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RESEARCH ARTICLE

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The influence of individual personality traits and team characteristics on training transfer: A longitudinal study

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Abstract

Previous research has established that the successful transfer of training content into daily work life depends both on the trainees' individual characteristics and the characteristics of their work team. Specifically, multiple meta-analyses and reviews have confirmed that individuals' openness to experience, agreeableness, and neuroticism, as well as cohesion and transfer climate within the team, influence training transfer. The present study is the first to operationalise and measure both individual and team characteristics in the same sample with a longitudinal study design, enabling a comparison. Training transfer was operationalised as changes in psychological strain following an intervention. Using multilevel analysis techniques with a sample of 275 nurses, individual personality characteristics were not found to influence training transfer, but team cohesion and team members' mean-level conscientiousness did. However, these influences were not in the expected direction. This can be partially explained by the pattern of longitudinal development in the data, in which individuals with higher initial values on psychological strain experienced greater improvement; however, some aspects of the results remained unexplained. Generally, the results

suggest that team characteristics are more important than individual characteristics for training transfer. Theoretical and practical implications for future studies are discussed.

INTRODUCTION

Across all types of work, organisations frequently conduct some form of on-the-job training aimed at improving either the performance or the psychological well-being of their employees (e.g., Hayes et al., 2004; Maddi et al., 1998; Shapiro et al., 2007; Slaski & Cartwright, 2003). However, it has been known for some time that such training does not always lead to actual changes in on-the-job behaviour—an observation that has been labelled the "transfer problem" (Baldwin & Ford, 1988; Burke & Hutchins, 2007; Ford & Weissbein, 1997) because it is believed to arise from insufficient transfer of the training content to daily work life. This leads to the following questions: Under which specific circumstances is training effective, and which factors influence training transfer?

Broadly defined, training transfer refers to the application of new information or behaviour from an intervention or training to daily work life (Burke & Hutchins, 2007). In practice, training transfer is rarely dichotomous in the sense that an intervention or training either has an effect or does not; instead, it is differential, in that individuals who participate in a training can experience anything from strong negative to strong positive effects (Burke & Hutchins, 2007; Cheng & Ho, 1999; Colquitt et al., 2000; Grossman & Salas, 2011). Essentially, training transfer can be seen as the extent to which a training results in the desired effect.

Past research has identified important factors influencing training transfer beyond the design of the training or the intervention itself (Rowe, 2000). It is well-accepted that the characteristics of the individuals participating in the training (e.g., extraversion) as well as the characteristics of the teams or organisations in which these individuals work (e.g., team cohesion) have been shown to affect training transfer (Blume et al., 2010; Burke & Hutchins, 2007; Cheng & Ho, 1999; Colquitt et al., 2000). However, many studies fail to take either the trainees' individual characteristics (Clarke, 2002; Hill et al., 2010; Velasco & Harder, 2014) or the influence of their team and work environment into account (Castillo-Gualda et al., 2019; Salas et al., 2008; Skodova & Lajciakova, 2013). Such studies are important for identifying which specific trainee or team characteristics influence training transfer, but do not enable a comparison between these two domains. Other studies aim to include both sets of factors by conceptualising team characteristics as aggregates of team members' individual characteristics (e.g., Sunaga et al., 2017). However, this omits aspects of the individual perspective and has conceptual problems, such as team characteristics often being considered as separate constructs that are conceptually distinct from team member characteristics (this will be discussed in more detail below).

Therefore, it is unknown under which circumstances and for which types of training one factor (individual trainee characteristics vs. team characteristics) is more important than the other. Such information is important to obtain because it can answer questions about how characteristics of the training itself can influence which factors related to the participant or work environment affect training transfer. In other words, seeing how various factors can have differential predictive power for transfer in different types of trainings might shed light on the origin of some of the inconsistent results in the literature regarding the influence of individual and team

characteristics on training transfer. Essentially, only a comparison of this type can shed light on moderation effects in training transfer and effectiveness.

Therefore, there is need in the literature on training transfer for studies that directly compare characteristics of the individual and characteristics of their work environment in terms of their ability to influence training transfer. Such a direct comparison has been called for multiple times in literature reviews on this issue. For example, Cheng and Ho (1999) maintain that "some new individual, motivational and environmental constructs are recommended to be incorporated in newly created models" (p. 115) and "(...) a set of critical constructs will be distilled" (p. 115), highlighting that the goal of new research should be to identify which factors are more important for training transfer and which play less of a role. Burke and Hutchins (2007) stated that "Research should theorize and assess training transfer as a multidimensional phenomenon with multilevel influences" (p. 287), with the latter referring to the fact that both individual and team characteristics influence training transfer simultaneously and independently. In addition, both reviews, along with older work (Baldwin & Ford, 1988; Ford & Weissbein, 1997), call for more longitudinal research to be conducted on training transfer. For these reasons, there is a need for longitudinal studies examining the influence of both individual and team characteristics on training transfer in order to find out which is the more influential factor.

It should also be noted that some studies suffer from a lack of generalizability due to using operationalisations of individual or team characteristics specific to the profession with which the study was conducted. For example, examining training transfer among managers and differential effects based on position and responsibility (Clarke & Higgs, 2016; Franke & Felfe, 2012) or training/program transfer among adolescents in schools as a function of their specific classroom-climate-based strain (Hampel et al., 2007) do not necessarily generalise to occupations without leadership responsibilities or individuals outside of school contexts. We aim to increase the generalisability of our results by operationalising individual and team characteristics as more abstract constructs that apply to virtually all individuals and groups (of which teams are a subset). This will be explained in detail below.

Overall, the present study adds to the literature on training transfer by examining the extent to which characteristics of individuals and their work teams influence training transfer after an intervention. We implemented the recommendations made in past work by conducting a longitudinal study and examining both individual and team characteristics in our sample, enabling a comparison between them.

Effects of personality and team characteristics on training transfer

Overviews and meta-analyses on training transfer

In the following sections, we summarise literature reviews and meta-analytic results of studies that have focused on training transfer and have assessed individual personality or team characteristics. In general, studies have examined either the influence of individual or team characteristics, but so far, these two levels of characteristics have not been directly compared in the same study. As a typical example and frequently cited review of early work, Cheng and Ho (1999) reported that effective transfer is based on individual-level and organisation- or team-level (often also termed environment-level) variables. The authors also explained that motivation variables and locus of control have been examined as predictors of training transfer at the individual level, but personality dimensions such as the Big Five have not yet been a focus of such studies. They

also explained that successful training transfer is more likely to occur when some form of social support and some form of what is often called "transfer climate," with members being more open to change and innovation, exist at the team level.

With the intention of creating an overarching theory of training motivation, Colquitt et al. (2000) conducted a meta-analysis with a large body of studies examining many different types of training (e.g., job skill trainings or active stress reduction interventions), in which differential training transfer effects were reported. The authors identified trait anxiety on the individual level and positive climate on the team level as relevant for training transfer. They reported that more anxious people had less successful transfer (and other training outcomes), while a more positive general organisational climate led to more successful transfer. The authors found mixed results for conscientiousness (from the Five Factor Model; McCrae & Costa, 1999), which had a positive relationship with motivation to learn but a negative relationship with skill acquisition in training. Their study once again underlined the relevance of both individual-level and team- or organisation-level factors for training transfer as both personality and climate explained variance in training transfer independently of one another and beyond several other more proximal predictors (e.g., self-efficacy). Overall, the authors argued that personality should be considered a particularly important antecedent of successful training transfer, and called for more research in this area: "(...) the fact that so few personality variables have been examined with great frequency suggests that much more research needs to be done in this area. Future research might expand the breadth of personality variables, possibly by examining trait goal orientation, other Big Five variables [i.e., other than conscientiousness; author's note], or affectivity" (p. 699).

Burke and Hutchins (2007) conducted an integrative review of the literature on training transfer (using studies examining a variety of training forms involving some form of skill acquisition) involving a closer inspection of individual characteristics, intervention design factors, and work environment characteristics. Individual characteristics found to be especially relevant included neuroticism (with a negative relationship with training transfer) and openness to experience (with a positive relationship with training transfer). Among the less influential factors, conscientiousness was identified as having "mixed support" (in line with Colquitt et al., 2000) and extraversion as having received only minimal attention in existing empirical research. Relevant work environment factors included a transfer climate (in line with Cheng & Ho, 1999), which describes a general climate of openness and encouragement for the acquisition and use of new skills, and peer support, which describes a climate of mutual support and high cohesiveness within the organisation or team. The effects of peer support were found to differ from those of supervisor support, as both could influence training transfer independently. The authors also once again stated that a comparison of multiple different factors in successful training transfer should be the focus of future research.

Finally, Blume et al. (2010) conducted a similar meta-analysis with a focus on measurement biases, as well as individual and work environment characteristics that predict training transfer. They conclude that, among work environment predictors, both social support and transfer climate have an association with transfer, with the relationship with support being slightly more consistent. Among individual-level predictors (with a focus on personality characteristics), conscientiousness and neuroticism were identified as particularly important; the former finding contradicts the findings of prior meta-analyses.

It should be noted that all meta-analyses examining differential training transfer effects only had access to studies assessing either individual-level or team-level influences, not both at the same time (as explained above). Therefore, what meta-analyses have achieved so far is to uncover critical constructs on each level. New insights into both levels could be gained by conducting a meta-analysis of multiple studies directly comparing individual-level and team-level influences

on training transfer; however, as previously mentioned, no such studies currently exist, and this paper aims to serve as a starting point for filling this gap.

Individual studies on training transfer

Our study examines an intervention aimed at reducing psychological strain. Therefore, in order to provide additional relevant information at this point, we summarise recent studies that have evaluated training transfer for interventions addressing psychological strain.

In a study that reported differential training effects of a burnout intervention program for oncology care providers (involving support group meetings in which work-related feelings were shared and problems were discussed), Le Blanc et al. (2007) found that changes in burnout over time covaried with changes in perceived job characteristics in the training group. However, effects based on personality or team characteristics were not explored. In a study with somewhat counterintuitive results, Beehr et al. (2015) found that individual responses to a training situation in which stress increased (a 3-month training program for soldiers aimed at increasing relevant skills and physical fitness) depended on individuals' neuroticism, which worked to *reduce* their stress response. This was unexpected, especially because individuals high in neuroticism had higher overall stress levels at the beginning of the program. Finally, in a study of the effectiveness of an intervention to reduce teacher burnout that sought to improve their socioemotional skills when interacting with students, Castillo-Gualda et al. (2019) found that teachers higher in agreeableness experienced a larger burnout reduction after the intervention. However, this study also did not assess differences in intervention effectiveness depending on team- or organization-level factors.

To sum up, the literature on effects of personality traits and team characteristics on training transfer has relatively clearly shown the importance of peer support and transfer climate. The literature is less clear on the importance of individual personality, although there is some evidence that openness to experience and agreeableness are beneficial for successful transfer and even for burnout reduction specifically, in the case of agreeableness (Castillo-Gualda et al., 2019). There is also evidence that neuroticism has an effect, although the direction is not clear-cut given the counterintuitive results found by Beehr et al. (2015). Similarly, conscientiousness has yielded mixed results concerning its importance for explaining differential training transfer effects. Taking these results into consideration, a comparison of individual and team characteristics as predictors of training transfer is a logical next step, which is also in line with the conclusions of prior literature reviews (Burke & Hutchins, 2007; Cheng & Ho, 1999; Colquitt et al., 2000).

Approach of the present study

The goal of the present study is to compare individual and team characteristics in their ability to uniquely predict training transfer by overcoming the limitations of the previous studies described above. For this purpose, we assessed individual and team characteristics, individual training transfer, and team membership in a sample of healthcare professionals before and 3 to 4, 7 to 8, and 11 to 12 months after they took part in a professional two-day training programme using a longitudinal multilevel modelling approach.

Individual characteristics were operationalised as individual personality traits from the HEXACO model (Ashton & Lee, 2007), which has been established as an alternative to the Five Factor Model (FFM) and has been shown to represent human personality more completely

(Ashton & Lee, 2019). This more complete representation is achieved through the addition of the Honesty-Humility dimension and a re-conceptualisation of the Neuroticism and Agreeableness dimensions (Ashton & Lee, 2009). Specifically, in the HEXACO model, Agreeableness is a combination of high FFM Agreeableness and high Emotional Stability, and high HEXACO Emotionality is a combination of low FFM Emotional Stability and high Agreeableness. Honesty-Humility has no direct counterpart in the FFM, but its highest correlation is with FFM Agreeableness. Overall, many FFM inventories have been shown to be lacking in at least one aspect captured by the HEXACO model and its corresponding inventories (Ashton & Lee, 2019). Team characteristics were operationalised with direct and indirect measurement approaches, which we aimed to differentiate as a secondary goal (for an overview, see Barrick et al., 1998; Dang & Ilgen, 2006).

The extant literature on personality defines individual personality characteristics as intra-individually (rank-)stable, abstract (non-reduceable), cross-situationally consistent latent influences on human perception and behaviour (for an overview, see: McCrae & Costa, 1999). In comparison, team characteristics are most often conceptualised with two different approaches. The first approach conceptualises team characteristics as composites, means, or extremes derived from and calculated based on individual group members' characteristics (for example, see: Barrick et al., 1998; Bell, 2007). The second approach conceptualises team characteristics as completely conceptually distinct from individual team members and their characteristics—this approach assumes that team characteristics are possessed uniquely by the team, are independent of the team's members (and their characteristics) and arise through different mechanisms (for an overview, see Chan, 1998). Since both approaches have been used in past research and come with distinct advantages and disadvantages, team characteristics were operationalised with both approaches in this study. This also makes it possible to compare these two approaches in this context, which we set as a secondary goal of the study. More details are given in the method section.

We operationalized training transfer as reductions in psychological strain following the aforementioned intervention. We essentially assumed that individuals who successfully transferred the intervention content into their daily work life would experience reduced psychological strain over time, with better transfer leading to greater reductions in psychological strain. This operationalisation of training transfer is overtly training-effectiveness focused, which a meta-analysis by Blume et al. (2010) has identified as a particularly strong and useful type of transfer operationalisation.

The training itself was based on empathy-based communication practices and self-reflection and is described in more detail in the Method section.

By using changes in psychological strain after the intervention as the dependent variable, we technically measure a training transfer *outcome* and not a training transfer *behaviour*. This operationalisation is the best one available to answer our research questions, because the exact behaviour change following the training likely differs from participant to participant, but these different behavioural and/or attitude changes are assumed to lead to the same outcome: reduced psychological strain. Given that the participants worked in different units/teams and faced very different challenges during their workdays, how exactly the training content could best be applied was highly subjective. This was reflected in the interactive aspects of the training, in which the participants were asked to apply the newly learned concepts to situations they had experienced in the past. We believe the end-goal of reduced psychological strain to be achievable through a behaviour (and attitude) change that can differ from person to person, as this ensures optimal person-need fit of the training content. Therefore, using reduced psychological strain (the goal of the training) as the dependent variable essentially "filters out" differences in how the training was applied and focuses on the actual intended outcome, making it a strong operationalisation,

as explained by Blume et al. (2010). How different behaviour and attitude changes lead to differences in this outcome is not the focus of this study and would require a completely different set of methods.

Our study is also one of the very few to examine an intervention targeting strain reduction in the first place, which is an area of training seldom studied. This enables us to draw conclusions about this specific type of training, which might raise new questions about how training type moderates the influence of individual and team characteristics on training transfer, as described above.

Based on the results found in the literature, we formulated the following hypotheses for our study: For individual personality, our hypotheses were that individual neuroticism would negatively influence training transfer after the intervention (although the direction of this influence was unclear in light of the mixed results in past research, there appeared to be slightly more evidence for a negative influence), and that agreeableness would positively influence training transfer. For team characteristics, our hypotheses were that team cohesion and transfer climate within the team would both positively influence training transfer. Concerning the broader comparison between individual personality and team characteristics, we had no hypotheses about one having a larger influence than the other (the differences in relationships reported by Blume et al. (2010) were not large enough in magnitude for us to conclude that one factor is more important than the other, especially given that other meta-analyses did not report such differences). Their influence was therefore quantified and compared without a directed hypothesis.

The full research model and relationships between constructs are summarized in Figure 1.

METHOD

Procedure

Intervention design

This study was part of a larger multicentric study examining the effectiveness of an intervention. This intervention aimed to reduce psychological strain in nurses and consisted of a two-day

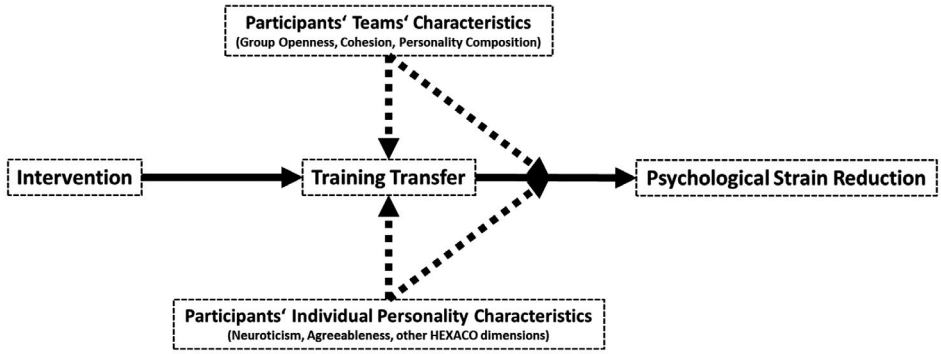

FIGURE 1 Shown here is the research model displaying the conceptual relationships between the intervention and the examined constructs. Team characteristics and individual characteristics influence training transfer and its relationship with the effective outcome of reduced psychological strain. Interaction terms with changes in psychological strain over time can therefore be seen as influences on training transfer, as reduced psychological strain cannot occur without some form of training transfer

professional training intervention, combined with a four-hour coaching session approximately three months later. The training focused on empathic responses in emotionally challenging interactions and long-term psychological effects of the so-called "empathic short circuit" on caregivers in such situations (Altmann & Roth, 2013). Through exercises targeting the perception of emotions and needs in oneself and others as well as communication exercises on these topics, the training aimed to reduce psychological strain stemming from maladjustment to the emotional demands of the nursing profession. The intervention's content and goals are summarized in Table 1, and more information about the intervention is given in Thiry et al. (2021).

Data collection and sample

Data were collected at four university hospitals in Germany at four evenly spaced measurement points (labelled t0, t1, t2, and t3) over the span of one year (with 3 to 4 months between waves on average) for both an intervention group and a control group. The intervention and control groups were recruited at different hospitals to ensure that the control group did not come into contact with the intervention or its content in any way. Participation was voluntary in both groups. To ensure that no self-selection bias was present for the intervention group, some restrictions were placed: The training dates were set in advance (restricting participation to nurses who were not working the respective shifts), 1 to 2 nurses per unit were required to participate in each training, unit leaders were required to participate, and which units would participate was pre-determined to ensure a broad selection of representative units. These restrictions were put in place to ensure that the training group did not only consist of nurses who perceived themselves as most in need of the training and therefore self-select into the study. Similar restrictions were in place for the control group to ensure relative equivalence in the selection process. Participants in the intervention group did not receive compensation for their participation, while participants in the control group received € 100.00 (approx. $ 122.00) after completing all four measurement waves. The first measurement occasion, t0, took place immediately before the intervention for the intervention group (see Table 2).

TABLE 1 Intervention content

Training day	Key components
Day 1, first half	• Raising awareness of the topic • Psychological mechanics of empathy and pseudo-empathy
Day 1, second half	• Partner and group exercises on describing behaviour without judgement and on recognising and describing emotions in oneself and others • Partner and group exercises on empathic listening • Theory of needs and strategies
Day 2, first half	• Partner exercises on empathic communication • Discussion of practical solution ideas
Day 2, second half	• Discussion of the utility and feasibility of empathic communication in difficult situations • Integrating the content into daily work life • Group and partner exercises using examples based on work experiences
Coaching session	• Discussing and solving practical issues and situations that occurred after the training • Recollection of key theoretical components

TABLE 2 Sample data for the intervention and control groups separately

	Measurement occasion	*N*	Dropout from t0	Dropout from previous occasion	Age *M* (SD)	Gender
Intervention group	t0	275			36.94 (11.00)	79.9% female
	t1	238	37	37		
	t2	198	77	40		
	t3	178	97	20		
Team analyses subsample	t0	245				
	t1	208	37	37		
	t2	169	76	39		
	t3	150	95	19		
Control group	t0	184			39.22 (11.34)	80.6% female
	t1	151	33	33		
	t2	143	41	8		
	t3	141	43	2		

Note: The "team analyses subsample" consisted of nurses from 38 teams for which we assessed three or more members at t0. On average, the sample comprised 28.12 per cent of each respective team.

Measures

All measures used in this study, including their items, response anchors, and instructions, were in German. In most cases, an already available translation was used, while in one case, a translation was created by the authors for the purpose of this study. More information is given in the respective subsection about each specific measure.

HEXACO-PI-R

We used the revised, 60-item version of the HEXACO Personality Inventory (HEXACO-PI-R; Ashton & Lee, 2009). The HEXACO model of personality has been established in recent years as an alternative to the Five Factor Model (Ashton & Lee, 2007, 2019; McCrae & Costa, 1999). The HEXACO model contains the dimensions Honesty-Humility (example item: "I would never accept a bribe, even if it were very large"), Emotionality (example item: "I sometimes can't help worrying about little things"), Extraversion (example item: "In social situations, I'm usually the one who makes the first move"), Agreeableness (example item: "I tend to be lenient in judging other people"), Conscientiousness (example item: "I often push myself very hard when trying to achieve a goal"), and Openness to Experience (example item: "If I had the opportunity, I would like to attend a classical music concert"). All six dimensions were rated on a 5-point Likert scale from 1 to 5, and the response anchors were worded as the German equivalent of *strongly agree*, *agree*, *neutral (neither agree nor disagree)*, *disagree*, and *strongly disagree*. The HEXACO-PI-R was applied at t0 only. Cronbach's alpha was acceptable for all scales (Honesty-Humility $\alpha = 0.68$, Emotionality $\alpha = 0.74$, Extraversion $\alpha = 0.62$, Agreeableness $\alpha = 0.66$, Conscientiousness $\alpha = 0.68$, Openness to Experience $\alpha = 0.71$). For the HEXACO-PI-R, lower Cronbach's alphas are expected and acceptable due to the breadth of content in each dimension. The six HEXACO dimensions are further divided into four facets each, which are in turn measured with just two or three items, respectively; therefore, item redundancies are reduced considerably compared to other measures, leading to lower Cronbach's alpha values (see also: Lienert & Raatz, 1998). This measure has been validated in the German language with a representative sample by Moshagen et al. (2014).

Group Openness and Cohesion Questionnaire

To measure group characteristics, we employed the relatively new Group Openness and Cohesion Questionnaire (GOCQ; Deckers et al., 2018). This instrument measures group characteristics on the dimensions of Group Openness and Cohesion, which are theorized to be fundamental to the characterisation of groups and applicable to all types of groups. Each individual team member was asked to rate their entire team on 10 items measuring Cohesion (example item: "In our team, problems can be freely brought up") and seven items measuring Group Openness (example item: "Bringing new ideas into our team is difficult"), all of which were rated on a 5-point Likert scale ranging from 1 to 5, with the response anchors being the German equivalent of *totally agree*, *mostly agree*, *somewhat agree*, *agree a little bit*, and *do not agree at all*.

The COCQ dimensions of Group Openness and Cohesion essentially represent generalised and broadly applicable forms of within-group social support and a transfer climate, respectively: Cohesion is conceptualised as mutual trust and affection among group members, thus

representing the group's "inward orientation." Group Openness is conceptualised as the group's consensual response to any outside changes or impulses affecting the group, representing the group's "outward orientation". These dimensions were conceptualised to be applicable to all types of groups rather than specific to any one type. This conceptualisation entails that the dimensions are essentially compounds of facets of groups' behavioural tendencies, making them highly abstract. This parallels the conceptualisation of individual-level personality characteristics, which are subdivided into facets, but are useful as composites of human behavioural tendencies that can be generalised across different individuals. Using a similar concept of group characteristics has the advantage of increasing the validity of the comparison being made in this study—however, it also comes with the disadvantage of not being facet-specific, which will be discussed in the limitations section, as it is potentially problematic in the case of Cohesion. Overall, Cohesion is a compound of different aspects of trust, affection and support within the group, while Group Openness is a compound of the group's attitudes and reactions to outside influences, which, in the case of an intervention, are the new information and new skills the intervention aims to teach. Group Openness can therefore be seen as a generalized version of transfer climate when it comes to interventions and trainings. Therefore, both Cohesion and Group Openness might be expected to affect changes in psychological strain/burnout following an intervention aimed at reducing burnout. Cronbach's alpha was good for both scales (Group Openness $\alpha = 0.90$, Cohesion $\alpha = 0.91$). Like the HEXACO-PI-R, the GOCQ was applied at t0 only. For more details on the GOCQ and its development, see Deckers et al. (2018).

Copenhagen Burnout Inventory

Psychological strain was operationalised with the Copenhagen Burnout Inventory (CBI; Kristensen et al., 2005). The CBI has been validated in contexts similar to the one in this study (for examples, see: Montgomery et al., 2021; Walters et al., 2018). The CBI differentiates between the facets of Personal Burnout (six items), Work-Related Burnout (seven items), and Client-Related Burnout (six items). Cronbach's alpha was good for all three facets (Personal Burnout $\alpha = 0.87$, Work-Related Burnout $\alpha = 0.86$, Client-Related Burnout $\alpha = 0.78$), and all three facets were rated on a 5-point Likert scale ranging from 0 to 4, with the same response anchors as for the GOCQ. Because this study was conducted in a hospital setting, the word "client" was replaced by the word "patient" for all items. All items retained their intended meaning after this replacement. A German translation of the CBI was created specifically for this study and its content equivalence was confirmed by native speakers of the German and English languages. The CBI was administered at all four measurement occasions (t0, t1, t2, and t3). Structural equation modelling was used to test for measurement invariance across the measurement occasions, with the highest order of invariance tested being scalar invariance, as this is a requirement for an analysis of change over time when multiple latent constructs are used (Little et al., 2016; Meredith, 1993; Vandenberg & Lance, 2016). Residual invariance (sometimes referred to as strict factorial invariance) was not tested, as violations of it are inconsequential for analyses of change over time (Cheung & Rensvold, 2002). Scalar invariance was confirmed through statistical comparisons of multiple structural equation models, with an unconstrained model (CMIN = 1959.270, DF = 596, RMSEA = 0.039) showing the same model fit as a model with measurement weights constrained (CMIN = 1992.794, DF = 644, RMSEA = 0.037) at $p = 0.94$, which in turn exhibited the same model fit as a model with structural covariances constrained (CMIN = 2000.205, DF = 662, RMSEA = 0.037) at $p = 0.99$.

Symptom Checklist-90

Psychological strain was also operationalised with the Symptom Checklist-90 (SCL-90-R; Derogatis & Unger, 2010; Franke, 2014). The SCL has been validated in contexts similar to that of this study (Schmitz et al., 2000) and has also been validated with a representative German sample (Hessel et al., 2001). Within the SCL, we employed the Somatisation subscale, which measures psychological strain expressed through psychosomatic symptoms such as stomach pain or headache. Somatisation comprises 12 items rated on a 5-point Likert scale, with respondents rating each symptom by answering the question "How much did you suffer from [symptom] in the last 7 days?" using the German equivalent of the response anchors *not at all*, *slightly*, *moderately*, *strongly*, and *very strongly*. Cronbach's alpha for Somatisation at t0 was good ($\alpha = 0.84$). The Somatisation scale was applied at all four measurement occasions (t0, t1, t2, and t3). As with the CBI, structural equation modelling was used to test for measurement invariance across the measurement occasions; scalar invariance was not tested, as only one latent factor was used. An unconstrained model (CMIN = 1040.864, DF = 216, RMSEA = 0.048) showed the same model fit as a model with measurement weights constrained (CMIN = 1042.896, DF = 249, RMSEA = 0.046) at $p = 0.57$.

Operationalisation of team-level variables

As mentioned in the introduction, this study also further differentiates team-level effects based on two different approaches to conceptualising and measuring group characteristics. In the direct approach, individuals directly rated their group's characteristics, and these ratings were then averaged for the group (for a detailed explanation, see Deckers et al., 2020). Thus, in this approach, group characteristic scores were calculated based on group members' direct ratings of the group characteristics of interest. In the indirect approach, the group members' individual personality self-ratings were aggregated as proxies for the group-level characteristic (e.g., Halfhill et al., 2005; Homan et al., 2008; Neuman et al., 1999; van Vianen & De Dreu, 2001). Thus, in this approach, group characteristic scores were calculated based on individual members' self-ratings and were therefore only indirect representations of the group characteristics, as no group characteristics were rated directly. This approach is common in the literature on group characteristics and typically employs group members' individual personality characteristics (for an overview, see Barrick et al., 1998; Dang & Ilgen, 2006). This approach also has been discussed critically (Chan, 1998; Dang & Ilgen, 2006; Deckers et al., 2020; Shoda et al., 2002).

In the present study, the GOCQ ratings (Deckers et al., 2018) were used to operationalise the direct approach, whereas the HEXACO-PI-R self-ratings were used to operationalise the indirect approach. It was important to ensure that the team-level variables we used represented the latent characteristic for the team to which each individual belonged to the greatest extent possible. To achieve this, we applied the following procedure to the GOCQ scores and HEXACO-PI-R scores: We calculated a new variable that assigned the mean ratings of all other team members on the Group Openness and Cohesion dimensions, as well as all six HEXACO dimensions, to the respective individual. In other words, on a team with four members (A, B, C, and D), for example, Member A was assigned the mean rating of Members B, C, and D on the GOCQ and HEXACO dimensions, and the same procedure was applied to Members B, C, and D, respectively. This procedure resulted in a team-level variable applied to each individual that served as the best available proxy for a latent team-level characteristic independent of the respective individual and

his or her perspective. This method was applied only to teams (from the intervention group) for which we assessed three or more members at t0, as mentioned above. By applying this procedure to both instruments' variables in the manner described above, (a) we could differentiate between these approaches in their ability to predict training transfer, while also (b) ensuring that the variables applied to each individual were the best available proxies for the latent group characteristic independently of how the individual would rate this characteristic him- or herself.

By applying this procedure, both the team mean of individual Openness to Experience from the HEXACO model and the team mean of the Group Openness ratings from the GOCQ can be seen as operationalisations of a transfer climate, given their underlying conceptualisations (Ashton & Lee, 2007; Deckers et al., 2018). Individuals high in Openness to Experience are inquisitive about new and unusual ideas and how they can be implemented creatively. Therefore, a team in which members' mean level of Openness to Experience is high can be expected to react more favourably to the intervention. The Group Openness scale from the GOCQ measures how the team reacts to any outside influence, including changes in how the team works and communicates.

It should be noted that other approaches to applying individual personalities to the team level exist, such as using the lowest or highest score within a team, or variability within a team, on a certain dimension (Bell, 2007). We decided against using these approaches, as we were rarely able to recruit full teams for this study (due to the time- and shift-related constraints nurses work under), and thus could not ensure that the team members with the highest or lowest scores were part of the sample. We also could not ensure that the variability was adequately represented for the same reason. Therefore, we decided to use the mean values of personality scores as the operationalisation of team personality (composition). Conceptually, this operationalisation makes the weakest out of a set of strong assumptions about the data from individuals who were not assessed. Since the number of teams assessed was rather large, the overall sample of means is likely to follow a normal distribution similar to that of the underlying population-level means. Therefore, the presence of team-level outliers within the sample is unlikely to affect the results as much as it would have if extremes were used instead, which are less likely to be adequately represented.

Analysis strategy

We used a repeated-measures multilevel analysis to analyse our data, for which dropout is far less relevant than it is for traditional analysis tools (e.g., repeated-measures ANOVA), because even individuals who participated in only the first wave of data collection can be used to estimate some of the parameters in the statistical models. In our analyses, data for each measurement occasion are "nested" within individuals, making the first level the measurement occasion level and the second level the individual level. The four dependent variables were Personal Burnout, Work-Related Burnout, Client-Related Burnout, and Somatisation. Separate analyses were carried out for each dependent variable; thus, a multivariate approach was not pursued. Analyses of the polynomial contrasts indicated that a linear trend sufficed for all dependent variables. Bottom-up model building (Hox et al., 2017) was used on the data, and we employed the restricted maximum likelihood (REML) method to estimate the model parameters.

Four models were sequentially applied for each dependent variable. These models and the statistical comparisons between them (where applicable) provided the following types of information: Model 1 (an intercept-only model) was used to calculate intraclass correlation coefficients

(ICCs), which indicate the relation between first-level and second-level variance in the model. In the case of longitudinal models, this shows how much of the overall variance in the data is accounted for by variance within individuals (representing change over time) and how much is accounted for by variance between individuals. Model 2 adds a term for the average rate of change over time to the intercept-only model as a fixed slope. Model 3 adds a term for random variance in the average rate of change over time to the previous model. This random slope term can then be tested statistically by comparing Model 2 and Model 3. If the test indicates statistically significant differences in the models' fit to the data, we can conclude that the variance of the slope is significant, which would indicate that individuals differ in their change in psychological strain over time. When analysing only the intervention group, such significant slope variance indicates variance in training transfer. Model 4 then adds interaction effects with Level 2 variables to the previous model. Model 4 can be used to test whether differences in each individual's rate of change over time can be explained by their membership to either the intervention or control group, serving as a test for differences between groups in the development of the dependent variables. When the entire procedure is applied only to the intervention group, Model 4 can be used to test whether differences in rates of change over time can be explained by other individual-level variables, such as personality traits or team traits (assigned to each individual using the procedure described above). Therefore, this analysis strategy allowed us to test for differences between the training and control groups (which were not the focus of this paper but needed to be taken into consideration nonetheless) as well as for differences in the development of psychological strain, and therefore training transfer, in the intervention group.

Team characteristics could only be meaningfully calculated for a subsample of the intervention group with participants from teams from which we assessed three or more members at t0. Therefore, all analyses involving team characteristics were done with this subsample and will be presented separately in the results section.

RESULTS

Comparisons between the intervention and control groups

The focus of this study is on differential training transfer effects within the intervention group. Still, an inspection of such differential effects is only meaningful if differences between the intervention and control groups emerged in the average rate of change over time as well as variance in the rate of change over time. The analysis strategy described above was used to obtain this information. The first set of analyses revealed significant differences in average slopes between the intervention and control groups for all dependent variables (all $ps < 0.05$), indicating that (on average) the variables developed differently in the training and control groups. For all four dependent variables (Personal Burnout, Work-Related Burnout, Client-Related Burnout, and Somatisation), the differences occurred in the expected direction, in that the intervention group either experienced reduced psychological strain or remained stable, whereas the control group experienced increased psychological strain. In detail, group assignment (intervention vs. control group) explained the following percentages of slope variance in each variable: 22.6 per cent for Personal Burnout, 9.1 per cent for Work-Related Burnout, 25.1 per cent for Client-Related Burnout, and 8.3 per cent for Somatisation. These values were computed to be interpretable parallel to an R^2 in OLS regression. A post hoc analysis of achieved power following the calculations described by Snijders and Bosker (2012) showed that a power of 96 per cent was achieved even

for small posttest effects of $d = 0.3$, given the sample size. Further analyses revealed that, in the control group, no dependent variables showed significant slope variance (all ps > 0.05), indicating that individuals in the control group did not differ from each other much in the development of their burnout symptoms or somatisation symptoms over time. This was not the case for the intervention group, in which significant slope variance was found for some but not all variables; the next sections will provide further details.

It should also be noted that the differences that emerged between groups in the average trend over time were not the same for each measurement. In short, for Personal Burnout and Somatisation, the control group remained constant while the training group improved, and for Work-Related and Client-Related Burnout, the training group remained constant while the control group deteriorated (therefore, all differences were indicative that the training was effective, albeit in different ways). These differential effects can only be interpreted by taking a very detailed look at the training content, which is beyond the scope of this paper, but the observation itself is important evidence against a general regression to the mean in the data (which would affect all observations in the same way, creating a "parallelism" between the differences) and therefore should not go unmentioned.

Training transfer and individual personality

Because the models for individual personality characteristics as Level 2 predictors were calculated using the full intervention group sample, whereas the models for team characteristics as Level 2 predictors were calculated using a subsample (as described above), the former will be presented first and in their own section. For two of the four dependent variables, Client-Related Burnout and Somatisation, significant slope variance was not found (in the full intervention group sample), with the model fit differences failing to reach statistical significance (both ps > 0.05). In other words, individuals in the intervention group did not differ significantly in how their Client-Related Burnout and Somatisation developed over time and therefore did not show differences in training transfer for those variables. We therefore decided to present tables only for the dependent variables Personal Burnout and Work-Related Burnout, for which significant slope variance was found (see Tables 3 and 4, respectively).

The statistical comparison of model fits for Models 2 and 3 in Table 3 was significant ($p < 0.01$), which indicates that the variation in slopes between individuals should be integrated into the model, as this model fit the data significantly better than a model without this variation. In other words, there was statistically significant variation in change over time between individuals for Personal Burnout, indicating differences in training transfer for this variable. Model 3 also contains the correlation between the intercepts and slopes of this random slope model ($r_{u_{01}}$). The negative value of −0.067 indicates that the regression slopes form a "fanning in" pattern, meaning that there is more variance between individuals at the earliest measurement occasion (which is coded as 0 and therefore equal to the y-axis) than at later measurement occasions. In other words, individuals in the intervention group who start with a higher Personal Burnout score at t0 tend to experience greater declines in scores over time than individuals who start with a lower Personal Burnout score at t0. This is not an absolute effect, which would have been indicated by an $r_{u_{01}}$ close or equal to 1, but rather an average tendency. By itself, this result indicates that individuals in the intervention group with higher Personal Burnout at baseline had better training transfer on average. It is very important to point out that this pattern, in which the regression

TABLE 3 Multilevel model parameters for personal burnout as the dependent variable and the individual HEXACO characteristics as level 2 predictors

Model	Model 1: Intercept only	Model 2: +Occasion	Model 3: +Random slope occasion	Model 4: +Level 2 predictors		
Predictor	**Coefficient (SE)**	**Coefficient (SE)**	**Coefficient (SE)**	**Coefficient (SE)**	**Standardised (Model 4)**	**Significance (Model 4)**
Fixed part						
Intercept	1.9530 (0.0381)	2.0190 (0.0400)	2.0193 (0.0394)	2.0122 (0.0360)		$p < 0.01$
Measurement occasion		−0.0565 (0.0111)	−0.0567 (0.0126)	−0.0557 (0.0126)	−0.0912	$p < 0.01$
Honesty-humility				−0.1504 (0.0721)	−0.1140	$p < 0.05$
Emotionality				0.3362 (0.0750)	0.2440	$p < 0.01$
Extraversion				−0.2938 (0.0855)	−0.1899	$p < 0.01$
Agreeableness				−0.1697 (0.0823)	−0.1174	$p < 0.05$
Conscientiousness				−0.0312 (0.0769)	−0.0223	$p = 0.69$
Openness to experience				−0.0087 (0.0635)	−0.0073	$p = 0.89$
Honesty-humility × Occasion				0.0243 (0.0264)	0.0311	$p = 0.36$
Emotionality × Occasion				0.0143 (0.0272)	0.0176	$p = 0.60$
Extraversion × Occasion				0.0489 (0.0295)	0.0556	$p = 0.10$
Agreeableness × Occasion				0.0342 (0.0279)	0.0417	$p = 0.22$
Conscientiousness × Occasion				−0.0116 (0.0268)	−0.0141	$p = 0.67$
Openness to Experience × Occasion				−0.0032 (0.0229)	−0.0045	$p = 0.89$
Random part						
σ^2_e	0.1230	0.1188	0.1029	0.1032		
$\sigma^2_{u_0}$	0.3471	0.3435	0.3430	0.2724		
$\sigma^2_{u_1}$			0.0103	0.0102		
$r_{u_{01}}$			−0.067	0.019		

Note: The ICC for personal burnout in this analysis was 0.735 (calculated from Model 1) and was significant at the $p < 0.001$ level.

TABLE 4 Multilevel model parameters for work-related burnout as the dependent variable and individual HEXACO characteristics as level 2 predictors

Model	Model 1: Intercept only	Model 2: +Occasion	Model 3: +Random slope occasion	Model 4: +Level 2 predictors		
Predictor	**Coefficient (SE)**	**Coefficient (SE)**	**Coefficient (SE)**	**Coefficient (SE)**	**Standardised (Model 4)**	**Significance (Model 4)**
Fixed part						
Intercept	1.6220 (0.0372)	1.6208 (0.0396)	1.6220 (0.0397)	1.6178 (0.0375)		$p < 0.01$
Measurement occasion		0.0010 (0.0114)	0.0013 (0.0130)	−0.0008 (0.0131)	−0.0014	$p = 0.95$
Honesty-humility				−0.1415 (0.0750)	−0.1104	$p = 0.06$
Emotionality				0.2090 (0.0780)	0.1562	$p < 0.05$
Extraversion				−0.2967 (0.0889)	−0.1976	$p < 0.01$
Agreeableness				−0.1885 (0.0856)	−0.1343	$p < 0.05$
Conscientiousness				0.0236 (0.0799)	−0.0174	$p = 0.77$
Openness to experience				0.0065 (0.0661)	−0.0057	$p = 0.92$
Honesty-humility × Occasion				−0.0101 (0.0273)	−0.0134	$p = 0.71$
Emotionality × Occasion				0.0132 (0.0282)	0.0168	$p = 0.64$
Extraversion × Occasion				0.0326 (0.0306)	0.0381	$p = 0.29$
Agreeableness × Occasion				0.0412 (0.0289)	0.0518	$p = 0.15$
Conscientiousness × Occasion				−0.0304 (0.0278)	−0.0384	$p = 0.27$
Openness to Experience × Occasion				0.0154 (0.0237)	0.0226	$p = 0.52$
Random part						
σ^2_e	0.1245	0.1247	0.1060	0.1062		
$\sigma^2_{u_0}$	0.3298	0.3298	0.3461	0.2987		
$\sigma^2_{u_1}$			0.0122	0.0123		
$r_{u_{01}}$			−0.198	−0.169		

Note: The ICC for work-related burnout in this analysis was 0.716 (calculated from Model 1) and was significant at the $p < 0.001$ level.

lines fan in, thereby representing a tendency for individuals with higher initial psychological strain to improve more, was not found in the control group. These findings were also in line with the aforementioned finding of no significant slope variance for the dependent variables in the control group, indicating that the patterns found in the intervention group are meaningful and not a product of chance.

Regression to the mean also cannot account for the finding of the fanning in pattern, given that the average trend over time in the variables is not 0, which indicates a mean change over time. In other words, the mean at t0 is not the value the data regress towards at later measurement occasions, making is unlikely that regression to the mean accounts for the fanning in pattern. Additionally, no significant differences in psychological strain at the first measurement occasion were observed between groups for any measurement (all $p > 0.05$), ruling out the possibility that only one of the samples was an extreme observation at the beginning of the study.

Because of the interaction terms in Model 4 and the coding scheme of the measurement occasion variable, the direct effects describe influences of the HEXACO dimensions on the dependent variable at t0 (before the intervention). Four of the HEXACO dimensions turned out to be significant predictors of Personal Burnout at t0 (see Table 3): higher Honesty-Humility, lower Emotionality, higher Extraversion, and higher Agreeableness were all associated with a lower Personal Burnout score (all ps < 0.05). The standardised coefficients showed that the effect of Emotionality was strongest.

In Table 3, Model 4 yielded no statistically significant interaction terms. This indicates that no individual personality characteristic in the HEXACO model moderated the strength of the rate of change over time in Personal Burnout, indicating no influence of individual personality on training transfer.

The random variance terms estimated in Models 3 and 4 (Table 3) confirmed the interpretation that the HEXACO dimensions influenced Personal Burnout scores only at t0 and did not explain variation in changes over time: The slope variance $\sigma^2_{u_1}$ and the residual individual-level variance σ^2_e barely changed from Model 3 to Model 4, whereas the intercept variance $\sigma^2_{u_0}$ (which refers to variance at t0) decreased considerably from 0.3430 to 0.2724. For Model 4, the variance terms capture the variance that is not explained by the predictors in the model, facilitating interpretation.

As Table 4 shows, the results were slightly different for Work-Related Burnout in terms of direct effects. Honesty-Humility did not have a significant direct effect on Work-Related Burnout at t0, whereas lower Emotionality, higher Extraversion, and higher Agreeableness were associated with lower Work-Related Burnout at t0 (all ps < 0.05). Extraversion had the strongest effect.

As was the case for Personal Burnout, Model 4 did not reveal any significant interaction terms for Work-Related Burnout or the individual HEXACO characteristics. Once again, the slope variance $\sigma^2_{u_1}$ barely changed at all between Models 3 and 4 (changing only from 0.0122 to 0.0123), further indicating that no slope variance was explained by the HEXACO variables. The average slope for Work-Related Burnout was close to 0, and the intercept-slope correlation $r_{u_{01}}$ was negative, once again indicating that the regression lines exhibited a pattern of fanning in.

For the dependent variables not shown in the tables (i.e., Client-Related Burnout and Somatization), no significant slope variance was found. A significant interaction effect was found for Agreeableness and Somatisation, but this interaction effect should not be interpreted because

the absence of significant slope variance indicates that the interaction effect was the result of random chance. In terms of direct effects, higher Extraversion and Agreeableness were associated with lower Client-Related Burnout at t0, whereas higher Agreeableness and lower Neuroticism were associated with lower Somatisation at t0.

In terms of the goal of this study, these results indicate a general lack of influence of individual personality on training transfer because no HEXACO characteristics of the participants in the intervention group explained any slope variance in Personal or Work-Related Burnout.

Training transfer and team characteristics

The results of the models containing team characteristics as Level 2 predictors are displayed in Tables 5 and 6. Once again, only the results for Personal Burnout (Table 5) and Work-Related Burnout (Table 6) are shown in the tables, as only these variables were shown to have significant slope variance. The results were obtained for a subsample of the intervention group, as described above.

As shown in Table 5, a significant direct effect was found for team mean Cohesion, with higher values significantly predicting lower Personal Burnout at t0 ($p < 0.05$). All other direct effects were nonsignificant.

The average regression line for Personal Burnout was slightly negative, and the interaction effects showed that higher team mean Cohesion ratings and higher team mean Conscientiousness self-ratings significantly predicted a flatter regression line for Personal Burnout scores (both ps < 0.05). In other words, higher team mean Cohesion ratings and higher team mean Conscientiousness self-ratings were associated with less drastic changes in Personal Burnout over time, which indicates less training transfer. This potentially counterintuitive result will be elaborated on in the discussion section.

For Work-Related Burnout (Table 6), higher team mean Extraversion significantly predicted lower Work-Related Burnout at t0 ($p < 0.05$). All other direct effects were nonsignificant.

Significant interaction effects for Work-Related Burnout were found parallel to those for Personal Burnout: Higher team mean Cohesion ratings and higher team mean Conscientiousness self-ratings significantly predicted a flatter regression line (both ps < 0.05). Because the direct effects of these two predictors were nonsignificant, this result can only be partially explained, which will also be elaborated on in the Discussion.

For Client-Related Burnout and Somatisation (not shown in the tables), no significant slope variance was found in this subsample either, making any significant interaction effects impossible to interpret; regardless, none were found.

Concerning the goal of this study, these results indicate a limited importance of team characteristics for training transfer, as a team's Cohesion and mean Conscientiousness were able to predict slope variance in Personal and Work-Related Burnout. Combined with the fact that individual personality was found to be completely irrelevant for training transfer, the results indicate that team characteristics seem to be more relevant than individual characteristics for training transfer, at least among the characteristics examined in this study (this interpretation comes with a few caveats; for details, see the discussion section). Concerning differences between the direct and indirect approaches to conceptualising and measuring team characteristics, no clear results emerged, as variables from both approaches significantly predicted differences in training transfer.

TABLE 5 Multilevel Model Parameters for Personal Burnout as the Dependent Variable and Team Characteristics as Level 2 Predictors

Model	Model 1: Intercept only	Model 2: +Occasion	Model 3: +Random slope occasion	Model 4: +Level 2 predictors		
Predictor	**Coefficient (Standard Error)**	**Coefficient (Standard Error)**	**Coefficient (Standard Error)**	**Coefficient (Standard Error)**	**Standardised (Model 4)**	**Significance (Model 4)**
Fixed part						
Intercept	1.9720 (0.0406)	2.0333 (0.0426)	2.0338 (0.0421)	2.0327 (0.0416)		$p < 0.01$
Measurement occasion		−0.0546 (0.0122)	−0.0552 (0.0139)	−0.0528 (0.0134)	−0.0853	$p < 0.01$
Team mean cohesion (self excluded)				−0.2574 (0.1197)	−0.1764	$p < 0.05$
Team mean group openness (self excluded)				0.1576 (0.1121)	0.1141	$p = 0.16$
Team mean honesty-humility (self excluded)				0.1769 (0.1776)	0.0689	$p = 0.32$
Team mean emotionality (self excluded)				0.1423 (0.1739)	0.0558	$p = 0.41$
Team mean extraversion (self excluded)				−0.3371 (0.1880)	−0.1144	$p = 0.07$
Team mean agreeableness (self excluded)				−0.2710 (0.2359)	−0.0871	$p = 0.25$
Team mean conscientiousness (self excluded)				−0.1526 (0.2187)	−0.0493	$p = 0.49$
Team mean openness to experience (self excluded)				−0.1258 (0.1417)	−0.0539	$p = 0.38$
Team mean cohesion (self excluded) × occasion				0.1305 (0.0394)	0.1527	$p < 0.01$
Team mean group openness (self excluded) × occasion				−0.0150 (0.0390)	−0.0181	$p = 0.70$
Team mean honesty-humility (self excluded) × occasion				−0.0104 (0.0578)	−0.0068	$p = 0.86$
Team mean emotionality (self excluded) × occasion				−0.0828 (0.0637)	−0.0540	$p = 0.19$
Team mean extraversion (self excluded) × occasion				−0.0055 (0.0614)	−0.0032	$p = 0.93$

(Continues)

TABLE 5 (Continued)

Model	Model 1: Intercept only	Model 2: +Occasion	Model 3: +Random slope occasion	Model 4: +Level 2 predictors		
Predictor	**Coefficient (Standard Error)**	**Coefficient (Standard Error)**	**Coefficient (Standard Error)**	**Coefficient (Standard Error)**	**Standardised (Model 4)**	**Significance (Model 4)**
Team mean agreeableness (self excluded) × occasion				−0.0244 (0.0756)	−0.0134	$p = 0.75$
Team mean conscientiousness (self excluded) × occasion				0.1494 (0.0707)	0.0819	$p < 0.05$
Team mean openness to experience (self excluded) × Occasion				−0.0474 (0.0571)	−0.0330	$p = 0.41$
Random part						
σ^2_e	0.1260	0.1223	0.1045	0.1046		
$\sigma^2_{u_0}$	0.3553	0.3513	0.3546	0.3524		
$\sigma^2_{u_1}$			0.0116	0.0087		
$r_{u_{01}}$			−0.091	−0.021		

Note: The ICC for personal burnout in this analysis was 0.736 (calculated from Model 1) and was significant at the $p < 0.001$ level.

TABLE 6 Multilevel model parameters for work-related burnout as the dependent variable and team characteristics as level 2 predictors

Model	Model 1: Intercept only	Model 2: +Occasion	Model 3: +Random slope occasion	Model 4: +Level 2 predictors		
Predictor	**Coefficient (SE)**	**Coefficient (SE)**	**Coefficient (SE)**	**Coefficient (SE)**	**Standardised (Model 4)**	**Significance (Model 4)**
Fixed part						
Intercept	1.6456 (0.0404)	1.6386 (0.0428)	1.6402 (0.0432)	1.6412 (0.0429)		$p < 0.01$
Measurement occasion		0.0062 (0.0125)	0.0028 (0.0145)	0.0044 (0.0141)	0.0072	$p = 0.76$
Team mean cohesion (self excluded)				−0.1934 (0.1233)	−0.1345	$p = 0.11$
Team mean group openness (self excluded)				0.1193 (0.1155)	0.0877	$p = 0.30$
Team mean honesty-humility (self excluded)				0.1436 (0.1830)	0.0568	$p = 0.43$
Team mean emotionality (self excluded)				0.1108 (0.1792)	0.0441	$p = 0.54$
Team mean extraversion (self excluded)				−0.4099 (0.1937)	−0.1411	$p < 0.05$
Team mean agreeableness (self excluded)				−0.0110 (0.2431)	−0.0036	$p = 0.96$
Team mean conscientiousness (self excluded)				−0.2882 (0.2254)	−0.0946	$p = 0.20$
Team mean openness to experience (self excluded)				−0.0799 (0.1459)	−0.0347	$p = 0.58$
Team mean cohesion (self excluded) × occasion				0.0955 (0.0415)	0.1136	$p < 0.05$
Team mean group openness (self excluded) × occasion				0.0083 (0.0411)	0.0102	$p = 0.84$
Team mean honesty-humility (self excluded) × occasion				−0.0672 (0.0610)	−0.0450	$p = 0.27$
Team mean emotionality (self excluded) × occasion				−0.1213 (0.0669)	−0.0803	$p = 0.07$
Team mean extraversion (self excluded) × occasion				0.0254 (0.0648)	0.0150	$p = 0.70$

(Continues)

TABLE 6 (Continued)

Model	Model 1: Intercept only	Model 2: +Occasion	Model 3: +Random slope occasion	Model 4: +Level 2 predictors		
Predictor	**Coefficient (SE)**	**Coefficient (SE)**	**Coefficient (SE)**	**Coefficient (SE)**	**Standardised (Model 4)**	**Significance (Model 4)**
Team mean agreeableness (self excluded) × occasion				−0.0450 (0.0799)	−0.0251	$p = 0.57$
Team mean conscientiousness (self excluded) × occasion				0.1726 (0.0746)	0.0961	$p < 0.05$
Team mean openness to experience (self excluded) × occasion				−0.0754 (0.0597)	−0.0534	$p = 0.21$
Random part						
σ^2_e	0.1293	0.1294	0.1074	0.1067		
$\sigma^2_{u_0}$	0.3489	0.3494	0.3736	0.3648		
$\sigma^2_{u_1}$			0.0145	0.0124		
$r_{u_{01}}$			−0.237	−0.193		

Note: The ICC for work-related burnout in this analysis was 0.721 (calculated from Model 1) and was significant at the $p < 0.001$ level.

DISCUSSION

Summary of goals and results

This study was conducted to examine differential training transfer effects following an intervention aimed at reducing burnout symptoms. After the intervention, changes in burnout symptoms and somatisation over time were used to operationalise training transfer. Both individual personality as measured with the HEXACO dimensions and team characteristics were tested as predictors of training transfer. The team characteristics tested here were team-level means of individual HEXACO characteristics and team-level means of cohesion and group openness ratings. The goal in measuring these team characteristics with two different approaches was to differentiate their ability to predict training transfer, as both were assumed to capture aspects of transfer climate and team cohesion.

For the individual-level personality dimensions as predictors, there were no significant interactions for the subscales with significant slope variance, indicating that none of the HEXACO dimensions influenced changes in burnout over time and therefore influenced training transfer. Therefore, our hypotheses that agreeableness and emotionality would affect training transfer were not confirmed.

For the team-level characteristics as predictors, significant interaction effects with training transfer were found. In the intervention group, higher team cohesion and higher team mean conscientiousness were both associated with smaller (i.e., flatter) decreases in personal and work-related burnout. No interaction effects were found for client-related burnout or somatisation, which may have been because neither variable exhibited significant slope variance in its development over time that could have been explained by other variables. For team mean conscientiousness, we did not pose any interaction hypotheses. Our hypotheses that higher team group openness and higher team means on individual openness to experience would influence training transfer were not confirmed because no significant interactions were found for either variable. Overall, these results point toward the importance of a team's cohesion and the mean conscientiousness of its members for training transfer. These results and their unexpected direction will be discussed in detail below.

Concerning the main goal of this study, comparing individual characteristics and team characteristics in their ability to predict training transfer, the results indicate a higher (but still rather limited) importance of team characteristics for training transfer, as significant interactions with training transfer were found only for these variables. As explained in the method section, we split the analyses for each variable into one analysis for the individual-level predictors and another for the team-level predictors. These analyses can be compared in terms of significance and effect size (explained slope variance) because the variables used in each are highly unlikely to be intercorrelated: Past research has shown that calculating team-level variables using the procedure applied here causes them to be independent of the characteristics of the individuals rating them (Deckers et al., 2020)—in other words, intercorrelations, which are the main reason why comparisons between different models are usually not permissible (Hox et al., 2017; Judd et al., 2017), likely do not play a role here. Together, the results that no significant interactions were found for the individual HEXACO domains and no slope variance was explained by them, yet significant interaction effects were found for some team characteristics and these were able to explain slope variance, lead us to conclude that team characteristics play a larger (but, as mentioned, still rather limited) role in predicting training transfer in this specific context than individual personality does. Concerning differences between the direct and indirect approaches

to conceptualising and measuring team characteristics in their ability to predict training transfer, the two approaches were found to uniquely predict different aspects of training transfer, indicating that neither approach is superior to the other, at least in this regard.

Interactions between training transfer and individual and team characteristics

Absence of significant interactions for individual personality traits

The fact that no significant interactions were found for any of the HEXACO domains was surprising with respect to agreeableness: We expected that agreeableness would influence training transfer, as a similar result was found in a prior study with teachers that also involved a burnout-reducing intervention (Castillo-Gualda et al., 2019). However, our study did not yield similar results. Our results might therefore be highly specific to the nursing profession, which relies more heavily on teamwork than teaching does (Kalisch et al., 2010). This would explain why we only found effects of team characteristics, and not individual characteristics, on training transfer. Additionally, people high in openness to experience tend to value learning because they are inquisitive and creative, and this may have resulted in better training transfer. However, such a result has not been found in past studies.

Significant interaction effects for team characteristics

The only interpretable interaction effects were found for personal burnout and work-related burnout. In both cases, seemingly positive team characteristics (higher cohesion and higher mean conscientiousness) were associated with smaller (i.e., flatter) decreases in personal burnout and work-related burnout following the intervention; in other words, the intervention was less effective, and therefore the transfer of the training effect was weaker. This result needs to be interpreted in light of the fact that the correlations between the intercepts and slopes of the models were negative, which indicates a pattern of "fanning in" for the regression lines: Individuals with higher initial values on personal or work-related burnout at the first measurement occasion also experienced larger decreases in personal and work-related burnout over the course of the study.

Keeping this in mind, the results for cohesion and its influence on personal burnout fit together quite well: Individuals from teams where cohesion was higher already reported less personal burnout before the intervention (direct effect), leaving less room for improvement; therefore, those same individuals also exhibited less improvement in personal burnout following the intervention (interaction effect), indicating a weaker transfer of the training, which is in line with the regression line pattern of fanning in. A ceiling effect cannot fully explain this phenomenon, as only eight individuals reported personal burnout values near the low point of the scale (with values between 0 and 1 on a scale that went up to 4) before the intervention.

The results were less clear for team mean conscientiousness and its influence on personal burnout. Members of teams for which mean conscientiousness was higher also improved in personal burnout significantly less over the course of the study, a finding that is in line with the overall regression line pattern. However, those same persons did not report lower levels of personal burnout before the intervention. A possible explanation might lie in the standardised regression

coefficients, which showed that the effects of cohesion were generally larger than for group mean conscientiousness. Because of this, the direct effect of group mean conscientiousness on personal burnout, which could be very small at the population level, might not have been detected because the power of the test was too low.

The effects for work-related burnout were even more challenging to interpret: On average, individuals with higher initial values improved more (as indicated by the negative intercept-slope correlation). However, the individuals who improved more came from teams where cohesion and mean conscientiousness were lower (as indicated by significant interaction effects and their direction), whereas those same individuals were not the ones who reported higher work-related burnout before the intervention (as indicated by nonsignificant direct effects).

Whereas the general pattern of the regression models painted a clear picture of the largest improvements in burnout happening where there was the most room for them, the specific influences on initial values and interaction patterns were mostly incomplete and counterintuitive. This may have been the case because they were governed by completely different mechanisms and influences than the ones addressed in this study – or it might point to general reliability issues with these results. One possible explanation for the finding that, in general, less strained individuals also improved less is that these individuals might have believed they did not personally need the training, and thus transferred less of its content into their daily work life. A formative evaluation of the training had shown that participants rated it as practically relevant and useful; however, this does not necessarily mean that low-strain individuals perceive themselves as needing the training, leading to lower transfer among this group. The idea that individuals only transfer training content if they actively perceive themselves as needing it has been explained by Blume et al. (2019).

Another unexpected result was that neither team-level group openness nor the team means of individual openness to experience influenced the development of the facets of burnout or somatization over time. The literature has repeatedly demonstrated the importance of the transfer climate for the transfer of training effects and training effectiveness (Burke & Hutchins, 2007; Velasco & Harder, 2014). Moreover, the conceptualisation of (a) the group openness dimension and (b) the individual personality dimension of openness to experience when applied to the group level both fit the idea of a transfer climate quite well. Nevertheless, no interaction effects were found for either variable. It is possible that training transfer is less dependent on this specific group characteristic than initially assumed because the group's cohesion matters more, which would explain why we only found effects for cohesion and not for any operationalisation of the transfer climate. The group openness dimension of the GOCQ was conceptualised to better reflect a group's "outward orientation" than possible with group means of individual personality characteristics (e.g., the group mean of openness to experience) (Deckers et al., 2018). However, this study found no effects of either operationalisation.

Based on the existing literature on training transfer (Burke & Hutchins, 2007; Cheng & Ho, 1999; Ford & Weissbein, 1997), we expected that both individual and team characteristics would predict training transfer, but we did not expect either to be clearly superior to the other because no previous studies had ever compared these characteristics in the same study. The fact that no significant interactions predicting training effectiveness were found in the present study for the individual personality traits, but some interaction effects were found for the team characteristics, might indicate that team characteristics are generally more important for the successful transfer of training effects than individual characteristics. However, given that the nursing profession relies heavily on constant teamwork, the results might differ for other professions. As mentioned in the introduction, these effects (especially the unexpected absence of individual-level influences

on training transfer) might also be specific to strain reduction interventions, raising the question of how training, trainee and team characteristics interact to influence training transfer.

Implications for conceptualisations of group-level characteristics

When examining the team characteristics, we also sought to compare the direct and indirect approaches to conceptualising and measuring these team characteristics (for an overview, see Deckers et al., 2020). In this study, we found evidence for the importance and merit of both approaches—both team-level means of individual personality characteristics and team-level means of team characteristic ratings were found to influence training transfer (and were also associated with differences in psychological strain cross-sectionally). Future research should try to incorporate both approaches when aiming to explain other group-level phenomena because they both seem to provide unique insights into groups' characteristics and dynamics.

Limitations of the study and directions for future research and practice

It should be noted that the low reliabilities of the HEXACO-PI-R found in this study might have attenuated the observed effects of individual personality on training transfer. While such lower reliabilities are frequently observed with short versions of personality inventories and are often considered acceptable, as explained above (Lienert & Raatz, 1998), it is nevertheless possible that stronger effects might have been observed with higher reliabilities. The use of long versions of personality inventories should therefore be considered in future research in this area.

Concerning the comparisons between individual and team characteristics, there are multiple very specific aspects allowing for their interpretability, namely the absence of intercorrelations between the variables in the analyses, combined with the finding that individual characteristics exhibited no significant interactions with measurement occasion and could not explain any slope variance, while team characteristics did exhibit some significant interactions with measurement occasion and were able to explain slope variance. However, the fact that a model including all variables (especially at their respective levels without aggregation or disaggregation) is identified better by definition should be mentioned, as it demonstrates the limitation of our approach: We were mainly concerned that an analysis involving 14 different variables and their interaction terms and being based on the slightly smaller sample of individuals from teams represented by three or more members would have too little power. In addition, the disaggregation of the team-level characteristics described in the method section is not the only way of operationalising the team level; while this method comes with the advantages described in the respective section and here, a three-level model with fully defined team mean variables assigned to each team and individual therein would also have been an option. However, such a model would likely require even larger samples than available here at all levels (Snijders & Bosker, 2012), and would be more difficult to specify and interpret, especially with respect to cross-level interactions and the practical implications of the results. Nevertheless, the approach we took is a compromise that comes with some limitations, which can only be overcome in future work with much larger sample sizes involving complete teams. Such a sample would enable an analysis of all variables in a single fully identified model.

Of the dependent variables that showed significant slope variance and therefore variance in their change over time, only a small proportion of this variance could be explained by the

variables included in the study. As an example, the slope variance for work-related burnout (see Table 6) decreased from 0.0145 to 0.0124 when we took the interactions into account, indicating that about 14.5 per cent of slope variance was explained. The remaining variance remained unexplained and was not captured by the individual-level or team-level characteristics explored here. By using the HEXACO-PI-R and GOCQ, we included only general behavioural tendencies of the individual and the team. It is possible that the HEXACO characteristics are too abstract and that more specific characteristics, described by McAdams and Pals (2006) as characteristic adaptations (e.g., affect, self-efficacy, or locus of control), explain additional variance in training transfer. Locus of control in particular was found to be relevant for training transfer in past research (Burke & Hutchins, 2007; Cheng & Ho, 1999). Furthermore, cognitive ability / intelligence was not assessed due to time constraints in the applied setting in which the study was conducted, but has also been shown to influence learning outcomes (Chamorro-Premuzic & Furnham, 2008). A similar limitation applies to the team characteristics concepts used in this study. As explained in the Measures subsection, group openness and cohesion are essentially conglomerations of more nuanced facets of group characteristics. In particular, cohesion has been discussed as subdivided into task and social cohesion and has also been argued to depend on many factors other than group composition (for an overview, see Carron & Brawley, 2000). Therefore, a more nuanced approach to measuring cohesion specifically and group characteristics more generally might have revealed more of the underlying mechanisms for their influence on training transfer, an approach that future research should consider.

Generally, many factors have been suggested or confirmed to influence training transfer (Burke & Hutchins, 2007) beyond the variables included in this study, including the characteristics of the organisation in which the training is implemented, as well as multiple other time- and place-based factors, indicating that studies such as this should be repeated with different scales and other predictors. The more general question raised in the introduction about which factors are more important predictors of training transfer can only be conclusively answered through meta-analytic procedures taking multiple contexts into consideration. This study examined one specific context in detail; however, to obtain a complete picture of training transfer mechanics and influences, more meta-analytic research, such as that by Burke and Hutchins (2007), is necessary to unravel the highly complex network of influences on successful training transfer. Modern analytical methods such as structural equation modelling or multilevel modelling can help with this endeavour. Our study is a small puzzle piece showing the general importance of team-level factors, specifically cohesion and a team's mean conscientiousness, for training transfer. Unravelling the bigger picture will require more research in different contexts.

From a practical perspective, the finding that participants with higher levels of strain improve more indicates that the intervention we employed specifically targets such individuals and their needs. This can be considered a strength of the intervention; it seems to be most effective where the biggest effects are needed. This implies that future strain reduction interventions should adopt practices similar to the one we used. Details on the intervention can be found in Thiry et al. (2021).

CONCLUSION

The results of this study point towards the larger importance of team-level characteristics for successful training transfer, while also demonstrating that the intervention was more effective among individuals with higher levels of psychological strain before the intervention. This

study's results are important to consider in future work on the conceptualisation and measurement of group-level characteristics in general and on differential training effectiveness and training transfer. Many factors that contribute to explaining training transfer and the associated differential effects remain unexplored and should be included in future research; for example, while the effects of stable personality traits are frequently researched, emotional states can also have an effect on basic task performance (Bartolic et al., 1999), which might translate to long-term training transfer, especially for highly interactive trainings. Other research has demonstrated the influence of monetary incentives on training transfer (Dierdorff & Surface, 2008), for which long-term mechanisms and interactions with trainee characteristics also need to be further unravelled.

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CONFLICT OF INTEREST

None.

ETHICAL APPROVAL

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional research committees or comparable ethical standards. Three ethics committees approved all aspects of the study: The "Ethikkommission der Abteilung Informatik und Angewandte Kognitionswissenschaft der Fakultät für Ingenieurwissenschaften der Universität Duisburg-Essen" [Ethics committee of the department of informatics and applied cognition sciences of the faculty of engineering of the University of Duisburg-Essen] (no reference number given by the committee), the "Ethikkommission der Medizinischen Fakultät der Universität zu Köln" [Ethics committee of the medical faculty of the Cologne University] (no reference number given by the committee), and the "Ethik-Kommission – Medizinische Fakultät Bonn" [Ethics committee – medical faculty Bonn] (reference number: 154/16). This article does not contain any studies with animals performed by any of the authors.

INFORMED CONSENT

Informed consent was given by all participants in the study, and there is no identifying information in this manuscript or in the data available from the authors upon reasonable request.

AUTHOR CONTRIBUTIONS

Marius Deckers: data curation; formal analysis; investigation; methodology; resources; software; validation; writing – original draft; writing – review & editing. Tobias Altmann: funding acquisition; methodology; project administration; supervision; writing – review & editing. Marcus Roth: funding acquisition; methodology; project administration; supervision; writing – review & editing.

DATA AVAILABILITY STATEMENT

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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