), two of which (5.4%) were unpublished. Four primary studies presented results for multiple independent samples, based on differences in organizational rank, perceived health risk, or resilience-building programme condition. We presented data separately for each independent sample to enhance statistical power for exploring differences in effect sizes due to potential moderators. In total, we extracted 42 independent samples from the 37 primary studies.

Analytic strategy

Treatment of outcomes and time

Characteristics of resilience-building programmes implemented in the workplace have varied widely, and as described above, there has been only limited overlap in outcomes measured. Therefore, we took a broad perspective in summarizing the main effect of resilience-building programmes and in conducting moderator analyses by considering the full range of psychosocial health and performance-related outcomes included in primary studies. In most included studies, multiple relevant outcomes were included as part of programme evaluation. In these cases, we aggregated effects across outcomes within study, weighted by sample size, into a single mean effect for each independent sample. We also conducted separate analyses to assess programme effectiveness with regard to more specific outcomes (described below).

The time points at which programme effectiveness was measured also varied, ranging from immediately after the intervention to 24 months post-intervention. However, only 11 studies reported effects beyond 3 months post-intervention. The 1-month post-intervention time point provided a natural break in the included data that allowed for a sufficient number of studies reporting distal effects. In addition, the 1-month threshold likely allowed many participants sufficient time to employ the trained skills, and follow-up measurement at 1 month has been demonstrated to be easily sufficient for capturing diminished training effects in the workplace in other studies (Arthur *et al.*, 1998). Also worth mentioning is that many of the included studies provided estimates at multiple time points for the same primary data. Thus, we first evaluated the overall effect of resilience-building programmes (across outcomes and time points), followed by an examination of proximal ($\leq$1 month post-intervention) and distal (>1 month post-intervention) effects, separately. This allowed us to assess the extent to which programme effects are likely to be sustained beyond the immediate post-intervention period. Integrated proximal and distal effect sizes are presented separately for each independent sample in Table 1.

Moderator variables

We examined differences between independent samples on six potential moderators: Programme sample (*targeted/universal*), occupational setting (*military/non-military*), method of programme delivery (*computer-based/group-based classroom/one-on-one/train-the-trainer*), study design (*between-/within-participant*), comparison group (*non-intervention control/active comparison*), and participant assignment (*non-random/random*). It should be mentioned that the final two moderators listed, comparison group

Table 1. Study descriptions and effect sizes for each included independent sample

Study	Proximal			Distal			Format	Occ. setting	Sample	Design	Comp. grp.	Assign.
	N	*d*	95% CI	*N*	*d*	95% CI						
Abbott *et al.* (2009)	31	−0.21	−0.90, 0.49				CB	C	U	B	NIC	R
Adler *et al.* (2009) low exposure				272	0.00	−0.29, 0.28	G	M	U	B	AC	NR
Adler *et al.* (2009) moderate exposure				264	0.02	−0.24, 0.27	G	M	U	B	AC	NR
Adler *et al.* (2009) high exposure				222	0.19	−0.08, 0.47	G	M	T	B	AC	NR
Arnetz *et al.* (2009)	18	0.71	−0.21, 1.63				G	C	U	B	NIC	R
Bond and Bunce (2000) ACT programme				44	0.32	−0.27, 0.90	G	M	T	B	AC	NR
Bond and Bunce (2000) IPP programme				41	0.16	−0.44, 0.76	G	M	U	B	AC	NR
Brouwers *et al.* (2006)				173	0.15	−0.14, 0.45	G	M	U	B	AC	NR
Burton, Pakenham, and Brown (2010)	18	0.48	0.00, 0.95				G	C	U	W	–	–
Carr *et al.* (2013)				146	−0.11	−0.27, 0.05	G	M	U	W	–	–
Castro *et al.* (2012)	542	0.22	0.05, 0.39				G	M	U	B	NIC	NR
Cigrang *et al.*(2000)	178	0.12	−0.17, 0.41				G	M	T	B	AC	R
Cohn and Pakenham (2008)	174	0.04	−0.26, 0.34				G	M	U	B	NIC	NR
Fortney, Luchterhand, Zakletskaia, Zgierska, and Rakel (2013)	28	0.17	−0.19, 0.53	23	0.30	−0.10, 0.71	G	C	U	W	–	–
Gardner *et al.* (2005) cognitive programme				28	0.76	−0.03, 1.54	G	C	T	B	NIC	R
Gardner *et al.* (2005) coping programme				27	0.61	−0.16, 1.38	G	C	T	B	NIC	R
Grant, Curtayne, and Burton (2009)	40	0.47	−0.15, 1.09				O	C	U	B	NIC	NR
Grime (2004)	39	0.56	−0.08, 1.19	34	0.27	−0.41, 0.95	CB	C	T	B	AC	R
Hammermeister *et al.* (2009)	27	0.61	0.21, 1.01				G	M	U	W	–	–
Hodges (2010) associates	297	0.16	−0.07, 0.39				T	C	U	B	NIC	NR
Hodges (2010) managers	95	0.21	−0.19, 0.61				G	C	U	B	NIC	R
Jennings, Frank, Snowberg, Coccia, and Greenberg (2013)	50	0.31	−0.24, 0.85				G	C	U	B	NIC	R
Jones *et al.* (2008)	326	0.56	0.44, 0.67				G	M	U	W	–	–

Continued

Table 1. (*Continued*)

Study	Proximal			Distal			Format	Occ. setting	Sample	Design	Comp. grp.	Assign.
	N	*d*	95% CI	*N*	*d*	95% CI						
Lester *et al.* (2011)/Harms, Herian, *et al.* (2013), Harms, Krasikova, *et al.* (2013)				9,305	0.04	0.00, 0.08	T	M	U	B	NIC	NR
Liossis, Shochet, Millear, and Biggs (2009)	84	0.17	−0.34, 0.68	69	0.45	−0.22, 1.12	G	C	U	B	NIC	NR
Litz *et al.* (2007)	31	0.43	−0.26, 1.11	21	0.58	−0.26, 1.42	CB	M	T	B	AC	R
Luthans, Avey, and Patera (2008)	364	0.10	−0.11, 0.30				CB	C	U	B	NIC	R
Luthans *et al.* (2010) managers	80	0.53	0.30, 0.77				G	C	U	W	–	–
McGonagle, Beatty, and Joffe (2014)	48	0.40	−0.17, 0.96				O	C	T	B	NIC	R
Millear, Liossis, Shochet, and Biggs (2008)	71	0.04	−0.48, 0.55	50	0.27	−0.45, 0.99	G	C	U	B	NIC	NR
Petree, Broome, and Bennett (2012)				426	0.04	−0.01, 0.12	G	C	U	B	NIC	NR
Pidgeon, Ford, and Klaasen (2014)	35	−0.16	−0.82, 0.51				G	C	U	B	NIC	R
Richards (2001)	444	−0.13	−0.32, 0.07	258	0.26	0.02, 0.51	G	C	T	B	AC	NR
Sarason, Johnson, Berberich, and Siegel (1979)	18	−0.17	−1.02, 0.69				G	C	U	B	AC	R
Sharpley *et al.* (2008)				818	0.05	−0.10, 0.21	G	M	U	B	NIC	NR
Sherlock-Storey *et al.* (2013)	12	1.01	0.34, 0.167				O	C	U	W	–	–
Sood *et al.* (2011)				32	0.71	0.00, 1.42	O	C	U	B	NIC	R
Stoiber and Gettinger (2011)	53	1.19	0.56, 1.82				G	C	U	B	NIC	NR
Van Breda (1999)	24	0.20	−0.20, 0.60				G	M	U	W	–	–
Waite and Richardson (2004)	138	0.23	−0.11, 0.56	138	0.04	−0.29, 0.38	G	C	U	B	NIC	NR
Williams *et al.* (2004)	200	−0.04	−0.32, 0.23				G	M	T	B	NIC	R
Williams *et al.* (2007)	1,199	0.20	0.09, 0.32	1,120	0.03	−0.09, 0.15	G	M	U	B	NIC	NR

Note. Programme delivery format (Format): O = one-on-one coaching/therapy; G = group-based delivery; CB = computer-based delivery; T = train-the-trainer. Occupational setting (Occ. setting): C = civilian (i.e., non-military); M = military. Programme sample (Sample): T = targeted sample; U = universal sample. Study design (Design): B = between-participants; W = within-participants. Comparison group (Comp. grp.): AC = active comparison condition; NIC = non-intervention control condition. Method of participant assignment (assign.): NR = non-random; R = random.

and participant assignment, were only applicable among primary studies using between-participant designs; studies employing within-participant designs were coded as missing on these variables. Moderator classifications for each independent sample are presented in Table 1.

Outcome analyses

Our decision to integrate effects across outcomes allowed us to conduct more meaningful moderator analyses. However, we were also interested in the effects of resilience-building programmes on specific types of outcomes. Consequently, we conducted separate analyses assessing the proximal and distal effect of resilience-building programmes on outcomes reflecting the following: Performance (e.g., supervisor-rated performance, successful task completion), psychological deficits (e.g., anxiety, depression), and well-being (e.g., positive affect, purpose in life, subjective well-being).

Effect sizes

The effect sizes (*d*s) reported in this study represent sample size-corrected estimates, based on the potential for effect sizes to be overestimated among small sample sizes (Hedges, 1981). However, corrected *d*s tend to converge with Cohen's *d* when the sample size is greater than $n = 20$. When primary study designs allowed, we calculated *d*s based on between-participant differences (i.e., effects of a resilience training condition compared to the effects in a control condition). Across all studies, 34 of 42 (80.1%) independent samples provided data from which between-participant *d*s were calculated. Effect sizes were calculated from raw means and the pooled standard deviation whenever possible ($d = [M_{\text{control}}–M_{\text{intervention}}]/SD_{\text{pooled}}$). Means and standard deviations (*SD*s) were available for 24 of 34 (70.6%) independent samples. In the absence of means and *SD*s, we relied on the available method of computation that most closely represented the raw data. That is, we used Cohen's *d*s ($k = 3$), frequencies/proportions ($k = 4$), and *F*- or *t*-test values ($k = 5$). Among studies that employed within-participant designs ($k = 8$), *d*s were calculated from *t* values ($k = 7$) and raw mean differences ($k = 2$) representing pre- and post-test change on outcome measures.[1]

Inter-rater agreement

All effect sizes (*d*s) were initially calculated by the first author using DSTAT (Johnson, 1993) and Comprehensive Meta-Analysis version 2 (CMA; Biostat, Englewood, NJ, USA) and recreated by another member of the research team. In total, 342 separate effect sizes were calculated and integrated within independent samples. Over 95% of these effect sizes were successfully recreated. The most common discrepancy was the direction (+/−) associated with the effect size. All discrepancies were resolved by the first author recalculating the effect size from the data provided in the primary study. Coder agreement of over 95% was achieved across moderator codings. The first author resolved all coding discrepancies.

[1] *Multiple statistics were used to calculate* ds *for different outcomes included in three primary studies (Carr* et al., *2013; Lester* et al., *2011/Harms, Herian,* et al., *2013; Williams* et al., *2007). As a result, these three studies were each counted twice in reporting the statistics used.*

Analyses

Main effect and subgroup moderator analyses were conducted in CMA. Given that the resilience-building programmes evaluated in primary studies varied greatly with regard to potential moderating characteristics, we assumed there to be variability in effect sizes beyond that due to sampling error alone, which led to our decision to use a random effects model (see Lipsey & Wilson, 2001). We report the *d*, 95% confidence intervals (CIs), number of studies (*k*), and total sample size (*n*) for each analysis. In addition, we assessed the heterogeneity within the distribution of *d*s using the *Q* statistic and I^2. The *Q* statistic is similar to the *F* ratio, and a significant *Q* value indicates the presence of heterogeneity. The I^2 statistic provides an estimate of the proportion of heterogeneity between studies. Moderator analyses conducted in CMA for each moderator variable, separately, provide a direct assessment of individual moderators' influence on resilience-building programme effectiveness. However, this approach is somewhat limited in that it does not control for confounds resulting from correlated moderators (Hedges & Olkin, 1985). Because moderators likely covary, possibly to non-trivial degrees, we further assessed these moderators simultaneously in a WLS regression model. We report the R^2, standardized regression coefficients, and squared semi-partial correlations. WLS regression analyses were conducted using SPSS, wherein *d*s were regressed on categorical moderators, weighted by sample size.

Results

Effectiveness of resilience-building programmes across independent samples

The sample size-corrected effect across independent samples and time points was $d_{\text{overall}} = 0.21$ (95% CI [0.13, 0.29], $k = 42$, $n = 16{,}348$). The positive directionality indicates participants in resilience-building programmes improved scores on performance and well-being outcomes and reduced scores on outcomes reflecting psychosocial deficits upon post-training assessment. The CIs' exclusion of zero indicates the effect of these programmes was statistically significant, a finding that supports Hypothesis 1.

Next, we examined the proximal and distal effects of resilience-building programmes. The proximal effect (≤1 month post-intervention) was $d_{\text{proximal}} = 0.26$ (95% CI [0.15, 0.36], $k = 29$, $n = 4{,}662$). Independent *d*s ranged from −0.21 to 1.19, with eight of the 29 effects significantly differing from zero, at $p < .05$, in the positive direction. The distal effect ($d_{\text{distal}} = 0.07$ [0.01, 0.12], $k = 21$, $n = 13{,}510$) remained positive and significantly different from zero but was substantially weaker in magnitude. Independent *d*s reporting distal effects ranged from −0.11 to 0.76, and two of the 21 primary distal effects were statistically significant. Results indicate that the effect of resilience-building diminishes over time. Thus, we failed to find support for Hypothesis 2.

Moderator analyses

There was significant heterogeneity among independent *d*s evaluating proximal effects, Q (28) = 80.90, $p < .001$, $I^2 = 65.38$, but not among the independent *d*s representing distal effects, Q (20) = 23.35, $p > .05$, $I^2 = 14.34$. This suggests the presence of moderators among the proximal effects of resilience-building programmes, but not the distal effects. As such, the moderator findings reported here were constrained to effects observed proximally unless indicated otherwise. Hypothesis 3 states that programmes targeting individuals believed to experience greater levels of stress or lack protective resources

would produce stronger effects than of those provided universally. Contrary to meta-analytic evidence reported by Brunwasser *et al.* (2009), we found a weaker effect among targeted programmes ($d_{\text{targeted}} = 0.09$) than among universal programmes ($d_{\text{universal}} = 0.29$; see Table 2). Although only five studies that evaluated targeted programmes reported proximal effects, CIs indicate these programmes have had a non-significant effect.

As a follow-up analysis, we sought to examine the effects of targeted and universal programmes among data observed distally in order to assess whether the difference observed proximally remained consistent across measurement time points. Results among distally measured outcomes better conformed to our expectations, as a far stronger distal effect was associated with targeted programmes ($d_{\text{targeted}} = 0.26$, 95% CI [0.11, 0.40], $k = 7$, $n = 762$) than universal programmes ($d_{\text{universal}} = 0.04$, 95% CI [0.00, 0.07], $k = 14$, $n = 12{,}749$). Taken together, we found mixed support for Hypothesis 3. The differential effects associated with targeted and universal programmes, when measured proximally versus distally, may have important theoretical implications which we discuss in greater detail below.

Hypothesis 4 proposed that resilience-building programmes have stronger effects among military than among non-military occupational populations. Resilience-building programmes showed a positive and significant impact in both military and non-military settings (see Table 2), with almost no difference in the observed effects ($d_{\text{non-military}} = 0.26$ and $d_{\text{military}} = 0.25$). Thus, Hypothesis 4 was not supported.

We hypothesized programmes using a one-on-one delivery format to show the strongest effect, as this method provides the most direct contact with trainees. Further, we hypothesized programmes using group-based classroom, train-the-trainer, and computer-based delivery formats to show ordinally weaker effects, as these methods provide progressively less direct contact with trainees (Hypothesis 5). In support of

Table 2. Results of categorical moderator analyses conducted among proximal effects

	k	*n*	*d*	Lower 95% CI	Upper 95% CI
Programme sample					
Universal	23	3,723	0.29	0.18	0.40
Targeted	6	940	0.09	−0.11	0.28
Occupational setting					
Non-military	20	1,961	0.26	0.12	0.41
Military	9	2,701	0.25	0.09	0.41
Form of delivery					
One-on-one	3	100	0.59	0.23	0.95
Group-based classroom	21	3,801	0.25	0.12	0.37
Computer-based	4	465	0.16	−0.08	0.39
Train-the-trainer	1	297	0.16	−0.07	0.39
Study design					
Between-participants	22	4,147	0.15	0.07	0.24
Within-participants	7	515	0.49	0.35	0.63
Comparison group					
Non-intervention	17	3,438	0.18	0.09	0.26
Active comparison	5	710	0.09	−0.16	0.33
Participant assignment					
Non-random	10	3,041	0.18	0.04	0.31
Random	12	1,107	0.12	0.00	0.24

Hypothesis 5, one-on-one delivery formats appear to have had the strongest effect ($d_{\text{one-on-one}} = 0.59$). Classroom-based formats had a moderate and statistically significant effect ($d_{\text{group}} = 0.25$), and both train-the-trainer ($d_{\text{train-the-trainer}} = 0.16$) and computer-based delivery formats ($d_{\text{computer-based}} = 0.16$) had weak, non-significant effects. That said, Table 2 clearly depicts that the vast majority of programmes used group-based classroom formats, while effects associated with the remaining delivery formats are based on very few studies (proximal *k*s ranging from 1 to 4). Thus, Hypothesis 5 findings should be interpreted with great caution.

Finally, we examined three moderators reflecting attributes of programme evaluation design, hypothesizing that less rigorous designs would lead to conclusions of stronger programme effects. First, we assessed study design (within- vs. between-participants; Hypothesis 6). Although only a small number of the included studies used within-participant designs ($k_{\text{proximal}} = 7$), the effect associated with these studies was much stronger than that associated with studies using between-participant designs ($d_{\text{within}} = 0.49$ vs. $d_{\text{between}} = 0.15$, respectively; see Table 2). Among studies employing between-participant designs, we further assessed differences due to the type of comparison group employed (Hypothesis 7) and the method by which participants were assigned to study conditions (Hypothesis 8). Programme effects were stronger among studies comparing resilience-building programmes to non-intervention control conditions ($d_{\text{non-intervention}} = 0.18$) than to active comparison conditions ($d_{\text{active}} = 0.09$), with only the former estimate differing significantly from zero (see Table 2). Further, studies employing non-random (i.e., group-random) assignment showed only slightly stronger effects than did studies employing truly random assignment ($d_{\text{non-random}} = 0.18$ vs. $d_{\text{random}} = 0.12$; see Table 2). Findings support all three evaluative design hypotheses, as stronger effects were found among studies employing less rigorous evaluative designs – that is, within-participant designs, non-intervention control conditions, and non-random participant assignment.

Joint moderator analysis

WLS regression results across proximal effects are presented in Table 3. In total, 47.7% of the variance in *d*s was accounted for by the moderator variables examined in this study ($r = .69$). As shown in Table 3, only two moderator variables, programme sample and

Table 3. Joint moderator analysis conducted among proximal effects

	β	η^2
Occupational setting	.10	.01
Programme sample	.35*	.11
One-on-one delivery	.25	.06
Online delivery	.01	.00
Train-the-trainer delivery	.00	.00
Study design	.48*	.21

Note. Reference categories were as follows: 'Occupational setting' = non-military, 'Programme sample' = targeted, and 'Study design' = between-participant design. The four delivery format categories resulted in three dummy coded variables. The labelled group was coded as '1' with all other categories coded as 'zero'. Group-based delivery was a reference condition throughout all three dummy codes.
*$p < .05$.

Table 4. Proximal and distal effects among outcome categories

	Proximal					Distal				
	k	*n*	*d*	Lower 95% CI	Upper 95% CI	*k*	*n*	*d*	Lower 95% CI	Upper 95% CI
Performance	12	2,597	0.36	0.21	0.50	8	10,250	0.03	−0.01	0.07
Psychological deficits	19	3,385	0.17	0.03	0.32	19	11,676	0.10	0.03	0.17
Well-being	23	3,464	0.25	0.15	0.34	12	11,442	0.06	−0.05	0.17

study design, showed statistically significant effects when all moderators were included simultaneously in the predictive model.[2] That is, universal programmes ($\eta^2 = .11$) and programmes evaluated through within-participant designs ($\eta^2 = .21$) were more effective.

Effect of resilience-building programmes on specific outcome categories

To provide continuity across the various outcomes that have been studied in the primary literature, we classified outcomes into one of three general categories: Well-being, psychosocial deficits, and performance. We examined the proximal and distal effect of resilience-building programmes on these outcome categories, hypothesizing the strongest effects on enhancing well-being (Hypothesis 9). Results are presented in Table 4. Resilience-building programmes had the strongest proximal effect on improving performance ($d_{\text{proximal-performance}} = 0.36$), while somewhat weaker, but still statistically significant, effects were observed for enhancing well-being ($d_{\text{proximal-well-being}} = 0.25$) and preventing psychosocial deficits ($d_{\text{proximal-deficits}} = 0.17$). In general, weaker effects were found across all three outcome categories when measured distally. The strongest and only statistically significant distal effect was found for preventing psychosocial deficits ($d_{\text{distal-deficits}} = 0.10$), while the weakest effect was found for improving performance ($d_{\text{distal-performance}} = 0.03$). Again, the median effect was associated with enhanced well-being ($d_{\text{distal-well-being}} = 0.06$).

Publication bias

Finally, we assessed the presence of publication bias. A potential issue when conducting meta-analyses is an upward bias due to primary research showing significant effects being more likely to be published, and subsequently included in meta-analyses, than primary research showing non-significant effects (Rosenthal, 1979). To examine whether this was an issue among primary data included in the present study, we created separate funnel plots for proximal and distal effects, with *d*s displayed on the *x*-axis, and study precision (1/standard error) on the *y*-axis (see Figure 1a,b). Figure 1a (proximal effects) depicts a fairly normal distribution of observed primary effects, with greater variability among

[2] *Two moderators (comparison group and participant randomization) were only applicable among between-participant studies, meaning study design, and these two evaluation attributes could not be included in the same equation. Because evidence from the initial subgroup analyses indicated study design to be the strongest predictor, these results are described in text and in Table 3. Subsequently, we assessed an alternative model in which comparison group and participant randomization, as opposed to study design, were included. This resulted in moderators accounting for less total variance in effect size estimates (23.6%), and none of the predictors being statistically significant at* $p < .05$.

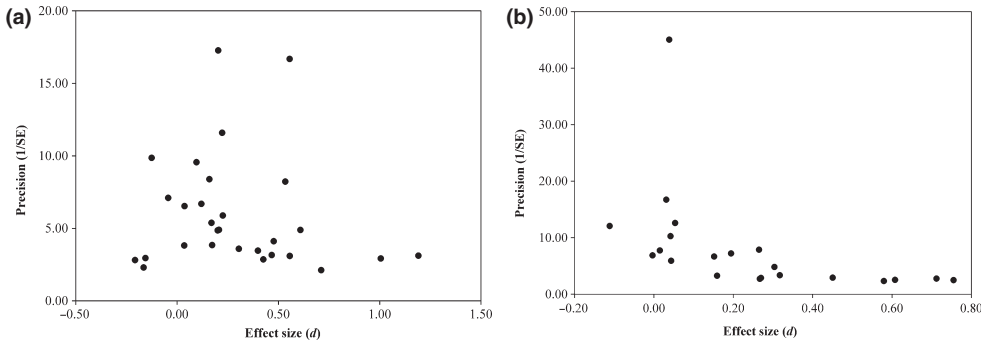

Figure 1. Funnel plot of included samples among: (a) Proximal and (b) Distal effects.

smaller studies (i.e., studies with less precision for identifying the true effect) and convergence around the 'true' mean among larger studies (i.e., studies with greater precision for identifying the true effect), thus creating a funnel shape. This suggests that publication bias is likely not influencing the mean proximal effect size magnitude reported above. A very different trend, however, can be observed in Figure 1b (distal effects), which depicts a fairly pronounced negative relationship between the *d*s observed in primary studies and their precision for identifying the 'true' effect. Stated differently, Figure 1b suggests that the 'true' distal effect of resilience-building programmes reported above has likely been upwardly biased by the lack of precision associated with smaller studies.

Discussion

The potential benefits of primary prevention efforts to employees and organizations cannot be overstated, and resilience-building programmes have quickly become a popular means of primary prevention within organizations. The purpose for conducting this meta-analysis was to summarize the effect that these programmes have had. Our findings show resilience-building programmes have had a statistically significant, albeit modest, effect across health and performance criteria. This effect is weaker than that observed among occupational SMIs (Richardson & Rothstein, 2008), but is similar to effects evidenced through other meta-analyses of primary prevention techniques (e.g., Horowitz & Garber, 2006; Martin *et al.*, 2009; Sin & Lyubomirsky, 2009). Thus, we can conclude that resilience-building has generally been as, but no more, effective than other primary prevention techniques.

The fact that resilience-building and other primary prevention approaches have had modest effects should not diminish their perceived utility to organizations. Even small preventive effects at the individual level have the potential to yield considerable benefits at the organizational level (Sorensen, Emmons, Hunt, & Johnston, 1998). Moreover, the potential effectiveness of resilience-building, specifically, may be greater than is actually reflected through the effects observed here. A possible reason is the rapid growth in the utilization of resilience-building. That is, with little evidence to guide decisions regarding the implementation of such programmes, efforts to build resilience have varied greatly in sample, design, and evaluative characteristics, which have likely led some of these programmes to produce less-than-optimal effects. Consequently, one of the contributions

of the present meta-analysis is to provide guidance in terms of the conditions and approaches where resilience-building is likely to have the greatest utility.

At the outset of this study, we highlighted concerns that have been raised regarding the generalizability of resilience-based theory to adult populations (Bonanno, 2004; Eidelson *et al.*, 2011). Much of the existing theory surrounding resilience is based on research conducted among children, and proposed differences in the nature of adversity typically experienced by adults have been cited as a factor potentially limiting the generalizability of such theory (e.g., Bonanno, 2004). The extent to which adversity actually differs between children and adults is a topic that remains open to debate, and one we are not positioned to answer here. Instead, we recognize that the *protective factors* identified through research on children are generally the same protective factors that resilience-building programmes conducted among both children and adults have aimed to develop. Thus, the more important theoretical issue is whether the effects of developing these protective factors have been similar, regardless of potential differences in the adversity experienced by different populations. The similarity of effects observed in the present study which focuses on organizational samples, and those reported by Brunwasser *et al.* (2009) which focuses on child samples, is particularly important in this regard. In addition, our findings show resilience-building has produced similar effects among military and non-military samples, further supporting the generalizability of protective factors across adult populations thought to experience differential levels of stress. Taken together, the findings presented here suggest that the core set of factors identified within the child development literature have robust protective effects across populations.

The effects of resilience-building may be less robust with regard to who benefits from efforts to develop these protective factors. Evidence of the different trends in programme effectiveness observed between universal and targeted programmes across proximal and distal time points provides important insight on this issue. We found the effects of resilience-building to diminish sharply among programmes implemented universally. Alternatively, we found increased distal effects for programmes targeting individuals perceived to be at elevated risk or lack protective skills and resources.

One possible explanation for this finding relates to the use or non-use of learned skills. As described above, one of the leading factors contributing to diminished training effects is the non-use of learned knowledge and skills (e.g., Arthur *et al.*, 1998). Although some individuals taking part in universally implemented programmes may have been at particularly high risk of experiencing stressors, many likely were not. Consequently, the protective factors developed during resilience-building went unused, which led to diminished effects over time. Those taking part in the targeted programmes were identified as being at elevated risk levels, which likely resulted in far greater opportunity to put learned skills to use. Moreover, the fact that programme effects actually increased among these individuals suggests that continued use resulted in these individuals becoming more proficient in deploying knowledge and skills learned through resilience-building.

Relevant to our findings of these differential effects is the idea that risk and protective factors typically do not exist in isolation, but instead function in a cumulative fashion. That is, those at risk of experiencing significant stress from one source are often at increased susceptibility of experiencing stressors from multiple other sources. Sometimes referred to as 'cumulative risk' (e.g., Cicchetti & Rogosch, 2002) or 'pile-up' effects (O'Dougherty Wright *et al.*, 2013), research has shown that the effects of stress from work or family domains can create or exacerbate stress and satisfaction in other domains (e.g., Adams,

King, & King, 1996; Amstad, Meier, Fasel, Elfering, & Semmer, 2011; Demerouti, Bakker, Nachreiner, & Schaufeli, 2000). Protective factors can function in a similar fashion, and enhancing one or more protective factors can subsequently serve to strengthen others, creating upward spirals or providing cumulative protection (O'Dougherty Wright *et al.*, 2013; Waller, 2001). For example, increasing social support can lead to enhanced self-efficacy and improved coping strategies, just as improving self-efficacy can lead to greater effort to secure sources of support and more positive appraisals of potentially stressful experiences. In addition to the majority of individuals in the universal programmes being at relatively low risk of experiencing substantial stress, these individuals may have also already possessed a diverse 'toolkit' proven useful for adapting to stressors. Thus, one could expect that efforts to develop fundamental protective factors would have only limited effects. On the other hand, the enhanced distal effect found among targeted programmes may not have been solely due to individuals becoming more proficient in using knowledge and skills learned through resilience-building. The successful use of knowledge and skills may have also led to individuals developing additional protective factors, which further contributed to the increased distal effects we observed.

The explanations put forth above are not mutually exclusive. For example, some individuals in occupations with even the highest exposure to stress possess the resources and skills to avoid experiencing deficits to health and performance, while others lack the protective factors necessary for overcoming comparatively mundane sources of adversity. Determining who will benefit most from resilience-building is certainly a complex issue, and one that deserves additional attention. At a basic level, however, efforts to build resilience should generally be more effective among individuals at risk of experiencing considerable stress and/or those identified as lacking the basic protective resources and skills. Thus, conducting a needs assessment prior to implementation is vital to determining whether resilience-building is necessary and to maximizing the organization's return on investment.

Our findings regarding programme and evaluative design characteristics hold a number of practical implications moving forward. Although sample sizes were extremely small in a number of the categories, moderator analysis results generally support the idea that more direct delivery formats have been more effective at building resilience. This may be due to the fact that such formats better attend to trainees' unique needs, allow trainees to apply training content to specific experiences and situations, and hold trainees accountable. Consequently, the more direct the delivery method, the more time and resource-intensive and often impractical the approach becomes. On the other hand, indirect delivery methods such as computer-based training can be highly efficient. The weak effect associated with this approach may suggest it is simply not conducive to building resilience. However, highly sophisticated computer-based resilience-building interventions implemented in non-workplace settings have been shown to be quite effective (e.g., Rose *et al.*, 2013). It is possible that our findings are more indicative of the quality of the computer-based resilience-building programmes that have been evaluated in the workplace thus far than the actual potential effects of such programmes. This idea highlights a broader issue alluded to already – that is, the rapid growth in the popularity of resilience-building may have led to misconceptions regarding its utility and the appropriateness of its use across settings and situations. Our findings regarding programme design further build on this point. In addition to carefully assessing training needs, organizational decision-makers must understand that the effectiveness of resilience-building is highly dependent on the quality of programme design.

In this vein, it is our position that resilience-building via computer-based formats may have greater potential than is reflected through the current results. Technology has made it relatively easy and cost-effective to provide and receive training on a large scale, and computer-based programmes focused on improving psychosocial health, such as cognitive bias modification, have been shown to have practical utility (e.g., Bar-Haim, Morag, & Glickman, 2011; Hallion & Ruscio, 2011). If not as a primary means of programme delivery, online resources and activities may have considerable utility in supplementing face-to-face training, while providing the practical advantages of reducing face-to-face time and programme costs. However, when designing computer-based delivery systems, programme developers should draw on the abundant computer-based training literature (e.g., Hallion & Ruscio, 2011; Kraiger & Jerden, 2007) to maximize the effectiveness of these efforts.

Finally, our findings underscore the effects of the decisions evaluators make when evaluating resilience-building programmes. Here, it is important to separate the actual effectiveness of programmes from the conclusions that are made and disseminated regarding their effectiveness. Evaluative decisions affect only the latter, and when they result in inaccurate conclusions, they can have serious consequences. In general, our findings suggest that more rigorous evaluations of resilience-building programmes have produced weaker effects. This should be expected, as more rigorous studies are better able to control for study artefacts. However, more rigorous evaluations are also more likely to estimate the 'true' effect of resilience-building programmes. Of course, the applied nature of organizational research often places limitations on evaluators' ability to use highly rigorous evaluative designs. Thus, the greatest utility of these findings may be in providing a reference for comparing future research. For example, researchers who are limited to within-participant designs should evaluate programme effectiveness in comparison with the mean effect for within-participant designs observed here (d = 0.49), while researchers using more rigorous designs should do the same, as appropriate (ds = 0.09–0.15).

Limitations and future directions

First and foremost, this study highlights limitations of the broader literature on resilience. It is well established that resilience involves successfully adapting to stress or adversity (e.g., Luthar *et al.*, 2000). However, there is some disagreement over the meaning of successful adaptation. Some have described it as 'bouncing back', and others, as maintaining normal functioning (see Werner, 1995; see also Bonanno, 2004). Both of these perspectives may be valid, and the appropriateness of one over the other is likely driven by the context. For example, bouncing back from acute traumatic experiences, such as those more common in high-risk occupations (e.g., combat soldiers, emergency responders), may be sufficient for labelling someone as having demonstrated resilience. Conversely, sustained functioning may better reflect resilience in the face of comparably mundane stressors that exist on a day-to-day basis. The idea that 'bouncing back' can be considered as a demonstration of resilience raises an additional issue – that is, it blurs the line between primary and secondary prevention in the context of operationalizing resilience-building. Consequently, there was no widely agreed upon set of criteria for clearly determining whether or not a programme constitutes a resilience-building effort. It is quite possible that future primary and meta-analytic research will take perspectives alternative to ours. Thus, a principal goal within the resilience literature, as a whole, should be better defining resilience as a construct,

and setting clear and agreed upon boundaries for what resilience-building efforts should entail.

This study also highlights the limitations of the organizational literature on resilience. A common theme throughout this study has been highlighting the rapid growth in popularity resilience-building has received recently, and potential for misconceptions being disseminated and built upon throughout this fledging literature. One of the primary purposes of this study was to combine existing theory and meta-analytic evidence in order to provide a foundation for moving the organizational resilience literature forward in a unified manner. We have identified a number of future research needs.

First, our findings suggest that resilience-based protective factors, which have mainly been identified among child populations, can have preventive effects across a wide range of stressors and sources of adversity. However, certain protective factors are likely more or less relevant to different types of stress and adversity (see French *et al.*, 1982). As described above, researchers have proposed that adults often face different types of adversity than children (e.g., Bonanno, 2004; Eidelson *et al.*, 2011). In the present study, we attempted to separate the effects of programmes conducted among military and non-military occupations, as a proxy for the potential differences in stressors across occupations. This dichotomy was likely too crude to identify any meaningful differences, but represents a limitation of the available data and conclusions we were able to draw from the present study. A primary need within the organizational literature is to better understand the specific types of stress associated with different categories of occupations and identify whether certain protective factors play a greater role in preventing the negative effects associated with those particular stressors. Doing so should contribute to greater effects on employee health and performance outcomes.

Second, key moderator findings indicate when resilience-building programmes are likely to be most effective and provide important practical implications for conducting these programmes in organizational settings in the future. For example, those considering implementing resilience-building programmes should attempt to identify who will benefit from the development of protective factors and carefully consider programme design aspects in order to produce optimal and lasting programme effects. In addition, evidence from studies using rigorous evaluative designs suggests that the effect of resilience-building programmes has been quite small. Given this, establishing the distal effects of programmes (1) conducted among appropriate populations and (2) rigorously evaluated may be most informative for estimating the true effectiveness of resilience-building efforts. Only two of the studies included in our analyses meet these criteria (Grime, 2004; Litz *et al.*, 2007), the distal effects of which were $d = 0.27$ and 0.58, respectively. Clearly, this is far too little evidence upon which to base any firm conclusions. However, this does draw much needed attention to the fact that further research evaluating targeted programmes through rigorous evaluative designs is needed to understand the potential value of resilience-building programmes within organizational settings. That being said, our findings also indicate the possible presence of publication bias among studies reporting distal effects. Thus, future research is needed to explicitly test whether our finding of an increased distal effect among targeted programmes was due to mechanisms such as frequent skill use and/or the creation of upward spirals in protective factor development, or was simply a function of publication bias.

In addition to these overarching limitations, there are a number of limitations to the present meta-analysis. First, we restricted our analyses to a set of moderators we felt were not only most important, but for which sufficient data were available. While several

potential moderators exist, the joint analysis results indicated moderators accounted for almost 50% of the variance in effect sizes. Future research may seek to explore additional factors that potentially influence programme effectiveness. Second, primary studies have evaluated resilience-building programmes against a wide range of criteria. To avoid violating the assumption of independence of observations, we integrated within-study effects across these various psychological and behavioural outcomes and used the integrated effects to conduct moderator analyses. Consequently, only broad conclusions can be drawn from our findings regarding the effects of programmes on relevant outcomes within the workplace. Through our outcome analyses, we attempted to provide greater insight into potential differences in programme effects across more refined, yet still broad, outcome categories. Findings did not indicate notable differences between outcome categories at either the proximal or distal time point. Moreover, the rank-order of effect size magnitudes was inconsistent across measurement time points, with effects being strongest (weakest) for performance (psychosocial deficit) outcomes when measured proximally, and vice versa when measured distally. Nonetheless, future research should explore whether potential moderators function differently across outcomes or whether programmes have differential effects across more specific outcomes, such as depression or PTSD. At present, existing evidence for doing so meta-analytically is limited.

Conclusion

This study provides meta-analytic evidence of the effectiveness of resilience-building programmes implemented in the workplace. Our findings suggest that the effectiveness of these programmes is similar to that of resilience-building interventions implemented among children (Brunwasser *et al.*, 2009). Moderator analyses indicate a number of factors that have contributed to programme effectiveness, and highlight the need to further research evaluating targeted resilience-building programmes using highly rigorous evaluative designs.

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Received 6 January 2015; revised version received 30 March 2015