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DIGITAL-BASED INTERVENTIONS FOR TEAMS IN THE WORKPLACE

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Introduction

Rationale for studying team digital interventions at work

Nowadays, most of the work performed in organisations is based on teams (Allen & Hecht, 2004; Barnes & Hollenbeck, 2009; Driskell et al., 2018; Salas et al., 2018). Teams can be defined as distinguishable collections of two or more individuals that interact socially, dynamically, and interdependently, either face-to-face or virtually, with the aim of achieving a common objective that is relevant to the organisation (Allen & Hecht, 2004; Costa et al., 2014; Mathieu et al., 2017; 2018). These individuals are assigned roles or functions and share responsibility for specific outcomes (ibidem). Consistently, the term teamwork refers to the process through which team members collaborate to accomplish the given tasks (Driskell et al., 2018) and enact integrative activities that translate team inputs (e.g., team behaviours) into team outputs (e.g., team effectiveness) via team processes (e.g., team collaboration).

From a psychological perspective, working in groups presents a number of socio-emotional and competence-related benefits (Allen & Hecht, 2004), such as fulfilment of social needs (belonging, affiliation, social comparison), positive attitudes (job satisfaction, mental health, decreased fatigue and stressfulness), reduction of uncertainty, expanded attributional opportunities, high performance illusions, and feelings of superior individual performance. Moreover, from a business-oriented perspective, previous authors (e.g., Mathieu et al., 2017; Salas et al., 2018) have argued that teams constitute a natural response to the increasingly complex, diverse, interdisciplinary modern-day world of work. Indeed, teams are needed when the tasks at hand are complex and require wide-ranging expertise, when the task outcomes affect a number of individuals that share responsibility for it, and when representing diverse constituencies and stakeholders is needed (Barnes & Hollenbeck, 2009; Edmondson, 2002) – all of which are commonplace situations in today's world of work. Mathieu and colleagues (2017) hold that "as work tasks became increasingly higher in scope and complexity, they often demand the specialised skills of more than one person" (p. 456). Interdisciplinary teams include experts having unique expertise, and their collaboration is instrumental in generating new insights into existing problems and new solutions, so they act as catalysts for innovation and learning (Edmondson, 2002). As a result, teams, once relegated to specific projects or departments, are now ubiquitous, being present in every work domain, including hospitals, schools, offices, safety, and security (Salas et al., 2018), and functioning as a cornerstone of productivity and innovation (Grote & Kozlowski, 2023). Furthermore, over the past decade, there has been a growing recognition in the scientific literature about the importance of effective teamwork and team collaboration within workplaces, as they are crucial factors that can lead to success across various industries. For instance, strong teamwork skills (e.g., communication, collaboration, and coordination) in organisations have been linked to a range of positive outcomes,

both at the employee and at the company level, including individual performance, helping behaviours, reduced absence, improved work attitudes, decreased turnover intentions, reduced depression, increased customer satisfaction, and improved organisational safety (Mathieu et al., 2017). In this regard, Driskell and colleagues (2018) cite Cartwright and Zander's (1953) statement about the importance of scientific investigation into teamwork since teams are ubiquitous, mobilise powerful forces producing important effects, these forces can result in positive and negative consequences, and understanding team dynamics allows to deliberately enhance positive consequences.

In recent decades, recognising the paramount role of teamwork in the workplace, a variety of interventions have been designed and tested to enhance the quality and effectiveness of team collaboration (McEwan et al., 2017). Traditional evidence-based strategies for team development and improvement, as described by Lacerenza and colleagues (2018) as well as by Grote and Kozlowski (2023), have predominantly centred on in-person team training, team-building exercises, and post-task debriefing. While these interventions have shown some effectiveness, they have often overlooked the social dynamics and interrelationships that can influence teamwork patterns within teams, for instance communication, which is regarded as a key teamwork competence (ibidem). Moreover, digital interventions have recently emerged as a potential alternative to foster positive workplace outcomes, however little is still known about digital interventions in enhancing teamwork rather than individual-level outcomes. The digital age has introduced an array of tools and interventions that promise to enhance teamwork (e.g., Koh et al., 2020). While Salas and colleagues (2018) advocated that "we need to increase the use of technology for team interventions" (p. 599), digital-based interventions, encompassing several technologies such as collaboration platforms, project management tools, and communication applications, have taken center stage in organisational strategies worldwide. Yet, their potential and effectiveness within team environments remain subjects of ongoing exploration, with the need for scientific investigation underscored by the profound impact they have on the dynamics, performance, and well-being of employees in the contemporary workplace. Particularly, no studies have conducted evaluations of real-world or context-specific effectiveness of digital-based interventions for team in the workplace. That is, studies have not delved into the underlying mechanisms or the reasons why such interventions achieved their intended outcomes for the targeted participants.

The present doctoral dissertation describes four studies conducted as part of a three-year research project aiming to investigate digital-based interventions for teams in the workplace. In the pursuit of understanding their implications, this research project has ventured to unravel the complexities and nuances of this type of interventions. The fundamental premise behind this research is rooted in the realisation that the workplace of today stands as an intricate ecosystem where diverse teams navigate a maze of digital tools to achieve common objectives. This necessitates a closer look into the effects of digital-based interventions on team dynamics,

communication patterns, and performance outcomes. As organisations continue to adopt these technologies, the need for empirical evidence regarding their implications becomes pressing. The rationale for this investigation is not solely driven by the pervasiveness of digital tools in the contemporary workplace but also by the potential for their misuse or misalignment with organisational goals, leading to unintended consequences. An extensive body of literature suggests that the inappropriate use of technology may lead to information overload, reduced face-to-face interactions, feelings of isolation, and diminished work-life balance (e.g., Grant et al., 2018). Conversely, when harnessed effectively, digital-based interventions can promote collaboration, knowledge sharing, task coordination, and overall well-being (e.g., Majchrzak et al., 2018). This research project seeks to provide a comprehensive understanding of how teams interact with digital interventions and how these interactions, in turn, influence team processes and performance. By doing so, it positions itself as a relevant contribution to the growing body of knowledge surrounding digital-based interventions for teams in the workplace and aims to offer actionable insights to organisations striving to optimise their team's digital work environment.

In the pages that follow, after a description of the overarching theoretical framework this project was based on, the dissertation delves into the four studies conducted. Each study is presented with its background, methodological approach, empirical findings, and theoretical and practical implications of the research. Through rigorous analysis and synthesis of both qualitative and quantitative empirical data, this work strives to illuminate the complexities, challenges, and opportunities that characterise the intersection of teams, digital interventions, and the modern workplace.

Overarching framework

The doctoral research project reported on in the present dissertation was based on four main theoretical pillars, namely (1) Lacerenza and colleagues' (2018) stepwise framework for team interventions, (2) the IGLO model (Day & Nielsen, 2017; Nielsen & Christensen, 2021; Nielsen et al., 2017), (3) the Job Demands-Resources model (Bakker & Demerouti, 2017; 2018; Schaufeli, 2017), and (4) the realist evaluation approach (Nielsen & Abildgaard, 2013; Nielsen & Miraglia, 2017; Nielsen & Randall, 2013; Nielsen & Shepherd, 2022; Roodbari et al., 2021a, 2021b, 2023). Each theoretical framework is illustrated in detail in the following paragraphs.

Stepwise Framework for Team Interventions

First and foremost, this project followed Lacerenza and colleagues' (2018) stepwise framework for team interventions. In their attempt to provide evidence-based recommendations regarding how to design, deliver, implement, and increase the

effectiveness of team development interventions, Lacerenza and colleagues (2018) introduced a comprehensive framework that can be used as a structured approach to enhance teamwork within organisations. Resonating with more general models of participatory workplace interventions (e.g., Nielsen et al., 2010; Nielsen & Noblet, 2018; von Thiele Schwarz et al., 2021), this framework comprises four main phases, offering a systematic path to facilitate team development and improvement. The first phase of the process involves extensively reviewing experimentally supported evidence from previous academic literature, in order to know which solutions and strategies work according to science. The second phase corresponds to conducting a thorough needs assessment to identify specific areas of concern or improvement within the team; the authors recommend conducting a need analysis in order to provide diagnostic feedback and ensure that stakeholders' expectations align with the goals of the training. The third phase is the implementation of team interventions and focusses on putting the intervention plan into action, utilising various strategies such as team training, team-building activities, and debriefing sessions. Fourth, an integral aspect of the framework is the evaluation phase, where the effectiveness of the intervention is assessed; this evaluation not only gauges the impact of the intervention on teamwork but also informs any necessary adjustments or refinements.

As it constitutes a valuable tool for organisations seeking to systematically improve team dynamics, ultimately leading to enhanced teamwork, team collaboration and team performance, Lacerenza and colleagues' (2018) framework was deployed throughout the four studies that the present research project was composed of. Each study correspond at least one of the phases of Lacerenza and colleagues' (2018) framework and contributes a unique facet to the overarching exploration of digital-based interventions for teams in the workplace. Thus, Study 1 represented a foundational review of the already existing body of knowledge about digital workplace interventions; while this initial phase did not directly involve the implementation of a digital intervention for teams, it was crucial in establishing the groundwork by synthesising previous evidence and providing context for the subsequent studies. Study 2 performed an assessment of team-level needs, thus facilitating the fine-tuning of the forthcoming digital intervention and serving as a preparatory stage to ensure that the subsequent implementation would be tailored to address the requirements of the teams under investigation. Study 3 and Study 4 both concentrated on the implementation and evaluation of a digital-based team intervention, each offering distinct perspectives. While Study 1 and Study 2 did not directly address digital interventions for teams, they were preparatory with respect to the subsequent Study 3 and Study 4, which rather delved into issues related to a specific intervention aiming to promote work communication within teams. Also, whereas implementation and evaluation is addressed in both Study 3 and Study 4, they present different ways of investigating the intervention's factors of effectiveness.

Each study included in the present dissertation received ethical approval by the Bioethics Committee of the Alma Mater Studiorum – University of Bologna (Prot. n. 0185076) and complied with the Declaration of Helsinki (World Medical

Association, 2013). In each study, workers were given an informed consent form detailing participation procedure, study contents, data collection purposes, future data dissemination modalities, participants' rights, and addressable contacts. Participation was voluntary and could be withdrawn at any time without consequences.

IGLO Model

From an ecological perspective, the workplace can be viewed as a system made of different sub-systems, where various patterns of relationships between workers and different working environments occur. Also, workers' outcomes can be seen as embedded in such a system. Consequently, psychosocial interventions should be developed at all systemic levels of the workplace to address potential sources of either good or poor workers' outcomes (e.g., Bakker & Demerouti, 2018; Chen et al., 2018; Martin et al., 2016; Teoh et al., 2020). Specifically, sources of positive or negative work outcomes can exist at four levels, such as the individual (I), the group or work team (G), the leader (L), and the organisation (O). These levels are framed as the IGLO model (Day & Nielsen, 2017; Nielsen & Christensen, 2021; Nielsen et al., 2017). At the individual level, work outcomes can derive from work-specific cognitive, affective, and behavioural factors or resources, for instance, work-related self-efficacy and job crafting. At the group level, work-related psychological states and behaviours can be associated with colleagues' support and workgroup climate and subsequent interventions can be carried out such as team coaching (Clutterbuck, 2010). The leader level encompasses predictors of work-related outcomes like line managers' knowledge, skills, abilities, attitudes, behaviours, and support. Finally, at the organisational level, human resources management practices and policies, job design, and occupational health services can play a meaningful role in promoting or hindering workers' psychological and behavioural outcomes. To summarise, the individual level has to do with personal variables, the group level is about team states, processes, and dynamics, the leader level refers to characteristics of and actions implemented by managers, and the organisational level points to how both the work and the working environment are designed, managed, and organised.

In the present research project, the IGLO model was used in (1) Study 1, to classify digital workplace interventions systematically retrieved from previous literature according to the four levels of the model (Peláez Zuberbühler, Giusino et al., under review), and (2) Study 2, to assess intervention needs at the different workplace levels as part of a broader multilevel workplace needs assessment exercise (Giusino et al., 2022a; 2022b). However, for the purposes of the present dissertation's main topic, which is digital-based interventions for teams in the workplace, the group level of analysis and intervention is the most relevant. Therefore, Study 1 especially highlights findings regarding group-level digital interventions, whereas Study 2 mostly focuses on needs identified at the team level of analysis.

Job Demands-Resources Model

The Job Demands-Resources (JD-R) model (Bakker & Demerouti, 2017; 2018; Schaufeli, 2017) conceives the work environment as a potential source of either positive or negative workers' outcomes depending on how the work environment is designed, organised, and managed. According to this framework, the work environment can be considered as a constellation of job demands and resources, which differently influence workers' psychological states and behaviours. On the one hand, job demands refer to physical, psychological, social, or organisational aspects of the job that require physical or psychological efforts from the worker. Examples may be emotional demands, team conflict, heavy workload, time pressure. As such, job demands can be understood as risk factors for workers. Nevertheless, job demands have recently been differentiated into hindering job demands and challenging job demands (Van den Broeck et al., 2010), where the former hinder the optimal functioning of the individual and the latter stimulate positive work outcomes. On the other hand, job resources correspond to physical, psychological, social, or organisational aspects of the job, that workers can use to counterbalance the costs implied by job demands in terms of physical, cognitive, and emotional energy. Examples may be personal protective equipment, safety devices, cognitive and behavioural patterns, job autonomy, skill variety, performance feedback, support from colleagues or supervisors, role clarity, job control, adequate pay, job security, career opportunities. In addition, recent studies (e.g., Chen et al., 2018) have integrated job resources with personal resources from the positive psychological tradition – such as, for instance, resilience, adaptability, flexibility, optimism, self-efficacy, hope, psychological capital. Job resources are intrinsically motivating and may help workers fulfil their basic needs, achieve work-related goals, and positively influence their personal growth and development. Although both job demands and job resources can independently impact workers' psychological states and behaviours, job resources may buffer job demands by enabling workers to cope with job demands. In this framework, negative work outcomes result from an imbalance between job demands and resources; when job demands exceed resources, poor work outcomes may show up. Specifically, the JD-R model postulates two distinct processes leading to workers' outcomes; through the impairment process, high job demands are causally linked to negative outcomes over time, while through the motivation process, high job resources result in positive outcomes.

In the present research project, the JD-R model was used in Study 2, where a workplace needs assessment exercise was performed to identify job demands and job resources at the different IGLO levels (Giusino et al., 2022a; 2022b). However, consistent to the present dissertation's main topic, which concerns team interventions, Study 2 mostly focuses on job demands and job resources identified at the group level of analysis. For the purposes of this project, the main aim of Study 2 was indeed to check for the organisation-intervention fit (Andersen et al., 2021; Peters et al., 2020)

and ensure the meaningfulness of implementing digital-based interventions to foster teamwork within the targeted organisation.

Realist Evaluation

This project deployed a realist approach towards the evaluation of workplace interventions (Nielsen & Abildgaard, 2013; Nielsen & Miraglia, 2017; Nielsen & Randall, 2013; Nielsen & Shepherd, 2022; Roodbari et al., 2021a, 2021b, 2023). With this, the project intended to refer to a whole corpus of theoretical frameworks and models, such as, Nielsen and Abildgaard's (2013) research-based framework for the evaluation of both intervention process and effects, Nielsen and Randall's (2013) model of process evaluation, the Integrated Training Transfer and Effectiveness Model (Nielsen & Shepherd, 2022), or the Integrative Process Evaluation Framework (Nielsen et al., 2023). Overall, realist evaluation frames the causality process occurring during a workplace intervention through the linkages between the changes in certain mechanisms that happen in the context where the intervention takes place, which, in turn, lead to specific outcomes. In other words, in workplace interventions, the context in which the intervention takes place, influences its working mechanisms, which in turn trigger intervention outcomes (Nielsen & Abildgaard, 2013; Nielsen & Randall, 2013; Roodbari et al., 2021a, 2021b, 2023). Here, the term "context" refers to the conditions under which an intervention is effective. According to Nielsen & Abildgaard (2013), context can be further subdivided into omnibus context and discrete context. Omnibus context is made up of those impacting external factors that exist before and regardless of the intervention (e.g., organisational culture and climate), while discrete context refers to everything that occurs during the actual implementation of the intervention (e.g., pandemics, financial crisis, mergers). Mechanisms correspond to those elements or "ingredients" that make an intervention work, for instance, particular intervention contents, specific activities and exercises, or special devices or tools deployed. Finally, outcomes correspond to the improvements in working conditions and workers' well-being or performance that can be observed, or the effects that were aimed to be produced. So, if certain contextual conditions are present, then certain intervention working mechanisms are activated and, as a result, the intervention brings about the changes it aims to achieve. Therefore, in addition to outcomes, context factors and working mechanisms should be considered when evaluating interventions, as they may influence intervention outcomes, facilitate or hinder the interventions' effectiveness, and explain the success or failure of an intervention. In this sense, the realist evaluation goes beyond the traditional pre-post randomised controlled approach towards the workplace interventions' effectiveness (Nielsen & Miraglia, 2017).

At its very core, realist evaluation tries to provide an answer to the question of "what works for whom, and under which circumstances" (Nielsen & Miraglia, 2017; Roodbari et al., 2023). This is done by investigating the so-called context-mechanisms-

outcomes (CMO) configurations, expressed through the formulation "If… then… as a result" or other similar formulations depending on whether, in statistical terms, they refer to moderation, mediation, or other models, as illustrated later in this paper. The CMO framework allows for an in-depth examination of the contextual factors, underlying mechanisms, and outcomes associated with an intervention, acknowledging the complex and context-dependent nature of real workplace settings in which interventions take place. The realist approach to workplace interventions evaluation allows to delve into the underpinning interventions' mechanisms, to understand what elements work and why, in which circumstances, and for whom they are particularly successful.

This approach allows achieving an understanding of the working mechanisms of effective interventions, and how they succeed or fail in specific settings. It also involves understanding the context in which the intervention is implemented, identifying the mechanisms by which the intervention produces change, and examining the outcomes of the intervention. For instance, the effectiveness of digital interventions in the workplace can be influenced by the organisational culture and technological infrastructure, which are part of the context (Armaou et al., 2019). The mechanisms may include user engagement with the digital tool, the delivery method of the intervention (e.g., mobile app, web-based platform), and the contents' relevance to the users' needs. The outcomes may then be evaluated regarding improvements in psychological and behavioural outcomes at work. This holistic approach ensures that the evaluation of digital interventions is not just focused on the outcomes but also considers the underlying processes and environmental factors that contribute to these outcomes.

One last relevant aspect of the realist evaluation approach concerns intervention recipients' perceptions. According to recent models for evaluating workplace interventions (Nielsen and Abildgaard, 2013; Nielsen and Randall, 2013) as well as empirical studies in the same research strand (e.g., von Thiele Schwarz et al., 2021), it is crucial to understand and address the perceptions by recipients of the dimensions of workplace interventions. Intervention recipients' perceptions refer to their attitudes towards the intervention and its various aspects, such as its dimensions, qualities, features, elements, components, and ingredients. These aspects may encompass content, structure, facilitators, design, relevance, usefulness, objectives, and more. Persson et al. (2012) suggest that each worker understands their work environment uniquely. Individuals interpret cues from the environment, developing a shared understanding based on common experiences and conditions. This concept can also be applied to workplace interventions. When workers participate in an intervention together, they may develop a collective perception of the intervention, influenced by cues from one another. In particular, in team interventions, these shared perceptions may shape their views on the positive or negative aspects of the action or initiative. By considering individual and team perceptions, researchers and practitioners can better understand and explain the overall impact of workplace interventions. Specifically, recipients' perceptions should be an integral part of

workplace interventions' evaluation because they are key underlying mechanisms for the effectiveness of the intervention. Thus, an essential part in evaluating workplace interventions should be measuring change in employees' perceptions of the intervention, and their expectations that the intervention can bring about changes (Nielsen and Randall, 2012).

To the author's knowledge, realist approaches towards the evaluation of digital-based workplace interventions were not frequently mentioned in literature – Havermans and colleagues' (2018) process evaluation of a digital platform-based implementation strategy aimed at work stress prevention in healthcare constitutes a rare exception – and had not yet been applied to investigate the effectiveness of group-level digital interventions. In the present research project, the realist evaluation approach was used in (1) Study 1, to explore the working mechanisms and the contextual conditions for effectiveness of workplace digital interventions systematically retrieved from previous literature (Peláez Zuberbühler, Giusino et al., under review), (2) Study 3, to longitudinally examine recipients' perceptions of a digital team coaching intervention using social network visualisation (Giusino et al., 2023), and (3) Study 4, to test two CMO configurations of the same group-level digital intervention (Giusino et al., in preparation).

Study 1. Digital Interventions at Work: A Multilevel Realist Review

Abstract. Digital interventions (DIs) at work have proven effective in many instances, but knowledge regarding their working mechanisms and the contextual conditions under which these interventions are most effective is still scarce. Also, it is unclear at which level of the workplace ecological system they have been implemented the most. To fill these gaps, a realist synthesis with a multilevel IGLO approach was conducted to explore how, why, and under which circumstances DIs may promote, prevent or reduce workers' psychological and behavioural outcomes. Forty-four DIs studies were gathered through a systematic electronic search. For the analysis, context factor, mechanisms and outcomes were extracted from the selected studies. Findings suggested some relevant context factors to consider when implementing DIs at work, and working mechanisms that can trigger the study outcomes. In addition, results showed that, out of 42 digital workplace interventions reviewed, 40 interventions were implemented at individual level, whereas two occurred at leader level. None was implemented at the group level. This was deemed as an input to more research into group-level digital workplace interventions.

Background

With the recent progress in information and communication technologies and increasing digitalisation of work (Cijan et al., 2019), psychosocial digital interventions (DIs) have emerged as a noteworthy opportunity for organisations (Armaou et al., 2019; Stratton et al., 2017; 2022). Generally defined as planned, structured, science-based actions or initiatives aiming to achieve a certain goal by exploiting the potential offered by digital technologies (e.g., Giusino et al., 2021), such interventions may correspond to either interventions that were originally designed to occur in physical presence and subsequently adapted to the digital formats offered by online teleconferencing platforms, or to interventions explicitly meant to be available for computer or smartphone apps only (ibidem). In particular, DIs such as smartphones, websites, or text messaging are delivered via digital technologies to provide effective, safe, and scalable interventions to benefit people at work, whether used in conjunction with, or independently of, other type of people services (Murray et al., 2016). DIs can be used to promote behaviours, improve work-related outcomes, with multiple aims, including sharing experiences with others, changing perceptions and cognitions, assessing and monitoring specific behaviours, and improving communication between customers and professionals (ibidem). Previous literature reviews on DIs have shown that these interventions can be considered primary or secondary

prevention strategies (Armaou et al., 2019), referring to an intervention that aims to prevent exposure to psychologically harmful working conditions – that is, primary prevention –, or to give workers the appropriate skills to cope with or adapt to the working environment – that is, secondary prevention.

Research has highlighted several advantages that DIs offer over traditional face-to-face ones, thanks to their technical features. In their systematic review of the published literature, Griffiths and colleagues (2006) found that reasons for internet delivery of healthcare interventions included reduced costs, increased convenience for the users, overcoming isolation of users, need for timely information, reduced stigma, and increased user and supplier control. A subsequent review article by Baños and colleagues (2022) also mentioned reduction of stigma, geographical accessibility, and temporal flexibility as further advantages of digital interventions. Molino and colleagues (2020) reported that cost and time savings, as well as increased employee satisfaction are among the benefits of using DIs during a pandemic outbreak.

Previous meta-analyses and systematic reviews have consistently shown how DIs may produce benefits for workers, such as increased psychological well-being and work effectiveness (Carolan et al., 2017), reduced mental health conditions (i.e., stress, depression, and anxiety; Heber et al., 2017; Stratton et al., 2017; 2022), and moderate treatment effects on stress, insomnia, burnout, depression, well-being, and mindfulness (Phillips et al., 2019). Focussing more specifically on smartphone-based interventions for the promotion of employees' well-being, the systematic review by Paganin and Simbula (2020) found a lack of theoretical background, reliable study design, and the prevalence of physical health interventions, also underlining the importance of user engagement for intervention effectiveness. A systematic review of randomised controlled trials by Moe-Byrne and colleagues (2022) found promising results regarding presenteeism, sleep, stress, and somatic symptoms.

As it can be concluded based on previous research findings, DIs can be effective in promoting positive work outcomes or preventing/reducing negative outcomes at work. However, attention should not only be focused on the positive aspects of digital interventions, such as their benefits and advantages over traditional interventions. A more balanced presentation of this type of interventions should acknowledge their potential challenges or limitations. In this regard, mixed findings in the field of digital interventions have been shown. For instance, Philippe and colleagues (2022) conducted a systematic and meta-review of article reviews evaluating digital health interventions. The authors demonstrated the overall beneficial effects of digital interventions on various outcomes. Nonetheless, outcomes varied substantially based on intervention features and implementation methodology. These results highlight the need for more research to advance our understanding of these interventions, clarifying essential moderating and mediating factors, such as processes and implementation features.

Previous studies have rarely investigated the mechanisms that make an intervention work as intended in certain contextual conditions. Issues related to the adoption of DIs by employees and the mechanisms that can facilitate their

implementation and positive impact in the workplace may pose a considerable challenge in evaluating their effectiveness. Therefore, there is a critical need in literature to systematically analyse and synthesise the current state of the art of empirical evidence of DI studies at work to understand and report whether the interventions work, what makes them work, for whom, and under which circumstances, following a realist approach towards evaluating workplace interventions.

This study was based on a realist framework to assess workplace interventions (Nielsen & Miraglia, 2017; Nielsen & Shepherd, 2022; Roodbari et al., 2021a, 2021b, 2023). This approach focusses on understanding the causal process underlying workplace interventions by examining the connections between changes in specific mechanisms within the intervention context, leading to distinct outcomes. In essence, this approach

highlights that the context of a workplace intervention influences its operational mechanisms which, in turn, determine the intervention outcomes. The term context refers to the conditions that impact the effectiveness of an intervention and under which working mechanisms are triggered. Nielsen and Abildgaard (2013) further categorised context into omnibus and discrete. Omnibus context comprises pre-existing external factors that influence the intervention, such as organisational culture and climate and working conditions – e.g., work demands and resources –, while discrete context encompasses factors occurring during implementation of the intervention, such as pandemics, financial crises, mergers, organisational restructuring, downsizing, and budget cuts (Nielsen & Randall, 2013). Mechanisms, on the other hand, are the key components or ingredients that enable the intervention to function, including specific intervention content, activities, exercises, or tools deployed. Mechanisms can be classified into (1) process mechanisms, referring to the design and implementation of the interventions, for instance, transfer of training, peer or manager support, (2) content mechanisms, referring to the nature of the changes focussed on the content of action plans, for instance, changes in the work procedures to reflect teamwork, and (3) perceptions, referring to the perceptions of the participants regarding the process and content mechanisms, for instance, changes in their attitudes and abilities (Nielsen & Miraglia, 2017). Lastly, outcomes represent the observable improvements in working conditions and psychological or behavioural outcomes of employees, as well as the intended effects of the intervention. Consistent with psychosocial interventions literature, outcomes can be categorised into proximal, indicating the direct and causally closest outcomes of an intervention – e.g., changes in workers' knowledge, attitudes, and behaviours in relation to working conditions – and distal, indicating the indirect and causally far effects – e.g., job satisfaction, subjective well-being, and performance; De Angelis et al., 2020; Nielsen & Miraglia, 2017; Roodbari et al., 2021a, 2021b). If specific contextual conditions are present, the corresponding intervention mechanisms are activated, leading to the desired changes. Thus, when evaluating workplace interventions, it is crucial to consider not only outcomes, but also contexts and working mechanisms. These elements can influence

the effectiveness of interventions and provide explanations for their impact on workers and work-related outcomes.

Moreover, many calls have been made in literature, advocating for a multilevel approach towards evaluating workplace interventions (e.g., Martin et al., 2016). From an ecological standpoint, the workplace can be seen as a complex system consisting of various interconnected components. These components include the relationships between workers and different work environments. Psychosocial interventions should be implemented at different levels of the workplace system to address factors that can influence workers' psychological states and behavioural outcomes either positively or negatively. The workplace levels can be categorised in various manners, depending on the model that is taken as a reference. In the present study, the IGLO model (Day & Nielsen, 2017; Nielsen & Christensen, 2021; Nielsen et al., 2017) was adopted as an analytical framework for the characteristics of digital interventions at work. In addition, the model was used to classify context factors and working mechanisms of workplace digital interventions at individual, group, leader, and organisational level.

Consistent with realist evaluation and the multilevel approach, this study (Peláez Zuberbühler, Pietrantoni, Mazzetti, De Angelis, Giusino et al., under review[1]) aimed to review the current literature to explore and identify how DIs produce their effects on mental health and well-being at work, in which contexts, and for which group of employees. The specific objective of this review was to extract information regarding context factors, mechanisms, and outcomes of digital psychosocial interventions at work. This knowledge might be highly beneficial for researchers and practitioners in designing, implementing, and evaluating DIs at work, as it facilitates the understanding of how, why, and under what circumstances DIs may improve employees' psychological states and behaviours (Roodbari et al., 2021a, 2021b). This review then provides valuable information about the peculiarities of those DIs that are successful at work, and the conditions and mechanisms that ensure that the DIs achieve the intended outcomes. Findings might also help to clarify research areas that facilitate the use of DIs and their implementation in organisations, as well as to formulate research questions for future studies.

Methods

The current systematic review was conducted in line with the realist synthesis approach (Nielsen & Miraglia, 2017; Pawson et al., 2005; Wong et al., 2013). In contrast to other types of review – e.g., meta-analyses – that focus on intervention effectiveness, the realist review aims to explain causal interactions on how and why observed outcomes occur, by reporting empirical evidence about contextual factors, working mechanisms, and outcomes. A systematic realist synthesis combines the principles

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[1] Currently resubmitted after major revision and awaiting reviewer scores from *Organizational Psychology Review*. https://journals.sagepub.com/home/opr

and rigor of the systematic review methodology (Perestelo-Pérez, 2013; Petticrew & Roberts, 2008) with the realist evaluation framework (Nielsen & Abildgaard, 2013; Nielsen & Miraglia, 2017; Nielsen & Randall, 2013; Nielsen & Shepherd, 2022; Roodbari et al., 2021a, 2021b, 2023). In particular, realist synthesis provides a nuanced way of understanding how interventions work in different contexts. Compared to a general overview of available interventions, the main added value of a realist synthesis is that it explicitly addresses causality, going beyond merely describing the presence or absence of an intervention and its outcomes, as is the case in a traditional systematic review. Instead, realist synthesis aims to identify the context, the mechanisms triggered by the intervention and the observed outcomes. This approach is in line with the general aim of realist synthesis to uncover the underlying mechanisms that influence the outcomes of interventions in diverse and dynamic settings. In addition, realist synthesis also enables exploration of the role of context in determining the effectiveness of interventions. This contextual sensitivity is crucial for understanding the variability of the effects of interventions in different contexts. In general, this approach builds on the recognition that the functioning of interventions often involves a non-linear process, so it relies on the interaction between context, mechanisms, and outcomes. In doing so, it overcomes the descriptive nature of traditional systematic reviews. Furthermore, a standard review of the literature would make it possible to systematise which interventions work and which do not, while realist synthesis also provides specific insights at the operational level to further investigate, as it makes it possible to tailor interventions to specific contexts and optimise their effectiveness. For all these reasons, it was concluded that a general and descriptive review of digital interventions to promote work outcomes might be simpler but would not be as valuable in terms of novelty and input, as it would not go significantly beyond what is already known in the academic literature.

In the realist review methodology, the search process is characterised by its iterative and interactive nature, engaging in a dynamic back-and-forth movement between the literature and the research questions. This iterative process often leads to the development of search strategies and terms as the researcher's understanding deepens, as described by Pawson and colleagues (2005) and Nielsen & Miraglia (2017). Typically, a realist review search involves several different steps. The present review progressed following four steps inspired by the Realist And Meta-narrative Evidence Syntheses: Evolving Standards (RAMESES) quality and publication standards (Wong et al., 2013), namely (1) defining research questions, (2) searching for evidence, (3) selecting and appraising the studies, and (4) extracting, analysing, and synthesising the findings. Each of these steps is illustrated in detail in the following paragraphs.

The realist review approach has previously been used by researchers to understand the implications of contexts and mechanisms on the outcomes of other forms of health promotion interventions in the organisational psychological field (e.g., Adnan et al., 2022; Dickson et al., 2022; Gray et al., 2019; Micklitz et al., 2021; Roodbari et al., 2021a, 2021b; Sinclair et al., 2021). The usefulness of this theoretical framework is also underpinned by the studies that rely on its implementation to assess face-to-

face intervention designed to promote workers' mental health (e.g., Abildgaard et al., 2020; Higgins et al., 2015) and the effectiveness of digital tools in promoting mental health and well-being in the general population (e.g., Andersen et al., 2022). However, this study constituted one the first attempts to apply the realist methodology to DIs for mental health and well-being at work. This study represents an application of realist review methods specifically to DIs in the context of workplace mental health. The insights gained from this study were expected to shed light on aspects that facilitate the use of DIs and their implementation within organisations. Additionally, the findings were expected to assist in formulating pertinent research questions for subsequent studies in this field.

Defining Research Questions

The overarching research question for this realist review was "What works, how, why, for whom, and in what contexts in relation to DIs at work?". To guide the review, the three specific research questions of this review were (1) "what are the context factors that impact the effectiveness of DIs at work?", (2) "what are the mechanisms through which workplace DIs bring about changes?", and (3) what are the outcomes of DIs in terms of improved mental health or reduced well-being at work?".

Searching for Evidence

To identify relevant studies to include in the review, a systematic search was conducted (Perestelo-Pérez, 2013; Petticrew & Roberts, 2008) and different databases were consulted, such as PsycNet, Scopus, Web of Science and PubPsych, which are known to ensure good coverage of high-quality peer-reviewed articles (Mingers & Leydesdorff, 2015). Papers published in English, Spanish, and Italian were selected, and the search was limited to articles published between 2011 and 2022 in peer-reviewed scientific journals, while excluding conference papers, abstracts, doctoral theses, books, and unpublished research. The search for scientific articles was done by six authors belonging to independent research teams. The search terms were focused on titles, abstracts, and keywords, using the Boolean operators' combination ("*OR*", "*AND*"). The keywords used for this search were "digital" *OR* "digital-based" *OR* "digital based" *OR* "smartphone*" *OR* "smartphone-based" *OR* "smartphone based" *OR* "app" *OR* "app-" *OR* "app based" *OR* "app based" *OR* "web*" *OR* "web-based" *OR* "web based" *OR* "computer" *OR* "computer-based" *OR* "computer based" *OR* "on-line" *OR* "on line" *OR* "online" *OR* "on-line-based" *OR* "on line-based" *OR* "on line based" *OR* "on-line based" *OR* "internet" *OR* "internet-based" *OR* "internet based" *OR* "desktop*" *OR* "desktop-based" *OR* "desktop based" *OR* "game-based" *OR* "game based" *OR* "video-assisted" *OR* "video assisted" *OR* "video-based" *OR* "video based" / *AND* "intervention*" *OR* "training*" *OR* "program*" / *AND* "mental health" *OR* "m-health" *OR* "mhealth" *OR* "e-mental health" *OR* "e mental health" *OR*

"wellbeing" *OR* "wellbeing" *OR* "psychological" *OR* "psychosocial" / *AND* "work*" *OR* "organisation*" *OR* "organization*" *OR* "occupation*" *OR* "employee*" *OR* "manager*" *OR* "leader*" *OR* "team*" *OR* "job*" *OR* "compan*" *OR* "enterprise*". Using this search strategy, 3604 records were yielded. Last search was run in November 2022.

Selecting and Appraising the Studies

To be eligible for inclusion, studies needed to meet the four following criteria. First, studies in the review needed to provide empirical evidence, as the aim was to gather knowledge capable of eventually informing evidence-based practice (American Psychological Association, 2006). Quantitative and qualitative studies were included, as well as meta-analyses and systematic reviews focussing on empirical studies. Second, studies had to be conducted in work settings, whereas studies conducted outside the workplace or involving the general population or students were excluded. Third, the digital interventions had to focus on mental health and well-being at work, thus including digital interventions focussing on mental disorders and/or positive states of psychological well-being (Leka et al., 2015), or work-related issues laying a positive motivational path towards a state of fulfilment and goal achievement (Bakker & Demerouti, 2018). Accordingly, only studies promoting well-being or preventing, reducing, or managing distress – e.g., stress, anxiety, depression indicators – were included. Tertiary level prevention with a strong rehabilitative or treatment orientation were excluded from the original review's main scope. Fourth, studies had to use or focus on digital interventions, being delivered via the internet, mobile technology, or a computer program. Diagnosis or assessment-based digital technologies without suggesting or implementing any action plan for improvement were excluded.

A spreadsheet was used to collect the titles and references of the articles screened in this first process. After removing 428 duplicates from the initial 3604 records, 3176 papers remained for further screening. Next, an abstract screening was conducted, considering the four inclusion criteria, resulting in 152 papers. The following analytical step involved careful reading of the full texts and selection of the studies according to the inclusion and exclusion criteria. This left a total of 81 papers eligible for the review. The studies were screened independently by six authors (i.e., reviewers) following the search strategy and eligibility criteria. Discrepancies in the screening were resolved through discussion. Afterwards, using the open-source Rayyan software (Ouzzani et al., 2016), two other researchers (i.e., judges) settled the doubts regarding the studies in disagreement between the reviewers, and other four authors jointly discussed the final list and agreed on the final number of studies to be included in the review. This resulted in a final sample of 44 studies (Althammer et al., 2021; Avey et al., 2022; Bégin et al., 2022; Bormann et al., 2017; Bostock et al., 2019; Cantarero et al., 2021; Carissoli et al., 2015; Carolan et al., 2017; Cieslak et al., 2016;

Ebert et al., 2015; Ehrlich, 2022; Hammer et al., 2011; Hirshberg et al., 2022; Hosseinzadeh Asl, 2022; IJntema et al., 2021; Imamura et al., 2015, 2016; Keller et al., 2016; Keng et al., 2022; Knox & Franco, 2022; Kriakous et al., 2021; Lennefer et al., 2019, 2020; Li et al., 2021; Makowska-Tłomak et al., 2022; Nadler et al., 2020; Neumeier et al., 2017; Oliver & MacLeod, 2018; Ouweneel et al., 2013; Pandya, 2021; Paterson et al., 2021; Phillips et al., 2014; Pospos et al., 2018; Purdie et al., 2022; Querstret et al., 2016; Shann et al., 2019; Shirotsuki et al., 2017; Smith et al., 2020; Tonkin et al., 2018; Uglanova & Dettmers, 2022; Vanhove et al., 2016; Wang et al., 2021; Weber et al., 2019; Zhang et al., 2022). The fact that the final number of studies considered was reduced from 3604 to 44 articles can be thought as reflecting the soundness and clarity of the established criteria for study selection, resulted in a precise framework for the included DIs.

The quality appraisal of the 44 studies was conducted in accordance with RAMESES realist synthesis methodology. The relevance of the studies was assessed by examining whether they provide a description of the DIs' context factors, working mechanisms and mental health and well-being outcomes. This quality assessment was important for the analysis and synthesis of the findings. However, it was not considered an exclusion criterion for the review. To respond to the research questions, it was necessary to analyse the state of the art of the current DIs for mental health and well-being at work, in addition to the strengths and limitations of the selected studies on whether considering or not contexts, mechanisms and/or outcomes. This analysis may help identify research gaps and define research questions for future studies.

Figure 1 shows the flow diagram, which represents the search and retrieval process.
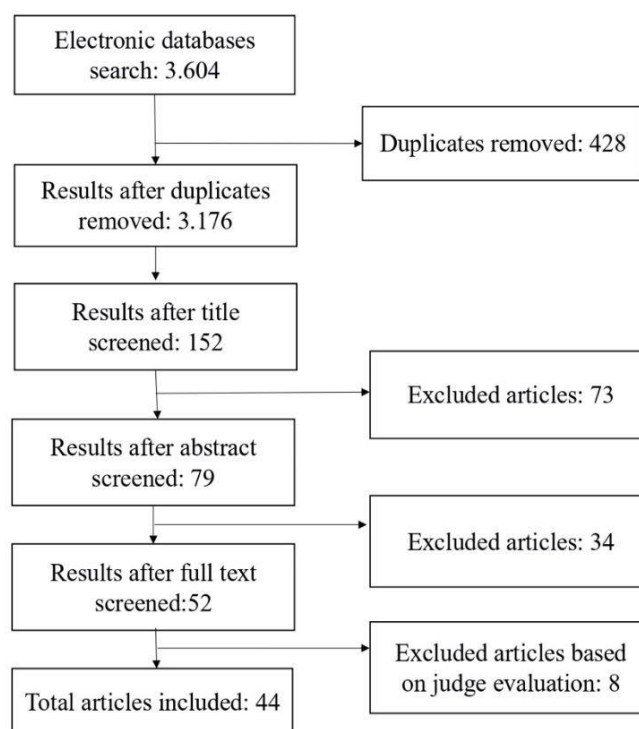
Figure 1. Flow diagram of the literature search process

Extracting, Analysing, and Synthesising the Findings

Five researchers participated in the data extraction process, including coding, analysis, and synthesis. A Microsoft Excel codebook was used to extract the information from all the studies included. The data was organised into the following themes, namely characteristics of the studies (including year, country, main theoretical framework, sample, method, design, and analysis), characteristics of the interventions (including format, level, structure, and contents), context factors, mechanisms, and outcomes. The context, mechanisms, and outcomes were either explicitly proposed in the studies, or implicitly extracted by the authors of the current review. Finally, these three elements were categorised based on the levels of analysis provided by the IGLO model (Day & Nielsen, 2017; Nielsen & Christensen, 2021; Nielsen et al., 2017).

Results

The current section reports the main findings of the present study, regarding the characteristics of the selected studies, the characteristics of the retrieved digital workplace interventions, and their context factors, working mechanisms, and outcomes.

Characteristics of the Studies

Of the 44 studies, 18 single studies were conducted in Europe (six from Germany, six from United Kingdom, two from Poland, two from The Netherlands, one from Italy, one from Turkey), 9 in the United States, 7 in Asia (three from China, three from Japan, one from Singapore), 3 were multinational, and 2 were from Oceania (Australia and New Zealand). The articles included a wide range of participants from different sectors and occupational backgrounds. The sample sizes varied across studies, ranging from 20 to 1236 participants, with mean sample size of 202.69 (SD = 268.01). The age of participants ranged from 19 to 70 years old. Only 25 studies reported the gender, 23 studies have predominantly female participants (ranging from 45.7% to 100%). All the papers were published after 2011. Most of these articles reported a quantitative approach (n = 39), a small number were meta-analysis (n = 2), one article was systematic review, one article was scoping review, and one article used a mixed-method approach combining quantitative and qualitative methods. Regarding the design of the 39 quantitative studies, 25 were randomised controlled trials with pre-, post-intervention and follow-up evaluation, 4 were controlled trial without randomisation, 2 were randomised controlled trials with longitudinal evaluation (pre-, post-, follow-up, and 12 months after baseline), 1 was a diary study, 1 was quasi-experimental with pre-test and post-test with a control group, 1 was non-randomised and non-waiting list (pre-, post-, follow-up at 4 months), and 1 was cross-sectional.

The type of analyses of the researches was very varied, ranging from ANOVAs (n = 9), t-tests (n = 6), one-way analysis of variance (n = 5), MANOVAs (n = 4), linear mixed regression modelling (n = 4), hierarchical linear modelling (n = 4), linear-mixed effects models (n = 2), structural equation modelling (n = 2), mixed model (n = 1), random effects models (n = 1) and, cross-lagged designs (n = 1).

Characteristics of the Digital Interventions

Selected studies reported interventions showing a variety of formats. Almost all the interventions entailed by studies were completely digital in nature, that is, making use of digital tools such as internet browsers, smartphone apps, and instant chat platforms. Nonetheless, two studies (Ehrlich, 2022; Hammer et al., 2011) sought comparisons between the online and the face-to-face version of two distinct interventions.

The specifically digital format of the reported interventions varied across studies. Twenty-two interventions were purely web-based, meaning that they deployed the internet browser as the main digital place where the intervention was delivered. Web-based interventions included websites and online platforms. Nine interventions were purely app-based, meaning that they were delivered on smartphone, tablet, or computer applications. Four interventions deployed a mixed format with both web- and app-based components. Two interventions made use of instant chat platforms that could be installed both on smartphone and computer. Finally, one intervention deployed a mixed format in which web- and app-based components were complemented by a physical activity tracker. Table 1 summarises the digital format of interventions reported by selected studies.

Table 1. Format of examined digital workplace interventions

Digital format	n	References
Web-based	22	Althammer et al., 2021; Bormann et al., 2017; Cieslak et al., 2016; Ebert et al., 2015; Hosseinzadeh Asl, 2021; Keller et al., 2016; Knox & Franco 2022; Ijntema et al., 2021; Imamura et al., 2015, 2016; Li et al., 2021; Makowska-Tłomak et al., 2022; Nadler et al., 2020; Neumeier et al., 2017; Oliver & MacLeod, 2018; Ouweneel, 2013; Paterson et al., 2021; Phillips et al., 2014; Querstret et al., 2016; Shann et al., 2019; Tonkin et al., 2018; Uglanova & Dettmers, 2022
App-based	9	Avey et al., 2022; Bostock et al., 2019; Carissoli et al., 2015; Hirshberg et al., 2022;

Web- and app-based	4	Keng et al., 2022; Pandya, 2021; Purdie et al., 2022; Smith et al., 2020; Weber et al., 2019 Bégin et al., 2022; Lennefer et al., 2019; Pospos et al., 2018; Shirotsuki et al., 2017
Chat-based	2	Wang et al., 2021; Zhang et al., 2022
Web, app, and activity tracker	1	Lennefer et al., 2020

Note. n = 38

There was also some extent of variability in the structure and contents of the reported interventions. The total length ranged from three weeks to three months. Also, the number of course sessions ranged from three to eight. Intervention activities included psychoeducational and informational reading materials, instructions for practical exercises (e.g., meditation), interactive games, pre-recorded listening pieces (e.g., audio guides, relaxing music), asynchronous videoclips and animated clips, synchronous videoconferences, questionnaires, polls, quizzes, essay forms for writing, downloadable documents, and stress and physical activity tracking based on wearable devices. Intervention facilitators were present in a minority of interventions, where sessions were delivered in real time via videoconferencing platforms or other virtual meeting formats, such as for instance in instructor-led mindfulness and on-demand online psychological support. However, most digital interventions were self-delivered. Most of the interventions were digital as per their original design. However, there were also digital adaptations of previously validated face-to-face interventions, especially in the case of mindfulness-based interventions (e.g., Althammer et al., 2021) and interventions that were translated online due to Covid-19 (e.g., Knox & Franco, 2022).

Almost all the DIs followed a scientific theoretical framework, the most predominant were based on mindfulness (Kabat-Zinn, 2015) with 13 studies, eight studies were based on cognitive-behavioural therapy (Beck, 1993), three on self-determination theory (Deci & Ryan, 2012), three on positive psychology (Seligman, 2012), two on the conservation of resources theory (Hobfoll, 1989), two on self-compassion (Neff, 2003), two on the job demands-resources model (Bakker & Demerouti, 2017; 2018). The rest of the studies are based on the broaden-and-build theory of positive emotions (Fredrickson, 2001), change theory (Lyubomirsky et al., 2005), and social support theory (Lakey & Cohen, 2000).

The content of almost all the reported interventions exclusively referred to psychosocial issues, such as factors of positive and/or negative mental health and well-being at work, or indicators of psychosocial well-being and/or ill-being at work. There was only one study (Lennefer et al., 2020) integrating elements of physical health and physical activity in an intervention touching upon dimensions of workplace mental health, such as job control, self-efficacy, emotional strain, and negative affect.

Regarding the IGLO levels at which the examined digital interventions were implemented (Day & Nielsen, 2017; Nielsen et al., 2017; Nielsen & Christensen, 2021),

40 interventions took place at the individual level, whereas the remaining 2 interventions took place at the leader level. This means that the reviewed digital interventions mostly aimed to address cognitive, affective, behavioural, and personal skills and abilities of individual workers – e.g., mindfulness, resilience, self-efficacy, self-compassion –, while only a huge minority of interventions aimed to tackle leaders' knowledge, skills, abilities, attitudes, or behaviours – e.g., supervisor support to employee work-family balance. Particularly, digital interventions mostly aimed to promote either individual- or leader-level job resources and positive aspects of work rather than reducing job demands and negative aspects of work.

Context Factors

All the methodological sections of the selected papers mentioned at least one omnibus context factor related to the general setting where the digital interventions took place. In most studies, these factors referred to participants' job positions or to the industrial sector of the involved organisation. Only a small number of studies explicitly tested the influences among context factors, working mechanisms and intervention outcomes, whereas in most cases information about implicit contextual conditions in which the interventions occurred had to be extracted.

At the individual level of analysis, context factors included participants' job positions, gender, age, previous levels of health and well-being, previous knowledge regarding intervention contents, and personal resources. Employees from selected studies represented a wide range of occupational sectors, encompassing healthcare (e.g., Bormann et al., 2017; Keng et al., 2022; Know & Franco, 2022; Kriakous et al., 2021; Pospos et al., 2018; Purdie et al., 2022; Wang et al., 2021; Zhang et al., 2022), education (Ebert et al., 2015; Hirshberg et al., 2022), social work (Hosseinzadeh Asl, 2021), self-employment (Neumeier et al., 2017), IT (Imamura et al., 2015), and manufacturing (Shirotsuki et al., 2017). Studies mainly included female participants over the age of 18. Only two studies found significant effects of gender and age, tested as control variables. Pandya (2021) found a smartphone app-based intervention to be more effective among males in reducing emotional exhaustion and depersonalisation and increasing resilience at post-test. Keller and colleagues (2016) found a web-based intervention to be more effective among older participants in increasing self-efficacy at follow-up. Several studies adopted pre-intervention levels of participants' health and well-being as an inclusion criterion, looking at baseline indicators such as burnout (Wang et al., 2021), exposure to traumatic events at work (Cieslak et al., 2016), work-related stress (Bostock et al., 2019; Carolan et al., 2017), digital stress during Covid-19 (Makowska-Tłomak et al., 2022), work-related affective rumination (Querstret et al., 2016), depression (Carolan et al., 2017; Phillips et al., 2014), and insomnia and psychological detachment from work (Carolan et al., 2017; Ebert et al., 2015). Other studies specifically focussed on non-clinical populations and healthy employees (Bostock et al., 2019; Imamura et al., 2015; Li et al., 2021; Shirotsuki et al., 2017; Weber

et al., 2019). Few studies tested the effects of pre-intervention levels of participants' health and well-being on intervention outcomes. Generally, employees reporting poorer levels of health and well-being at pre-test benefited significantly more from digital interventions (Carissoli et al., 2015; Hammer et al., 2011; Lennefer et al., 2019), but Avey and colleagues (2022) also found positive effects of higher levels of health and well-being at pre-test on employees' post-intervention resilience. Similarly, several studies adopted participants' pre-intervention knowledge about intervention contents as an exclusion criterion, especially prior experience with meditation practice before participating in mindfulness-based digital interventions (Hirshberg et al., 2022; Keng et al., 2016; Li et al., 2021; Purdie et al., 2022; Querstret et al., 2016). On the other hand, Nadler and colleagues (2020) found an online mindfulness training to be beneficial in terms of increased well-being – that is, higher resilience and positive mood, lower stress and negative mood – for both participants with and without prior meditation experience. Further, Makowska-Tłomak and colleagues (2022) suggested that prior use of information and communication technologies might be a relevant contextual factor when it comes to employees' engagement in digital interventions. For instance, during Covid-19 pandemic employees might have been reluctant to participate in additional online activities to prevent digital overload (ibidem). Finally, employees' personal resources was the last individual-level context factor identified. This encompassed readiness for change before starting the digital intervention (Makowska-Tłomak et al., 2022) and previous attitudes towards spirituality before taking part in a mantra repetition digital program (Bormann et al., 2017). Althammer and colleagues (2021) found lower work-family segmentation preferences to predict better intervention outcomes. Li and colleagues (2021) found no differential effects of pre-intervention trait self-compassion during a self-compassion digital intervention.

At the group level, context factors included peer support and type of interaction. Regarding the former, Ouweneel and colleagues (2013) found that lack of support from colleagues negatively impacted participants' work engagement after an online positive psychology intervention to promote engagement at work. Regarding the latter, Cantarero and colleagues (2021) found that employees interacting with other people via phone or internet during Covid-19 pandemic reported, as compared to employees interacting in person, higher levels of basic psychological needs satisfaction and well-being as a result of an online intervention.

At the leader level, manager support emerged as a relevant context factor. In this regard, Tonkin and colleagues (2018) found that the uptake of and engagement with an online gamified intervention was higher in organisations where senior managers encouraged employees to participate and provided useful resources during the implementation process. Similarly, Shann and colleagues (2019) showed the influence of supervisory support on transfer of a digital leadership intervention.

Finally, at the organisational level, context factors included organisational culture, economic incentives, organisational changes, and societal environment. Regarding indicators of organisational culture, several studies reported that employee participation in digital workplace interventions was voluntary, which can be

conceived as a discrete context factor. Testing voluntary participation's effect on intervention outcomes, Neumeier and colleagues (2017) found that self-selected employees where more motivated and reported larger gains from an online well-being programme. Organisational culture also encompassed omnibus context factors such as collective readiness, organisational capability to address digital interventions, and existing workplace mental health strategies, which can affect transfer of training (Shann et al., 2019). Economic incentives were leveraged to motivate employee participation in interventions, including gift vouchers (Hammer et al., 2011; Neumeier et al., 2017; Tonkin et al., 2018), money (Keng et al., 2022; Smith et al., 2020), continuing education credits, and credits for the company wellness store (ibidem). Moreover, organisational changes were reported to impact digital interventions' processes and outcomes. Shann and colleagues (2019) found that a shift in government and political priorities affected training transfer during a digital leadership intervention. Ijntema and colleagues (2021) found that resilience after an online coaching-based intervention was positively affected by changes in governmental policies related to working conditions during the process of a merger. With regard to the broader societal environment, several studies referred to Covid-19 pandemic outbreak during implementation of digital interventions in the workplace (Cantarero et al., 2021; Ehrlich, 2022; Hirshberg et al., 2022; Hosseinzadeh Asl, 2021; Keng et al., 2022; Knox & Franco, 2022; Makowska-Tłomak et al., 2022; Zhang et al., 2022).

Working Mechanisms

Twenty-nine studies mentioned working mechanisms of digital workplace interventions. Of these, 20 tested working mechanisms' effects on intervention outcomes. Working mechanisms were identified at the individual and the organisational level, whereas no mechanisms could be retrieved at the group and the leader level of analysis.

At the individual level, process mechanisms included type of DI usage, frequency of practice, implementation adherence, training transfer, modality, and duration. As an example of type of usage, Pandya (2021) found that using a smartphone meditation app once or twice a day, perusing both videos and learning sessions, and self-practicing daily, resulted in lower emotional exhaustion and depersonalisation and higher personal achievement and resilience post-test. Frequency of practice was measured in terms of amount of time using web or mobile app interventions (Bormann et al., 2017; Bostock et al., 2019; Keng et al., 2022; Purdie et al., 2022; Tonkin et al., 2018) and number of activities per week (Ebert et al., 2015) Implementation adherence was mainly operationalised as dose delivered versus dose received and measured in terms of number of attended sessions (Bostock et al., 2019; Knox & Franco, 2022; Weber et al., 2019) or modules (Ebert et al., 2015; Oliver & MacLeod, 2018). In all studies, higher implementation adherence predicted post-intervention improvements in mental health and well-being outcomes. Training

transfer was also found to be an important facilitator of workplace digital interventions' effectiveness. Vanhove and colleagues (2016) showed that greater opportunities to bring learnt skills back to everyday work led to improvements in resilience intervention outcomes. Similarly, Shann and colleagues (2019) reported that a set of context factors – i.e., collective readiness, attitudes and stigma, organisational changes – impacted training transfer which, in turn, impacted mental health and depression after an online leadership intervention. Few studies addressed modality as a working mechanism of digital interventions in the workplace. Vanhove and colleagues (2016) found that a computer-based delivery format of a resilience-building programme was less effective than its group-based classroom format in triggering well-being outcomes. Carolan and colleagues (2017) conducted a systematic review of the literature and found that studies that utilise secondary modalities for delivering the DIs and engaging users – i.e., e-mails and text messages, SMS – and use elements of persuasive technology – i.e., self-monitoring and tailoring – may achieve greater engagement and adherence, which lead to increased psychological well-being and work effectiveness. Regarding duration, Carolan and colleagues (2017) also found that a shorter intervention timeframe – from 6 to 7 weeks – led to higher engagement and adherence as compared to digital workplace interventions of longer duration.

Perception mechanisms included change in attitudes and relevance of intervention content. Shann and colleagues (2019) showed that the sustainability of attitude change and the content of an online leadership intervention being considered relevant by its recipients helped participants to overcome workplace stigma and improve mental health. Moreover, Querstret and colleagues (2016) mentioned mechanisms of changes, which can be classified as content mechanisms. Specifically, the authors focussed on facets of mindfulness – that is, acting with awareness, describing, nonjudging, and nonreacting – during an internet-based instructor-led mindfulness intervention for work-related rumination, fatigue, and sleep. Increased levels of acting with awareness explained the intervention outcomes (ibidem). Task crafting could be conceptualised as a working mechanism in the study by Uglanova and Dettmers (2022) regarding a web-based job crafting intervention, but no significant results about it were found.

Finally, at the organisational level, a process mechanism could be identified, namely external support, relating to how workplace interventions are designed, organised and managed. This variable referred to whether facilitator's guidance or supervision was provided during the intervention. Carolan and colleagues (2017) suggested that interventions that achieve the greatest engagement and adherence offer some form of guidance, such as therapist, coach, a coordinator or member of staff, and clinical psychologist. Later, Ijntema and colleagues (2021) tested the coach-client working relationship's strength and found that it was related to most of the immediate effects of a web-based resilience-building programme. The intervention seemed most effective for employees who experienced a stronger coach-client working relationship.

Outcomes

Workplace digital interventions' outcomes could mainly be identified at the individual level of analysis. Outcomes could be categorised into proximal versus distal outcomes, as well as into well-being versus ill-being outcomes.

Individual-level proximal well-being outcomes mostly included mindfulness (Keng et al., 2022), resilience (Zhang et al., 2022), self-compassion (Li et al., 2021), self-efficacy (Ouweneel et al., 2013), and purpose of life (Hirshberg et al., 2022; Ijntema et al., 2021). Furthermore, distal well-being outcomes at the individual level mostly included psychological well-being (Neumeier et al., 2017), general health (Lennefer et al., 2019), positive affect (Ouweneel et al., 2013), satisfaction (Keng et al., 2022) and job performance or work effectiveness (Carolan et al., 2017; Vanhove et al., 2016). Individual-level proximal ill-being outcomes mainly included perseverative thinking (Hirshberg et al., 2022; Ebert et al., 2015; Querstret et al., 2016) and negative affect (Lennefer et al., 2020). Furthermore, distal ill-being outcomes at the individual level mostly included stress (e.g., Carissoli et al., 2015), anxiety (e.g., Zhang et al., 2022), depression (e.g., Imamura et al., 2015), and burnout (e.g., Li et al., 2021).

Social support (Paterson et al., 2021) could be identified as a group-level proximal outcome of digital interventions in the workplace. No leader- or organisational-level outcomes could be identified. Table 2 summarises the main findings from the present study, namely context factors, working mechanisms and outcomes of digital workplace interventions, classified according to the IGLO model (Day & Nielsen, 2017; Nielsen et al., 2017; Nielsen & Christensen, 2021).

Table 2. Context factors, working mechanisms and outcomes at IGLO levels of digital workplace interventions

	I	G	L	O
Context	Job position Gender Age Previous health and knowledge	Peer support Interaction	Manager support	Culture Incentives Changes Society
Mechanisms	DI usage Frequency of practice Adherence Transfer Modality Duration Attitude change			External support

	Content relevance	
Outcomes	Health and well-being Work effectiveness Stress, anxiety, depression, burnout	Social support

Note. I = individual. G = group. L = leader. O = organisation

Discussion

The aim of this systematic review was to explore how, why, and under what circumstances digital interventions in the workplace are effective. In other words, the study sought to identify the contextual factors that might influence workplace digital interventions' effectiveness, the working mechanisms that need to be triggered for the intervention to work as intended, and the work-related outcomes that such interventions produce. It did so by adopting a realist CMO evaluation approach (Nielsen & Abildgaard, 2013; Nielsen & Miraglia, 2017; Nielsen & Randall, 2013; Nielsen & Shepherd, 2022; Roodbari et al., 2021a, 2021b, 2023) as well as an IGLO multilevel perspective (Day & Nielsen, 2017; Nielsen & Christensen, 2021; Nielsen et al., 2017), integrated into one analytical framework. As a result, several omnibus and discrete context factors, process, perceptions and content mechanisms, and proximal and distal well-being and ill-being outcomes were extracted from the selected studies, along with a number of varied digital interventions applied in workplace settings.

Despite variables being identified at all IGLO levels, most of them corresponded to individual characteristics, attitudes, psychological states, and behavioural outcomes. This probably reflects a more generalised tendency of research in work and organisational psychology towards predominantly focussing on individual issues and the individual as its essential unit of study (Anseel et al., 2018). However, the findings from the present study also pointed out to the importance of interpersonal dimensions such as, for instance, peer and manager support as relevant group- and leader-level context factors for workplace digital interventions' effectiveness (e.g., Ouweneel et al., 2013; Shann et al., 2019; Tonkin et al., 2018), as well as the relationship between the recipients and the facilitators as a process mechanism leading to desirable outcomes of digital interventions in the workplace (e.g., Carolan et al., 2017; Ijntema et al., 2021). On the one hand, these results are consistent with previous literature highlighting that peer and manager support positively affect workplace interventions' effectiveness (Christensen et al., 2019; Helland et al., 2021; Nielsen et al., 2010, 2023; Roodbari et al., 2021a, 2021b). Support from peers and managers facilitate the effectiveness of workplace interventions, as they provide

workers with the necessary social resources that sustain their participation in the interventions as well as the application of what they acquired during the intervention into their everyday work (ibidem). On the other hand, the present results are in line with previous empirical studies showing the positive effects of consultant support on organisational interventions' outcomes (e.g., Jenny et al., 2015; Niks et al., 2018; Roodbari et al., 2021a, 2021b).

In general, based on the present study's findings, it can be stated that digital interventions prove promising in reducing job demands and promoting job resources as conceived by the JD-R model (Bakker & Demerouti, 2017; 2018; Schaufeli, 2017), thus providing benefits to workers. Particularly, by fostering resources, DIs contribute to enhancing individuals' ability to cope with stress, adapt to challenging situations, and maintain a positive mindset, thereby promoting overall well-being at work.

This study has limitations which should be considered when interpreting its results. First, potential publication bias could not be controlled, as positive and significant findings are more likely to be published, thus leading to an overestimation of intervention effectiveness. Second, only English, Italian and Spanish studies could be included due to the authors' limited language skills, which may have results in the omission of relevant information from studies in other languages. Similarly, grey literature was not included in the study, but this decision was made to maximise high-quality scientific standards of reviewed evidence. Third, as contemporary technological developments continue advancing at an increasingly rapid pace, the review might have failed to capture the most recent workplace digital interventions. Fourth, as most context factors and working mechanisms were not explicitly investigated as such in the selected studies, some extent of subjectivity has to be taken into account regarding the conceptualisation of relevant variables identified throughout the review. Moreover, there was a causality problem to be taken into account in the selected articles, given the predominance of cross-sectional studies. The causal relationships in DIs were multifaceted and often not directly observable in the reviewed studies. Finally, the variability across studies, evidenced by differences in intervention methods, outcome metrics, and participant demographics, presented a significant impediment to the effective comparison and synthesis of research findings. This heterogeneity, spanning a range of study foci from mindfulness to job crafting, self-determination theory, and self-efficacy, complicated the interpretation of results and the conclusions that could be drawn.

This study also has strengths. Most of all, a systematic literature review is a useful tool for both researchers and practitioners, as it provides a comprehensive and rigorous examination of the available evidence by deploying a structured and predefined approach to searching, selecting and evaluating relevant studies. By following a predetermined set of criteria, this review method minimises bias and enhances the reliability and validity of the findings. Additionally, the inclusion of a wide range of studies allowed for a holistic understanding of digital interventions in the workplace, capturing their diverse forms and manifestations across different workplace settings. Particularly, the current review was conducted integrating

elements of both systematic and realist review methodologies. A hybrid approach was adopted, combining the structured rigor of systematic reviews (Perestelo-Pérez, 2013) with the flexible, theory-driven nature of realist reviews (Nielsen & Miraglia, 2017; Pawson et al., 2005; Wong et al., 2013). This combination was strategically chosen to mitigate the potential limitations of a purely realist synthesis approach, thereby enhancing the robustness and scope of the research.

On this basis, implications for both theory and practice can be considered. In terms of theoretical advancements, the findings from this study contribute to knowledge about and operationalisation of context factors, working mechanisms and outcomes of digital interventions in the workplace. While confirming some of the findings from previous reviews on context factors and working mechanisms of traditional organisational interventions (e.g., Dieleman et al., 2009; Gray et al., 2019; Roodbari et al., 2021a, 2021b), the present study moves beyond by applying the realist evaluation approach into digital-based interventions at work. Particularly relevant to future research, the identification of context factors, working mechanisms and outcomes allows the possibility of developing theories and empirically testable models to explain how different mechanisms of workplace digital interventions lead to various outcomes in several contextual conditions (Pawson et al., 2005; Roodbari et al., 2021a, 2021b). Overall, extracting frequent working mechanisms within the reviewed studies might help formulating context-mechanism-outcome (CMO) configurations that could be tested via moderation or mediation analysis. These theories and models may be used by occupational researchers to advance the knowledge and understanding of what makes digital interventions work for whom in what circumstances, as well as by practitioners for the design, implementation, and evaluation of digital interventions in the organisational field. As for practical implications, the insights gained from this review can inform evidence-based decision-making, guide the development of effective interventions, and ultimately contribute to the enhancement of work environments. Applying a realist perspective provides an opportunity to gain a better understanding of how different DIs can improve work outcomes, under which circumstances, and for whom, thus maximising their impact. As such, this study provides an important potential contribution to practitioners for the design, implementation, and evaluation of future workplace digital interventions. Through an attempt to combine the realist evaluation framework and a multilevel analytical perspective, the review aimed not merely to provide a body of empirical evidence on the effectiveness of digital interventions, but rather to specify how interventions are affected by contextual factors and working mechanisms to lead to specific outcomes. Practitioners and organisational managers could use this knowledge when planning new DIs and/or selecting existing ones to improve workers' outcomes. In other words, this approach allows for a more nuanced understanding of how interventions can be tailored to different contexts. This adaptability is critical when selecting DIs, as it enables the customisation of strategies to better meet the diverse needs of users. The additional insights gained from the application of such knowledge can inform decision-makers about the likely

effectiveness of a digital intervention in specific contexts, supporting context-sensitive and evidence-based decision-making in the selection of interventions.

Conclusion

It is encouraging that an increasing number of studies are providing evidence regarding workplace digital interventions, thus offering reliable solutions and strategies to organisations willing to act upon the working environment and workers. The present review enhances the practical knowledge related to such a type of interventions by identifying the contextual conditions under which they can be most effective, and the working mechanisms that can produce their intended outcomes. Knowledge is added not only to claim whether workplace digital interventions are effective, but also how and why, thus contributing to the overall realist evaluation literature.

Nevertheless, this study sheds light on several gaps still remaining in the literature, which can constitute an agenda for future research into digital-based interventions in the workplace. Most of all, studies should investigate more leader-, group-, and organisational-level digital interventions. Regarding the IGLO model, 40 interventions from the present review were implemented at the individual level, whereas two occurred at the leader level. Particularly relevant to the topic of the present dissertation, no intervention was implemented at the group level. Furthermore, studies should deploy qualitative and mixed method designs to reach a more comprehensive view of the factors that may affect intervention effectiveness. The incorporation of qualitative and mixed method designs could provide a more multifaceted and in-depth understanding of the contextual factors that influence digital interventions' effectiveness. These methods can help identify which contextual factors may either support or inhibit the mechanisms leading to the desired outcomes. Also, studies should be conducted including not only working mechanisms already suggested by previous research – e.g., acceptability of the intervention, consultant integrity, quality of implementation, opportunities to transfer and integrate training into everyday work –, but also mechanisms that take into account the peculiar digital nature of interventions – e.g., usability, human-technology interaction.

All of the above was deemed as an input to more targeted research into group-level digital workplace interventions. Such research was carried out throughout the studies that are introduced in the next chapters of the present dissertation.

Study 2. Job Demands and Resources at the Group Level: A Multi-Source Qualitative Needs Assessment Exercise

Abstract. Psychosocial interventions addressing workers should build upon an exhaustive understanding of job demands and job resources in the workplace at all the levels they might unfold, namely the individual, the group, the leader, and the organisation. This study draws upon a multilevel workplace needs assessment exercise performed within three different departments of a large healthcare institution and involving both managers and employees. It aims to illustrate the job demands and resources in the targeted organisation, differentiate among workers' mental models of their working conditions, and discuss the research and practical implications of such findings. Particularly relevant to the main topic of the present dissertation, resources and demands were found at the group level of analysis. Resources included mutual support, trust, cohesion, diverse expertise, and inter-professional cooperation. Communications, interactions, and information exchanges were reported as demands needing improvements at team level. Communication about organisational initiatives to support workers was reported as improvable. In one department, communication between doctors was described as fragmented. In another department, lack of training in communication skills was mentioned. This evidence supported the meaningfulness of implementing digital-based interventions to foster teamwork within the targeted organisation.

Background

When psychosocial interventions are introduced in organisations, an exhaustive understanding of the work environment is needed (e.g., Di Tecco et al., 2020; Fridrich et al., 2015; Ramos et al., 2020). This can be achieved through a workplace needs assessment exercise. Consistent with JD-R and IGLO, such assessment should encompass, on the one hand, both job demands and job resources and, on the other hand, cover all levels of the workplace system. So, since they can allow the identification of multilevel sources of either good or bad workers' outcomes within a given working environment – i.e., barriers to positive outcomes at work/major causes of negative work-related outcomes, and positive aspects of work/major causes of positive work-related outcomes –, JD-R and IGLO can be deemed as flexible and easy-to-use instruments, not only to perform actual interventions, but also to conduct workplace needs assessment exercises. In this regard, an integration between JD-R and IGLO can be achieved by making the individual, group, leader, and organisational levels serve as a classificatory framework for job demands and job

resources. Ultimately, this framework can be deployed as a guide for a needs assessment exercise in the workplace.

Workplace assessment activities are useful to tailor subsequent interventions according to the specific workers' needs. However, these needs may depend on how workers perceive their work environment. According to Persson et al. (2012), each worker has their mental model about their work environment. That is, people take cues from the work environment and make sense (e.g., Weick, 1995) and develop a certain understanding of it. This understanding is collectively shared because of common conditions that people may find themselves in together. For instance, one worker's type of perception of a given work environment may depend on the position the worker occupies within the work environment – e.g., in the hierarchy, in the organisational chart – as well as on local working conditions. Similarly, a perceptual distance phenomenon (Gibson et al., 2001, 2009) may occur, whereby managers and employees do not always interpret a given work situation in the same way. By taking cues from each other at work, people develop shared mental models about their working conditions. So, these appraisals influence what workers see as being a job demand or a job resource. Therefore, it is important to gather workers' mental models of their working environment and to identify which aspects of the work environment they share according to the positions they find themselves in or local conditions. In this vein, workplace needs assessment exercises should be properly contextualised (Nielsen et al., 2014; Vignoli et al., 2017). This means conducting them within the field of homogeneous work environments – e.g., same roles, same physical space, same set of activities, same cultural setting, same working patterns, and so on –, as each work environment is likely to show its own characteristics, peculiarities, and idiosyncrasies, and therefore is not necessarily comparable to others, as much as the knowledge retrieved in one work environment is not necessarily generalisable to another one. In addition, needs assessment activities should adopt a multi-source approach to combine information from different actors and acquire a comprehensive picture thanks to the triangulation of perspectives on the targeted assessment issues.

To capture workers' mental models, assessment activities need to involve workers directly (Nielsen et al., 2021). The bottom-up, participatory approach is a guiding principle in this regard. It is one of the most critical success factors of assessment and intervention activities and it consists of the direct participation of relevant employees and stakeholders throughout the whole process. According to Nielsen et al. (2010), the importance of employee participation is because it can (1) help optimise the fit with the local organisational context, (2) be considered an intervention, and (3) facilitate the intervention process. In a bottom-up perspective on workers' outcomes promotion, employees should not be seen as passive subjects, but rather as active actors able to change their work environment. Such an approach is able to (1) ensure the use of relevant stakeholders' local knowledge of what the key issues are concerning job demands and job resources, (2) show what changes need to be made and how, and (3) ensure stakeholders feel valued, empowered, and looked after. By using a participatory approach, workers and their managers collectively gain

resources, knowledge, and skills to identify workplace problems, develop solutions, and implement changes to improve their working conditions (Nielsen et al., 2013). Thus, employees and managers are to be considered key informants along the assessment activities (Christensen et al., 2019; Tafvelin, 2018).

The present chapter draws upon a broader multilevel workplace needs assessment exercise performed within a healthcare setting (Giusino et al., 2022a; 2022b[2]). The overarching aim was to collect suggestions to inform the subsequent design, development, and implementation of multilevel interventions, actions, and initiatives addressing healthcare workers' outcomes. However, for the purposes of the present dissertation's main topic, only job demands and job resources at the group level of analysis are reported, consistent with Lacerenza et al.'s (2018) indication that, when interventions are delivered to teams, needs of the teams are to be exhaustively understood first. The ultimate aim was to verify the organisation-intervention fit (Andersen et al., 2021; Peters et al., 2020) and ensure the relevance of the subsequent implementation of team-level digital-based interventions in the targeted workplace settings. The chapter presents the main group-level findings from the needs assessment exercise and discusses a list of key insights from performing the field experience. The importance of locally assessing work-related issues by means of a contextualised, bottom-up, participatory approach is argued. Consistently, the focus of the needs assessment was on three hierarchical positions (i.e., senior managers, middle managers, employees) from three departments of the targeted healthcare organisation, since (1) the implementation of subsequent interventions, actions and initiatives was planned in each of these departments, (2) this was thought to enable comparisons across both hierarchical positions and departments as well as to (3) clarify whether mental models of job demands and job resources differed across hierarchical positions and/or departments. Thus, along the chapter, study results are synthesised and organised according to hierarchical roles and departments. Finally, practical implications and recommendations for future research are discussed.

Methods

The workplace needs assessment exercise, designed to capture job demands and job resources, was carried out in three departments of a large healthcare institution in Northern Italy. The institution is one of Italy's largest public healthcare organisations in terms of size and care complexity. Its jurisdiction includes 46 municipalities on approximately 3.000 square kilometres, encompassing over 870.000 inhabitants, of which over 23% is over 65 years old, 8% is over 80 years old, and 11% is made of foreign residents. The organisation is divided into six territorial districts, extending across the metropolitan area, and is composed of six hospital departments, four

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[2] Preliminary findings from these published studies are also included in the European Association of Work and Organisational Psychology's EAWOP 2022 Conference Legacy Document. http://www.eawop.org/legacy-of-eawop-2022-glasgow-conference

territorial department, and five support departments. It has nine district clinics, a growing number of healthcare facilities for older adults, and outpatient clinics spread throughout the whole metropolitan area. It employs over 9.000 professionals, more than 1.300 of which are physicians and 5.100 are care workers.

In the present study, the three targeted departments will be named Department A, Department B, and Department C to preserve privacy and anonymity. Each department is different from the others not only in terms of size and discipline, but also because of unique work and organisational cultures. First, Department A counts around 600 employees and most of the clinical activities performed here by healthcare workers are characterised by emergency and urgency. These activities are multidisciplinary and take place in different buildings spread over and beyond the metropolitan area. Second, Department B counts around 600 employees, and it is a multidisciplinary medical institute whose clinical activities – e.g., prevention, diagnosis, and non-surgical treatment of several diseases – are quite routine as compared to Department A. These activities are also spread over the urban territory, such that Department B may include both people working in central hospitals and people working in peripheral hospitals. Third, Department C counts about 300 employees and it consists of a both clinical and research institute, where the medical and the academic mindsets intertwine. Given its monodisciplinary focus and strive for scientific excellence, Department C is considered as more of a specialised hospital. Different from the other two departments, all activities performed by Department C's healthcare workers take place in one building only. Despite the General Director of the main healthcare organisation being the same for all three departments, the management style may differ significantly across them, also due to the presence of different senior and middle managers. Also, the three department do not necessarily show the same working patterns, processes, and procedure, as well as they are not necessarily equipped in the same way in terms of technical, financial, and human resources. All these differences between the three departments legitimated the need for differently investigating working conditions and healthcare workers' mental models in each of them.

The workplace needs assessment methodology comprised four main parts, such as (1) a quali-quantitative contextual measurement, aiming to capture the extent to which management was committed to dealing with workers' issues, what sort of policies, practices, and programmes were in place in the healthcare setting and how they were perceived, (2) semi-structured individual interviews with middle and senior managers, aiming to understand middle and senior managers' experiences, ideas and perspectives around the needs for interventions to improve workers' outcomes, (3) focus groups with employees, aiming to gain mutual knowledge of psychosocial factors affecting psychological and behavioural outcomes at work, and (4) an action plan workshop with a Steering Committee composed of main organisational stakeholders, aiming to identify strategies and interventions needed to improve workers' outcomes in each department. In the targeted organisation, middle managers corresponded to coordinators of work teams within the hospital

departments – for instance, they might be head nurses managing other nurses or head physicians managing other physicians. In contrast, senior managers corresponded to directors or heads managing all the employees of the hospital departments. Available participants were invited to participate by the manager of Health and Safety unit at the hospitals, via either emails or direct contacts in the workplace. To get on the same page about the topic and to make the research protocol following our theoretical model, before each data collection session, all participants were shown a subtitled cartoon video (NTNU Lectures, 2016) providing an easily accessible description of the JD-R model. Also, at the beginning of each session, all participants were given an oral explanation of the IGLO framework. Then, they were encouraged to answer our exploratory questions by keeping in mind the integration between JD-R and IGLO.

Contextual Measurement: Organisational Perspective

Contextual measurement consisted of a survey to be completed by a small group of employee representatives and investigating three thematic areas, namely (1) description of policies, programs, and practices within the organisation, (2) perception of policies, programs, and practices, and (3) management support, commitment and priority, and organisational communication, involvement, and participation. The instrument was composed of 7 open-ended questions for part (1). Eleven Likert-type items were used for part (2) and inspired from the Workplace Integrated Safety and Health (WISH) assessment by Sorensen et al. (2018) and López Gómez et al. (2021). Twelve Likert-type items were used for part (3) and inspired from the Psychosocial Safety Climate (PSC-12) assessment by Hall et al. (2010). The Health and Safety Manager, the Workers Safety Representative, and each Director of the three departments contributed to completing the survey.

Qualitative text data went through full NVivo content analysis (Bazeley & Jackson, 2013), while quantitative answers were used to complement the summaries of qualitative findings.

Semi-Structured Individual Interviews: Managerial Perspective

For senior and middle managers, we administered online semi-structured individual interviews via a computer-based teleconferencing platform compliant with the General Data Protection Regulation (EU) 2016/679 (GDPR). Twenty-one one-hour individual interviews were completed. This flexible strategy was deemed appropriate to managers due to high unpredictability of their work schedules. Validity of this technique is supported by recent literature (Howlett, 2021). In Department A, two senior managers and three middle managers were interviewed ($n = 5$). In Department B, four senior managers and six middle managers were interviewed ($n = 10$). In Department C, two senior managers and four middle managers were interviewed ($n = 6$). The interviews investigated (1) perceptions, knowledge, and attitudes, (2)

hindering and facilitating aspects for the middle/senior managers' role, (3) needs towards creating a sustainable workplace, (4) barriers and triggers related to implementing interventions, and (5) proposals to create and implement workplace initiatives successfully. Interviews were conducted between September and October 2020 by two trained researchers, who committed to a strict code of ethical scientific and professional conduct whereby they should not disclose any sensitive information they might be aware of regarding the interviewed persons.

Interviews were audio-recorded. Recorded data were transcribed verbatim with any identifying information anonymised. One researcher cleaned data by formatting raw data files in a common format. Four native Italian speaker researchers performed deductive content analysis via NVivo version 1.3.1 software (Bazeley & Jackson, 2013). The output of the analysis was then directly translated into English by one bilingual native Italian and English-speaking researcher and approved by three other English-only-speaking researchers. Qualitative content analysis of text data implies the "systematic classification process of coding and identifying themes or patterns" (Hsieh & Shannon, 2005; p. 1278). It provides a flexible and practical technique to investigate human perspectives into matters of health and illness (Hsieh & Shannon, 2005). Particularly, deductive analysis starts from models or frameworks that determine the initial coding scheme or categories, as well as key themes and relationships among them, and are used as a guide for the coding process (Hsieh & Shannon, 2005; Thomas, 2006). The goal is to provide support or to expand existing theories or conceptualisations. In our study, the JD-R/IGLO integrated theoretical framework provided the initial coding scheme. Thus, content analysis was performed by searching for job demands and resources at individual, group, leader, and organisational level – although only group-level job demands and resources are reported here. If new themes emerged as subcategories to predefined codes, we deployed a more inductive analytical procedure (Braun & Clarke, 2006). No interrater reliability index calculation was deemed necessary as the starting theoretical framework determined agreement on identified codes since early process phases.

Focus Groups and Cognitive Mapping: Employee Perspective

We held in-person two-hour focus groups (Woodyatt et al., 2016) with employees at devoted meeting rooms at participants' workplaces. The focus groups were conducted by two trained researchers in September 2020. Four focus groups with 27 healthcare professionals were conducted. In Department A, two focus groups took place with a total of three doctors, eight nurses, and four healthcare assistants (n = 15). In Department B, one focus group was conducted with two doctors, three nurses, and one healthcare assistant (n = 6). In Department C, one focus group was conducted with six nurses and two healthcare assistants (n = 8), whereas doctors could not participate. The focus groups investigated (1) perceptions, knowledge, and attitudes, (2) hindering

and facilitating working conditions, and (3) needs towards creating a better workplace.

Trust-based measures were taken by focus group facilitators by informing participants that their information would be kept confidential by the study researchers. They also explained the importance of every participant's compliance with maintaining privacy and confidentiality about what was discussed in the groups. Each focus group participant was advised to respect the confidentiality of what was shared by the other members during the focus group. Researchers declared they would expect to collect various perspectives, so there would be no correct or wrong version. Researchers encouraged participants' willingness to share opinions by creating a convivial meeting climate. All participants were granted equal opportunity to contribute to the discussion and could decide not to intervene at any time.

The same procedure and data analytical approach as the managerial interviews was followed. Focus groups were audio-recorded and transcribed qualitative text data went through NVivo deductive content analysis.

Each focus group included a cognitive mapping exercise to gather healthcare workers' reflections on how job demands and job resources at different IGLO levels interact with each other. To ensure all employees having the same understanding about workplace issues and workers' psychological states and behavioural outcomes, the exercise started with an explanatory video of the JD-R model. Then, participants were given five minutes to individually note up to three keywords reflecting the current main issues they perceived in their workplace. With this reflection in mind, participants were asked to fill in green post-it notes with at least three job resources and red post-it notes with at least three job demands. This first part of the exercise was carried out without seeing the cognitive map not to bias participants' ideas with predefined categories, but to make them think freely. Subsequently, the facilitator introduced the actual cognitive map. On the map, some gears illustrated how the IGLO levels interact with each other in the workplace system. There were three smaller gears for the individual (I), the group (G), and the leader (L), placed within a larger gear for the organisation (O). Each gear had some example work-related categories attached to its teeth, which the facilitator provided some brief explanation about. However, there was also room for additional categories, if needed, which the facilitator could fill in by the unmarked teeth on the gears. Employees were instructed to place their post-it notes on the most suitable category. The facilitator could assist participants by discussing the reported job demand or job resource. Post-it notes that could not be placed clearly could be parked on a "P" area and discussed further later. Finally, participants' statements were discussed collectively in the group. The facilitator sorted participants' statements according to the map categories to check whether some were misplaced and/or pertained to multiple categories. "Parked" statements were discussed to identify the best fit on the map. The facilitator moved the green and red post-it notes around the map and drew relationships, if any, with a marker pen. (S)he summarised the most important discussion points and asked if participants had anything to add before concluding the meeting. In this way, the

facilitator guided the meeting to a harmonious and productive closure, ensuring that all important facets of the discussion had been explored and that every participant had the opportunity to enrich the collective understanding. The collaborative process, punctuated by the movement of colorful post-it notes, resulted in a visually captivating and intellectually stimulating meeting.

Results

The current section reports the group-level job demands and resources as expressed by each of the various groups of stakeholders involved in the workplace needs assessment activities at the targeted healthcare organisation, namely the employee representatives, the senior and middle managers, and the employees.

Group-Level Demands and Resources as Reported by Employee Representatives

Despite work was not reported to be systematically and preventatively designed, organised, and managed with the explicit aim of promoting healthcare workers' psychological states and behavioural outcomes – with the only exception being the organisation of work shifts –, some structured practices could be identified at the team level of analysis. Monthly team meetings were reported to be held whereby employees can discuss both work-related issues and concerns. These meetings were reported to help conflict management thanks to adopting a mediating leadership style. In addition, a "feedback meeting" was mentioned as part of a more extensive performance evaluation system and reported as an occasion for employees to express concerns. Interviewees agreed about internal organisational communication being a need to address for the organisation to be able to support workers.

Group-Level Demands and Resources as Reported by Senior Managers

In Department A, a positive team climate was reported as a group-level resource, as indicated by effective teamwork, cooperation, collaboration, cohesion, open communication, and ability to manage interpersonal conflicts. Especially cooperation among and between senior and middle managers was mentioned, as it was stated,

"through working groups, through meetings, which we do periodically, through observation, we try to understand how to strengthen the service and individuals".

Nevertheless, work-related problems were reported to be perceived as an individual weakness, which may be due to some degree of stigma, that is, a group-level demand. A desire for more open and inclusive organisational communication was also expressed.

In Department B, at the group level, the main resource reported was the availability of multidisciplinary teams composed of diverse expertise, skills, and abilities, which were deemed necessary to deal with patients' medical complexity. Team cohesion and open attitudes towards mental health in the workplace were also mentioned. Still, communication between doctors was described as fragmented.

In Department C, interpersonal conflicts, both among peers and different hierarchical roles, were reported as a group-level job demand, whereas no group-level job resources were mentioned. Interestingly, a supportive, empowering, and intellectually stimulating managerial style – that is, a leader-level job resource – was self-reported as fostering team cohesion, which is a relevant team-level outcome. Also, several demands attached to leaders' role were reported as preventing leaders from always ensuring a positive team climate. These findings show how the level of the group and that of the leader are closely intertwined, as there is no team without a leader as well as there is no leader without a team of followers.

Table 3 summarises the group-level job demands and resources in the healthcare institution as reported by senior managers.

Table 3. Group-level job demands and resources as reported by senior managers

Department	Demands	Resources
A	Stigma towards workers' issues	Positive team climate
B	Fragmented communication between doctors	Multidisciplinary teams Team cohesion Open attitudes
C	Interpersonal conflicts	

Note. A = multidisciplinary clinical activities in emergency. B = prevention, diagnosis, and non-surgical treatment. C = clinical and research institute

Group-Level Demands and Resources as Reported by Middle Managers

In Department A, at the group level, exchange of positive feedback within teams was reported among job resources. Among job demands, interpersonal conflict was linked to unfair career opportunities and lack of recognition from the management.

In Department B, a positive team climate was reported as a group-level resource, as indicated by cohesion, support, collaboration, trust, and good group communication. For instance, it was stated,

"[…] being able to feel like someone whose point of view is being asked is already a great openness".

In Department C, positive team climate was reported as group-level job resource, as indicated by cohesion, openness to problems, and quality teamwork. For instance, it was stated,

"There is a beautiful environment and exchange between specialists, which allows us to grow together".

On the other hand, concern was expressed that such a cohesive, established, and long-lasting team may reveal counterproductive over time when faced with needs for change or adaptations. For instance, it was stated,

"When I came to run this facility, I felt as if I was dealing with people who were all very rigid and reluctant to change".

Lack of communication skills training was also mentioned. Table 4 summarises the group-level job demands and resources in the healthcare institution as reported by middle managers.

Table 4. Group-level job demands and resources as reported by middle managers

Department	Demands	Resources
A	Interpersonal conflicts	Mutual positive feedback
B		Positive team climate
C	Excessive cohesiveness Lack of communication skills training	Positive team climate

Note. A = multidisciplinary clinical activities in emergency. B = prevention, diagnosis, and non-surgical treatment. C = clinical and research institute

Group-Level Demands and Resources as Reported by Employees

In Department A, at the group level, teamwork was referred to as a fundamental job resource. For instance, it was stated,

"My motivation for this work stays high only because of the group support".

Doctors and nurses listed peer mutual support, listening in difficult working conditions, organisational citizenship behaviours, strong sense of community, positive work climate, and team cohesion as crucial group-level job resources. Nevertheless, interpersonal conflicts, blaming attitudes, and disrespectful behaviours could be identified as group-level job demands. Figure 2 and Figure 3 show the cognitive maps from the first and second focus group at Department A. The maps allowed to gather links and interactions among job demands and job resources at different IGLO levels, but only group-level findings are highlighted here, consistent with the topic of the present dissertation. As it is shown, an individual-level job resource such as initiative for discussing workplace issues was reported to lead to a group-level job resource such as positive relationships with colleagues. Also, at the group level, team cohesion was mentioned as a possible resource to increase the sharing of both positive and negative experiences at work.
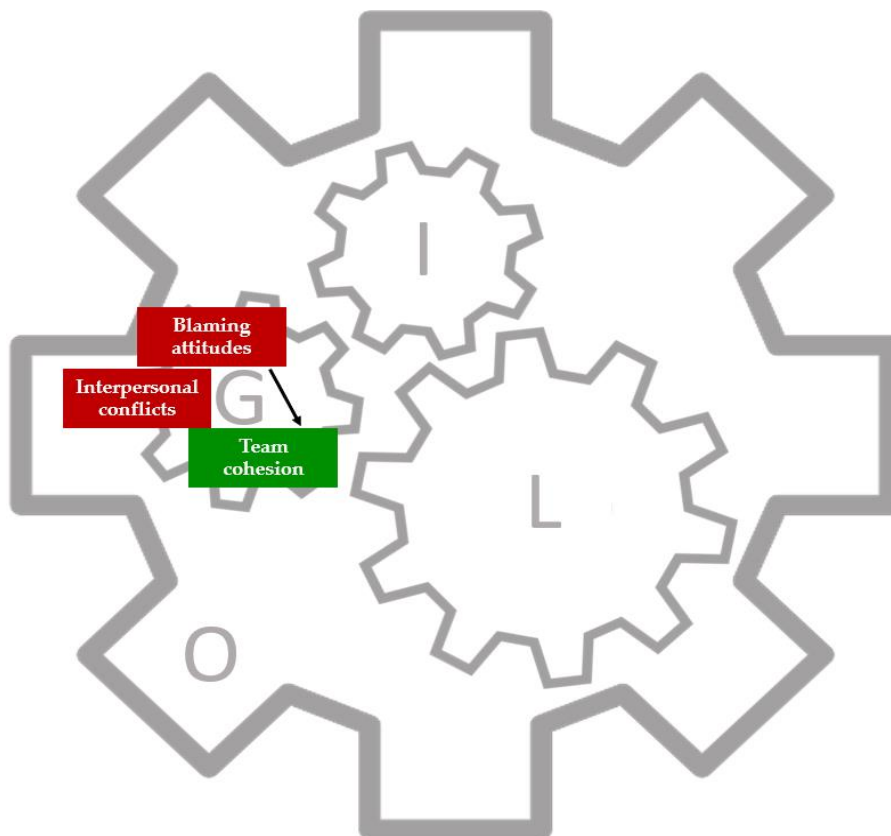
Figure 2. Cognitive map from first focus group at Department A
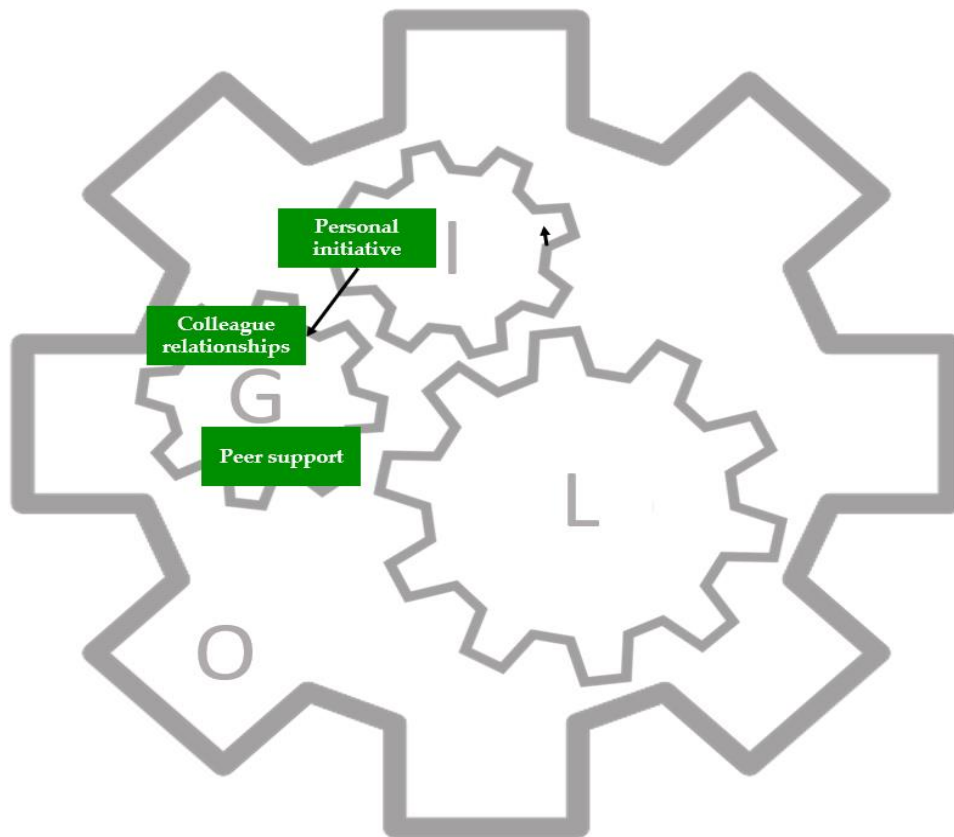
Figure 3. Cognitive map from second focus group at Department A

In Department B, team cohesion, effective cooperation, and positive relationships with colleagues were listed as group-level job resources. Figure 4 shows the cognitive map from the focus group held at Department B. With regard to group-level job demands and resources and their linkages to other IGLO levels, an organisational-level job demand such as high workload was described as threatening team cohesion and positive relationships with colleagues. High workload was in turn traced back to understaffing, which is another organisational-level job demand.
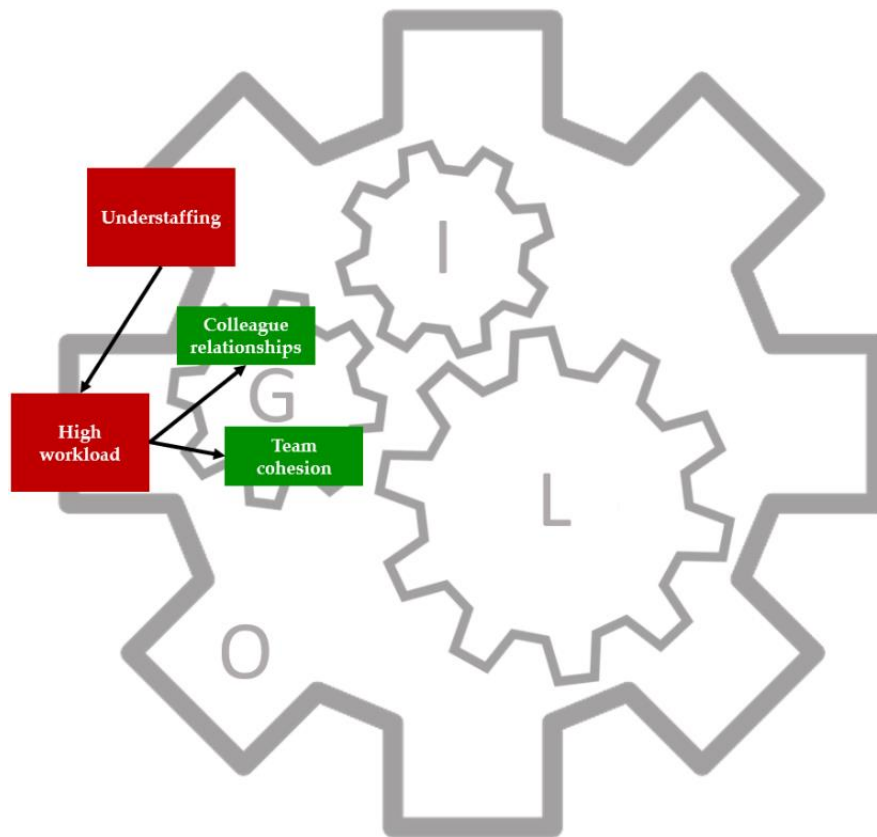
Figure 4. Cognitive map from focus group at Department B

In Department C, at the group level, team cohesion, team support, and positive team climate were listed among job resources. On the other hand, ineffective communication processes were also reported as a job demand. For instance, it was stated,

"*There is a lack of communication on how information is received and how it is given*".

Figure 5 shows the cognitive map from the focus group held at Department C.
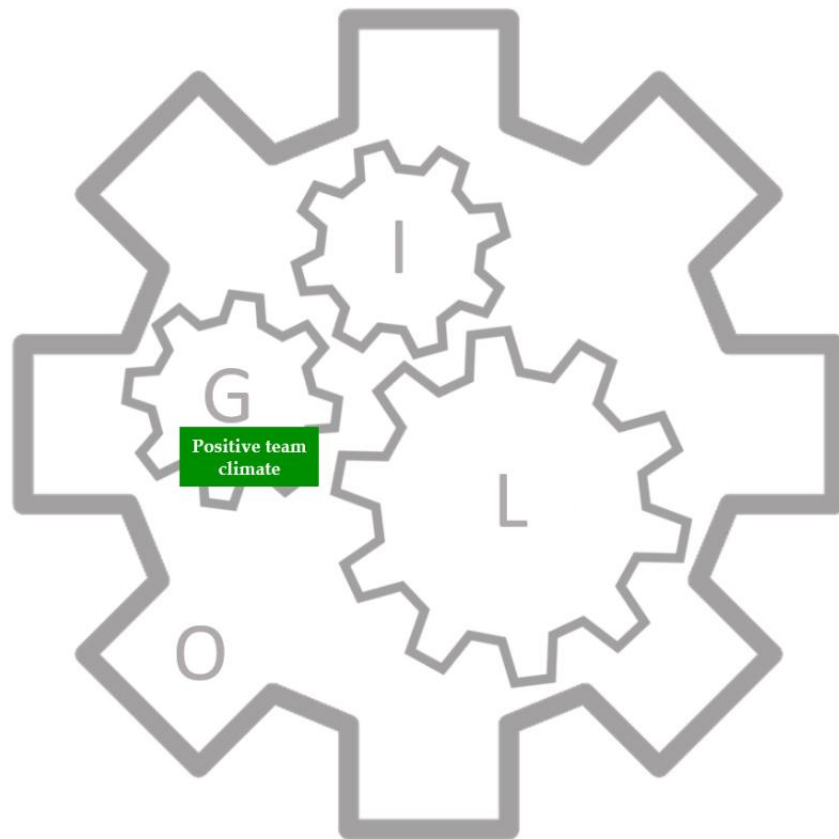
Figure 5. Cognitive map from focus group at Department C

Covid-19-Related Group-Level Job Demands and Resources

The workplace needs assessment exercise took place during the Covid-19 pandemic period. Thus, participants inevitably mentioned additional job demands and resources that were specifically related to the impact that the pandemic outbreak was having on healthcare workers and work at the targeted healthcare organisation. As for group-level job demands, social distancing was reported to hamper both formal and informal team interactions and communications, as it was reported by one middle manager,

"Certainly, one negative aspect of Covid is the distance […]. We're a close working group, and we like to work close together, we like to collaborate, we like to exchange opinions, and […] we like to stay […] close together to talk. Distance works against us because we can't "huddle together" anymore, so we can't even take a break […]. This is a very negative aspect of Covid […]. This has had a great impact […], this crisis of the relational aspect".

Information exchange had been made difficult by social distancing despite ICTs. Mention was made of communication about organisational changes. Besides functional aspects, social distancing was reported to make it harder to keep good team climate. In this regard, one senior manager indicated that

"Even just trivially, the meeting […]. We're talking about how to keep the climate, how to act discussions […]. Think of the difficulty we have, as departments, as coordination, in reaching the staff. We used to have the departmental meeting, everyone came, you used to talk and, at least, you managed to do it. Now […] the meetings are all in small groups, but this means that the coordinator must speak six times because, at each shift change, you take the group off in the morning, on in the afternoon, and you have the meeting […]. Or, trivially, it was sometimes a moment of pause – no? – to say, "come on, it's the birthday of […], we'll stop for a moment in the kitchen". It became those ten minutes of breath of oxygen that, every now and then, are good for you. We can't do all this anymore".

Social distancing was sometimes reported to make teams' life even more complicated due to lack of proper workspaces to comply with it. Furthermore, at group level, most resources were reported, namely, mutual support, increased cohesion, solidarity, teamwork, and inter-professional cooperation. One nurse referred to group-level resources as follows,

"We all started from the same base, and this created wonderful groups, because there was daily talking and discussion".

A shared perception was expressed about Covid-19's positive effect on interpersonal relationships within workgroups. Feeling "all in the same boat" facilitated dealing with the pandemic situation. This emerged, for instance, from the following words of one middle manager,

"a marvellous atmosphere was created that I'd never have thought possible […] and a kind of solidarity and extremely positive atmosphere was created despite the heavy workload […] because we felt very close to each other […]. The […] infectious disease […] meant that this new group immediately came together […]. With Covid, a great deal of solidarity was created, […] there was a coexistence of a couple of months where everyone appreciated each other, was well integrated".

A similar report was provided by another middle manager, as follows,

"certainly, working closely with everyone made this period less burdensome […]. It wasn't easy, but the key element that led us, however, to make stress a source of wellbeing, was the collaboration […]. Our working together has made us feel less alone, that's for sure […]. The team collaboration […] made everything flow spontaneously".

The pandemic situation was reported to have transformed previous inter-professional conflicts into a collaborative, cohesive, and mutually supportive climate. One middle manager reported that

"the way of looking at each other has changed […] There is a mutual esteem that there was not before; so, one has seen you working there, you have seen him working there, you have seen the shifts – and you look at them in a different way. And that's nice".

Another middle manager reported,

"we all worked and there was no longer the professor, the first-level manager, the nurse".

Nonetheless, employees reported the above group aspects were already forgotten after the first Covid-19 wave, but that improvements at the group level were needed anyway. As the groups already started to feel less cohesive and collaborative, participants stated that the Covid-19 experience should teach everybody much about teamwork.

Discussion

Psychosocial interventions addressing workers should build upon an exhaustive understanding of causes of negative work outcomes and factors of positive psychological states and behaviours among workers. Also, interventions should reduce job demands and promote job resources. As a mean to the design and development of tailored interventions, workplace needs assessment exercises should follow the same logic. Particularly, participatory, bottom-up assessment activities are required to directly ask workers what they feel about their working environment, as this cannot be known a priori. The present chapter drawn upon a workplace needs assessment exercise (Giusino et al., 2022a; 2022b) involving senior managers, middle managers, and employees from three departments of a large healthcare institution in Northern Italy. Healthcare workers' perceptions of local working conditions could be gathered via semi-structured individual interviews and focus groups. The workplace needs' assessment exercise allowed to gather job demands and job resources that healthcare workers perceived at the group level, identify similarities and differences in perceptions – i.e., shared versus diverging mental models – of working conditions across the considered hierarchical positions and departments, and inform a tailored action plan to enhance teamwork within the targeted organisation.

The contextualising, bottom-up, participatory approach towards the workplace needs' assessment exercise allowed to gather the extent to which different key stakeholders in different departments agreed or disagreed about major issues. That is, it was possible to capture similarities and differences in both the nature and the content of reported issues across hierarchical positions and healthcare departments. Ultimately, such an approach allowed to verify whether needs from senior managers versus middle managers versus employees – both within and between departments – , as well as those from Department A versus Department B versus Department C – both within and between hierarchical positions –, aligned or misaligned. In other

words, a picture of shared versus diverging mental models of working conditions within the targeted organisational contexts across the considered hierarchical positions and departments could be taken thanks to collecting a variety of views, perceptions, and needs. So, senior managers tended to agree about teamwork – e.g., team cohesion, peer support – as a group-level job resource. However, this was not the case for senior managers in Department C, who consistently reported frequent interpersonal conflicts as a group-level job demand. Middle managers from all three departments agreed about teamwork – e.g., team cohesion, peer support, positive social climate – as a group-level job resource. Nonetheless, middle managers from Department C reported concerns about excessive team cohesion in face of needs for change and adaptation. Also, middle managers from Department B mentioned effective team communication as a group-level job resource, whereas middle managers from Department C reported lack of training in communication skills as a group-level job demand. Finally, all employees mentioned positive social climate, team support, and team cohesion as crucial group-level job resources – and this finding was consistent with both senior and middle managers' reports. Nevertheless, employees from Department A and Department C mentioned interpersonal conflicts and ineffective team communication as group-level job demands. In addition, employees from all three departments agreed about ineffective leadership as a leader-level job demand, which was also associated with interpersonal conflicts and poor communication. Overall, shared versus diverging mental models of local working conditions could be gathered across both hierarchical positions and departments. All healthcare workers tended to agree about effective teamwork as a crucial group-level job resource. Ultimately, workplace needs' assessment findings might vary within the same healthcare organisation, as well as within the same hierarchical position – depending on healthcare departments – and within the same healthcare department – depending on hierarchical positions. Differences in results from assessment exercises may depend on perceptions of local working conditions. This was the case in the herein described workplace needs' assessment exercise since each department the assessment activities took place in corresponded to a unique work and organisational culture – e.g., workers providing healthcare versus research services, workers in central versus peripheral hospital, and so on. Thus, such differences reflect the organisational complexity of the targeted public healthcare institution, which is to be considered when performing workplace needs' assessment exercises.

Moreover, the needs' assessment exercise allowed to inform a tailored action plan to enhance work outcomes within the targeted organisational contexts. To ensure fit between the organisational context and subsequently implemented interventions (Peters et al., 2020), and thanks to the participatory approach, healthcare workers themselves offered concrete, practical, and applicable suggestions for improving their work environments. These suggestions varied according to shared or diverging mental models about local working conditions. For instance, suggestions for group-level interventions included the improvement of interdepartmental communication and training programmes to support open dialogue between managers and

employees. Employees from Department C also suggested regular meetings to share objectives, work plans, and updates. Psychological support services were suggested to improve healthcare workers' communication skills.

As a final phase of the workplace needs' assessment process, an action plan was developed. Healthcare workers' needs and suggestions were reported to the project's Steering Committee, which was composed of key stakeholders from each targeted hospital department. The aim was to define consistent interventions for each department. Factors to promote job resources – i.e., elements to preserve – and factors to reduce job demands – i.e., elements to improve – were identified. In Department A, elements to preserve included team cohesion and support. On the other hand, elements to improve included intra-team and inter-departmental team building. In Department B, elements to preserve included shared vision and identity, team cohesion, and team support. On the other hand, elements to improve included communication skills – i.e., between healthcare workers and customers, as well as between managers and employees. Finally, in Department C, elements to preserve included intergenerational collaboration, whereas elements to improve included team building.

Despite recruiting healthcare workers from different hierarchical positions and hospital departments may have ensured a sufficient degree of data triangulation (Ramos et al., 2020), also allowing to take the perceptual distance phenomenon into account (Gibson et al., 2001, 2009), one main limitation of the present study concerns a potential drawback of the deployed recruitment and data collection strategy, whereby ingroup bias might have occurred within focus groups, thus jeopardising the quality of collected information. For instance, doctors, nurses, and healthcare assistants in Department B seemed to express consistent opinions depending on the belonging occupational group. Therefore, the role of the facilitator in clarifying expectations related to the needs assessment is crucial; they should encourage participants' willingness to reveal their sincere viewpoints by creating a climate of psychological safety within a comfortable and convivial meeting environment. Regarding another limitation, although adopting the JD-R/IGLO analytical framework should have provided researchers with a shared mental model ensuring consistency of findings, these derive from an interpretive process, which is inherent to qualitative research and might be biased toward adopted theories (Hsieh & Shannon, 2005). Deductive coding might mitigate subjectivity-related inconsistencies across researchers, which more likely occur in inductive coding where no initial framework is adopted. Also, multiple data sources – i.e., managers and employees from three hospital areas – might enhance the credibility of our analysis (Hsieh & Shannon, 2005); in fact, the wide variety within our sample is why we define our study as "multi-source." Recall and self-report bias (Stone et al., 2002) might have occurred, and generalisability remains questionable.

This study has also a number of strengths. Most of all, in-depth qualitative methods proved effective to capture both risk and protective factors of psychological states and behavioural outcomes in the given work environment. Also, involving

organisational representatives and stakeholders within the action plan phase allowed them to have their say about future initiatives based on the results from the needs assessment, which can maximise the feasibility and monitorability of implemented actions.

As for the research and practical implications, occupational scientists and practitioners are hereby provided with a usable assessment methodology to gather job demands and job resources that workers might experience. The methodology considers the local conditions workers may find themselves working in or their hierarchical positions within their peculiar work environment. In general, the described procedure might inform the design and implementation of workplace needs' assessment activities in workplace settings, but also the development of interventions based on suggestions for improvement from participants.

Conclusion

To summarise, resources and demands were found at the group level of analysis. Resources included mutual support, trust, cohesion, diverse expertise, and inter-professional cooperation. Particularly regarding Covid-19, working for a common good such as patients' health was associated with motivation and lowered inter-professional conflict. Arguably, perceiving a common "enemy" or "threat" and the shared goal of fighting it determined social recategorisations whereby ingroup and outgroup have come to feel as one. This seems consistent with Makowiecki et al. (2020) stating that "war is happiness, in the sense that increased trust, friendship and collaboration in the fight" (pp. 35–36). On the other hand, communications, interactions, and information exchanges were reported as demands needing improvements at team level, despite increased deployment of ICTs. Communication about organisational initiatives to support workers was reported as improvable. Communication between doctors was described as fragmented. Lack of training in communication skills was also mentioned.

Taken together, this evidence supported the meaningfulness of implementing digital-based interventions to foster teamwork within the targeted organisation. The implementation was then carried out in a subsequent study (Giusino et al., 2023), which is introduced in the next chapter of the present dissertation.

Study 3. Digital Team Coaching for Workplace Communication Using Social Network Visualisation: Longitudinal Evaluation of Recipients' Perceptions

Abstract. The purpose of this study was to describe the implementation of a digital-based team coaching intervention aimed at improving team communication in the workplace through social network visualisation. The study examined recipients' perceptions of the intervention at two time points and assessed the temporal stability of various factors, including the intervention's integrity, design, transferability, acceptance and the usability of the adopted visualisation tool. The moderating role of digital usability was also evaluated. Four team coaching sessions were delivered to 62 participants from seven teams across three departments within a large public healthcare organisation in Northern Italy. Perceptions of the intervention dimensions were collected after the second and fourth sessions. Results indicated that, at both time points, recipients appreciated the intervention's integrity and usability more than its design, transferability and acceptance. Furthermore, no significant changes in recipients' perceptions were observed over time. The transferability of the intervention was significantly associated with its acceptance, but only when the usability of the digital tool was high. The study underscores the potential of integrating specific techniques such as Sociomapping and coaching within organisations, encouraging more research and development in these areas. The study also emphasises the critical role of usability and integrity in digital-based team coaching interventions, suggesting that high-quality, user-friendly tools not only lead to initial effectiveness but also sustain positive impacts over time, while also increasing transferability and acceptance.

Background

Teamwork and team communication are critical factors for successful team performance in the workplace and vital outcomes of team-level workplace interventions, as they significantly contribute to team effectiveness (Salas et al., 2018). Effective communication can be characterised by four primary attributes, such as clarity, timing, relevance and frequency (Franc et al., 2019). By focusing on these aspects, team-level workplace interventions, such as team coaching leveraging social network analysis and visualisation, can offer valuable strategies for its optimisation, foster teamwork and communication, ultimately promoting team effectiveness and organisational success (Bahbouh, 2012; Bahbouh & Lasker, 2014; Bahbouh & Willis, 2022).

Healthcare, in particular, exemplifies a domain where teamwork and communication are considered critical for patient safety and team performance (Rosen et al., 2018; Shoukat et al., 2022). Healthcare is a complex, demanding and diverse field requiring interdisciplinary collaboration. Team-based work plays a pivotal role in making informed decisions that draw upon a wide range of expertise (Barnes and Hollenbeck, 2009) and performing tasks requiring multiple individuals' specialised skills (Mathieu et al., 2017). Past research highlights the importance of communication as a critical determinant of team effectiveness in healthcare settings (Ervin et al., 2018; Fowler et al., 2021; Hopkinson et al., 2021; Molleman et al., 2010). Fostering effective communication within healthcare teams is thus crucial not only for team success but also for overall organisational performance.

Digital technologies have expanded the scope of interventions, giving rise to digital-based team coaching interventions in the workplace. Digital workplace interventions can be defined as structured, planned and science-based actions aiming to promote desirable work outcomes by exploiting the potential offered by digital technologies. It may be adaptations of traditional, in-person interventions facilitated through online teleconferencing platforms or designed exclusively for computer or smartphone applications (Baños et al., 2022). Although research has shown that digital interventions can effectively promote desirable workplace outcomes (Phillips et al., 2019), and despite promising preliminary evidence regarding the effectiveness of digital-based team coaching interventions in various industries (Bernardová, 2012; Franc et al., 2019; Tetour, 2019), much of the existing literature has primarily focused on individual-level implementation and evaluation of digital workplace interventions. This is especially true regarding digital-based team coaching interventions based on social networks and sociometric analysis (Bahbouh, 2012; Bahbouh & Lasker, 2014; Bahbouh & Willis, 2022). This leaves a gap in our understanding of the potential benefits and challenges associated with team-level digital-based team coaching interventions, presenting an opportunity for further investigation and development in this emerging field.

Recently, the main frameworks for the evaluation of both the process and effects of workplace interventions (Nielsen & Abildgaard, 2013; Nielsen & Randall, 2013) have underlined the importance of taking into consideration the perceptions of the workplace actors involved in interventions, including the recipients of the intervention itself. These models argue that recipients' perceptions should be integral to workplace interventions' evaluation as they are vital mechanisms for their effectiveness. Recipients' perceptions constitute underlying psychological aspects that may explain workers' behavioural reactions to the intervention activities and, as such, may facilitate or hinder the effectiveness of the intervention itself, thus contributing to its success or failure. Particularly, Nielsen and Randall (2013, p. 608) stated that "an important part of […] evaluation should be the measurement of change in employees' knowledge of the intervention, their expectations that the intervention can bring about changes".

In light of the above, this study (Giusino et al., 2023[3]) represented the first attempt to monitor aspects of the process, in particular, the perceptions of the recipients over time, of a digital-based team coaching intervention designed to enhance team communication through social network visualisation and team coaching techniques in the healthcare sector. The aim was to test whether this monitoring can provide an explanatory framework for the observed results and act as a catalyst for future outcome evaluation studies. This intervention was implemented in a large public healthcare organisation in Northern Italy as part of a broader project focused on evaluating organisational interventions (De Angelis et al., 2020). The study had three primary objectives. The first objective was to assess recipients' perceptions of dimensions that are relevant to digital team interventions according to previous literature (Broetje et al., 2022; Holton et al., 2000; Martin et al., 2020; Vuori et al., 2012; Yelon et al., 2004; Zhou et al., 2019), specifically the usability, the transferability, the integrity, the training design and the acceptance of the intervention. The second objective was to evaluate the temporal stability of recipients' perceptions, explicitly examining whether and how these perceptions evolved during the intervention implementation. The third objective was to investigate the role of the usability of the digital tool as a moderator in the relationship between perceptions of the intervention and its overall acceptance.

From Traditional Face-to-Face to Digital-Based Team-Level Interventions

Traditional face-to-face team interventions in healthcare have generally yielded positive results over recent decades, particularly those aimed at enhancing team communication. Numerous studies have demonstrated the efficacy of such interventions in improving various aspects of healthcare delivery (Hung et al., 2020; Kilpatrick et al., 2020; McCulloch et al., 2011; Prewett et al., 2013; Sacks et al., 2015). A systematic review by McCulloch and colleagues (2011) found some evidence of benefit on healthcare staff attitudes, teamwork quality, technical performance, efficiency, and medical error rates from studies with intensive team communication training programmes. Prewett and colleagues (2013) concluded that a low-cost, one-day teamwork training delivered to medical residents and encompassing guided discussions for feedback, positively affected behavioural choices for teamwork in the trauma room. A meta-analysis by Sacks and colleagues (2015) concluded that communication-based interventions prove promising to improve patient outcomes, healthcare efficiency, and surgical culture. Hung and colleagues (2020) found that multidisciplinary team discussions resulted in survival benefit for patients with stage III non-small-cell lung cancer. Finally, in a systematic review of brief team training interventions conducted in acute care in-patient settings, Kilpatrick and colleagues

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[3] Preliminary findings from this published study have also been presented at the XXX National Congress of the Italian Association of Psychology, held in Padua, Italy, in September 2022. https://aipass.org/xxx-congresso-aip-plenario-padova-27-30-settembre-2022/

(2020) found that three to four 30- to 60-minute training sessions spread out over several weeks with structured facilitation and debriefing appeared to improve non-technical skills, for instance, communication. Taken together, these studies suggest that even brief, well-structured interventions can have a significant impact on team communication and overall performance in healthcare settings. In other words, traditional in-person team communication interventions have demonstrated considerable success in fostering team communication within the healthcare sector. These interventions, ranging from intensive team programs to brief targeted sessions, have been linked to improvements in staff attitudes, teamwork quality, technical performance, healthcare efficiency and patient outcomes. As the healthcare landscape continues to evolve, it is essential to build upon these findings and explore innovative ways to enhance team communication and performance further (Larson and DeChurch, 2020).

Digital-based interventions have become powerful tools for enhancing team communication across various industries. By leveraging cutting-edge technology, these interventions facilitate more effective, efficient and adaptable communication strategies, which are critical for team success. Relative to traditional face-to-face interventions, digital workplace interventions generally come with peculiar challenges, including, for example, users' engagement and adherence, ethics, privacy and data protection (Baños et al., 2022; Phillips et al., 2019). On the contrary, digital interventions for teamwork can offer unique advantages over traditional face-to-face interventions, such as increased geographical and temporal accessibility, cost-effectiveness, personalisation and attractiveness (ibidem). Thus, digital interventions constitute a promising avenue for the future of workplace interventions. In this context, several studies have explored the impact of digital-based interventions on team communication in different sectors, such as military aviation (Bernardová, 2012), private enterprises (Franc et al., 2019), the hospitality industry (Tetour, 2019) and undergraduate business education (Willox et al., 2023). Taken together, these studies suggest that digital-based team communication interventions can enhance information sharing and situational awareness, improve clarity, timing, relevance and frequency of communication among team members, promote greater collaboration, problem-solving and overall productivity, and streamline communication processes, reduce misunderstandings and enhance overall team performance.

The increasing adoption of e-health practices (Eikey et al., 2015), along with the surge in remote teamwork following the Covid-19 pandemic (Newman & Ford, 2021), has led to a rise in online communication within the healthcare sector. This shift underscores the need to explore the potential of technology in facilitating healthcare team interventions, explicitly focussing on digital-based approaches to improve team communication. There is a notable gap in the current research landscape regarding digital-based interventions targeting team communication in healthcare settings.

Team Coaching Interventions Based on Social Network Analysis and Visualisation

Innovative team coaching techniques and tools are revolutionising the way organisations foster collaboration, communication and performance among their teams. In *The Team Coaching Casebook*, Clutterbuck and colleagues (2022) provided a comprehensive analysis of the power and impact of team coaching in organisational settings, emphasising the importance of a customised approach based on individual team dynamics and challenges. Techniques assessing team strengths and weaknesses provide coaches with invaluable insights into areas for development. Team coaching tools facilitate creativity and problem-solving by engaging team members in hands-on, collaborative activities or navigating interpersonal conflicts and promoting understanding among team members. Furthermore, digital technologies are being integrated into team coaching practices, enabling interactive experiences that foster team bonding and enhance learning. These innovative approaches not only drive team performance but also contribute to creating a culture of continuous learning, adaptability and organisational change capability (Supriharyanti & Sukoco, 2023).

In this framework, team communication interventions grounded in social network analytical theory and methods (Wasserman and Faust, 1994) leverage digital tools for collecting, processing and visualising complex relational data. In Bahbouh's (2012) seminal handbook, the theory and technique of an innovative digital-based approach to improving team communication by leveraging sociometric analysis, social network visualisation and team coaching were presented. Sociometric analysis and social network visualisation help identify group communication patterns, isolated members and subgroups, and pinpoint the influencers. For example, when teams and their managers understand who from the team feels isolated or there are smaller cliques within the group, they can take actions to work on it. However, these approaches focus on the as-is situation. Using valid and reliable team communication measures, such as clarity, timing, relevance and frequency of communication with each team member, these digital tools use algorithms to create graphical representations, known as "sociomaps", depicting the current and desired communication structures within the team (Rozehnalová, 2013). The structure of each intervention session comprises five sequential steps, such as (1) data collection, (2) team sociomap presentation, (3) team coaching, (4) creation of action plans and commitment, and (5) review of action plans and commitments. The intervention is based on team coaching workshops, defined as direct interactions with a team, intended to help members make coordinated and task-appropriate use of their collective resources in accomplishing the team's work (Clutterbuck et al., 2022). In these team interventions, the sessions and team coaching activities are guided by the digital visualisation of sociomaps to stimulate team reflexivity and self-awareness. The insights from the visualisation then help formulate individual and team action plans that lead to the desired and effective communication state within the team.

Therefore, the sociomaps help not only understand the current dynamics in the group but also provide visualisation of the desired situation and enable monitoring of the group dynamics over time. The visual clarity of sociomaps visualisation – 3D color-coded map of group dynamics – makes the trends and patterns visually apparent and more actionable than traditional sociograms. Still, sociomapping, sociometric analysis or social network visualisation can bring benefits to the group mainly when used with interpretation and potentially with team coaching sessions – face-to-face or online. This approach aims to foster better communication, collaboration and understanding among team members in various organisational settings. By combining digital software-based social network analysis and team coaching strategies, Bahbouh (2012) addressed communication gaps and inefficiencies within teams, ultimately enhancing overall team performance and satisfaction. This intervention not only highlights the importance of understanding the underlying structure of team communication networks but also emphasises the role of tailored coaching in addressing individual and collective needs.

Later, Zakharchyn and Kosmyna (2015) confirmed the benefits of using sociometric analysis techniques for organisations aiming to optimise employee behaviour and overall team performance. Despite such preliminary findings, the present contribution aims to advance the evidence related to this type of approach to improving team communication via social network analysis and team coaching by monitoring aspects related to the implementation of the intervention, that is, the recipients' perceptions of the intervention itself and of the actors involved – e.g., the facilitator or the coach. Back in 2009, Baron and Morin (2009) underscored the importance of coaching relationships in leadership coaching, emphasising that the quality of these relationships is a critical factor in achieving desired outcomes. Applying the significance of coaching relationships to team coaching, similar principles can be observed. In the context of team coaching, the quality of relationships between the coach and the team members, as well as among team members themselves, plays a crucial role in the success of the intervention. By establishing an environment where team members feel comfortable sharing their thoughts, concerns and feedback, the coach can facilitate meaningful discussions and encourage collective problem-solving. In team coaching, the role of the coach is to nurture and support the development of both individual and collective competencies, aiming to improve overall team performance.

Perceptions of the Dimensions of the Team Coaching Intervention

According to the realist evaluation approach and recent models and empirical studies about evaluating workplace interventions (Nielsen & Abildgaard, 2013; Nielsen & Randall, 2013; von Thiele Schwarz et al., 2021), it is important to comprehend the way individuals perceive the various dimensions of interventions. These perceptions, encompassing attitudes toward the intervention's content, structure, facilitators,

design, relevance, and more, are pivotal in evaluating their effectiveness. Each employee interprets their work environment uniquely, forming a shared understanding rooted in common experiences and conditions, which extends to workplace interventions as well. When employees engage in interventions as a team, their collective perceptions are influenced by interactions with one another, considerably influencing their perspectives on the intervention's positive or negative aspects. Therefore, it is recommended to both researchers and practitioners to incorporate recipients' perceptions as a key element in the evaluation of workplace interventions. These perceptions act as underlying mechanisms that play a pivotal role in determining the intervention's effectiveness. Consequently, a crucial component of evaluating workplace interventions should involve measuring changes in employees' perceptions of the intervention and their expectations of its ability to bring about positive changes. This approach underscores the importance of considering individual and collective viewpoints in evaluating the overall impact of workplace interventions.

Numerous studies (Broetje et al., 2022; Holton et al., 2000; Martin et al., 2020; Vuori et al., 2012; Yelon et al., 2004; Zhou et al., 2019) have underscored the importance of various factors associated with the implementation of interventions, including their transferability, integrity, design, acceptance and usability. These elements are pivotal in comprehending the underlying reasons for an intervention's effectiveness and its potential for broader application. Specifically, a thorough understanding of these aspects allows for a more nuanced analysis than merely assessing the effectiveness of an intervention pre- and post-implementation. It enables an examination of the components that may have been instrumental during the intervention, leading to a shift in perception among the participants.

Transferability can be defined as the extent to which intervention recipients think that the knowledge and skills that they learn during interventions are transferrable to the real-world workplace setting (Yelon et al., 2004). Yelon and colleagues (2004) emphasised the importance of transferability in the context of interventions, particularly in relation to their effectiveness and long-term impact. A successful intervention should not only facilitate learning and improvement within the context of the program but also enable participants to transfer these gains to their daily work. The integrity of an intervention refers to the extent to which the facilitator's behaviour was positive, rewarding and relevant to the recipients' participation (Vuori et al., 2012). When interventions are implemented with integrity, the intended benefits are more likely to be realised as participants receive the full range of intended support, guidance and resources. Design can be defined as the degree to which intervention recipients perceive that the intervention has been designed and delivered to give them the ability to transfer learning to the job and that intervention instructions match job requirements. Holton and colleagues (2000) stressed the importance of well-designed training interventions for ensuring effectiveness and impact.

When considering digital-based team intervention tools, it is essential to also recognise the role of acceptance of digital tools in determining the success of these interventions. It can be defined as the recipients' experience that the intervention met their expectations and needs. Specifically referring to an internet-based team development tool deployed among nurses, Broetje et al. (2022) argued that understanding the acceptance and other recipients' attitudes toward digital team interventions is critical to their successful implementation, uptake, adoption and use. Thus, these authors highlight the importance of investigating recipients' perceptions and acceptance, specifically when evaluating digital-based team-level interventions.

Finally, potential factors worth examining include the usability of the digital tool. Usability can be understood in terms of the quality of the recipients' experience with the technological platform where the digital interventions take place, entailing dimensions such as aesthetics, feedback, interactivity, functionality and other design elements (Zhou et al., 2019). Zhou and colleagues (2019) conducted a study to evaluate the usability of a mobile health social network analysis tool designed to enhance communication and collaboration among healthcare professionals. The digital tool aimed to facilitate information sharing and teamwork in healthcare settings, ultimately improving patient outcomes. The authors found that the tool was well-received by healthcare professionals and was efficient in helping users identify communication patterns and collaborate more effectively with their colleagues. The usability of the platform used in a team-based intervention is crucial for ensuring its recipients' better acceptance of the intervention. When a platform is highly usable, users are more likely to engage with the intervention, increasing adoption and compliance (Cruz Zapata et al., 2015; Kumar & Mohite, 2018). First, a user-friendly platform minimises frustration and barriers to use, allowing participants to focus on the intervention's content and objectives. Second, efficient and effective platforms enable users to achieve their goals within the intervention more easily. Third, when participants enjoy using the platform and find it beneficial, they are more likely to share their positive experiences with their colleagues, creating a ripple effect that can further enhance the acceptance of the intervention within the organisation. However, little is known about how the usability of digital platforms interacts with other dimensions of digital-based team communication interventions and its potential role as a moderator.

Methods

This study was part of the European project H-WORK (De Angelis et al., 2020), funded by the EU-H2020 research and innovation framework. The project aimed to design, implement and validate multilevel workplace interventions. The study received ethical approval and adhered to standard requirements. Data collection occurred between March 2021 and January 2022. To maintain anonymity, participants created

a personal code for each completed survey. The researchers' contact information was shared with participants to address any questions or concerns.

Implementation and Recipients of the Intervention

The intervention implementation followed a workplace needs assessment and stepwise framework for team interventions (Lacerenza et al., 2018), ensuring organization-intervention fit (Andersen et al., 2021; Peters et al., 2020). Team-level communication, interactions and information exchanges were identified as areas needing improvement – see Study 2 in the present dissertation as well as Giusino and colleagues (2022a, 2022b). A steering committee was established, as recommended by Nielsen et al. (2013), which included the health and safety manager, workers safety representative, directors of involved hospital departments and nursing manager.

Recipients were recruited through voluntary subscriptions to the team coaching intervention course, with information provided by their health and safety manager. Inclusion criteria required participants in each intervention edition to be members of the same team. Teams were usually co-located teams that only attended the digital team intervention. As healthcare workers, they do not usually work in a remote mode. The intervention was delivered in remote format, on a videoconferencing platform, because of Covid-19-related social distancing public health and safety measures during the implementation period.

The intervention consisted of four team sessions, with two-month intervals between sessions. The first session was 3 hours long, while the remaining sessions were 2 hours each. Sessions were led by two trained professionals, one as the main facilitator and the other as an assistant. The first session introduced participants to the intervention framework and key concepts, such as team communication and effectiveness. Using visualised sociomaps, a team discussion on current and desired communication helped formulate improvement strategies. The second session discussed team communication and developing action plans for desired changes. The third session provided feedback and evaluated progress while also enhancing meta-communication skills. Participants shared thoughts on behaviours or work situations to improve communication effectiveness within the team and individual feedback on colleagues' communication styles. The fourth and final session was a debriefing based on team coaching principles. Team communication measures were collected at each session to generate updated sociomaps, allowing for comparisons and enriching discussions.

Figure 6 displays an example of sociomaps used in the implementation of the intervention for the same team. The sociomap visually represents the interconnectedness of team members based on their communication about work-related topics. The positions of individuals on the map indicate their existing or desired communication patterns. For instance, communication frequency is represented by the proximity of team members on the map; the closer they are, the

more frequent their interactions are or are intended to be. Each individual's height and colour on the sociomap signify their average communication intensity within the team. A higher elevation, marked by red, does not inherently indicate a positive characteristic, just as a lower height, denoted by blue, does not necessarily suggest a negative quality. However, individuals in red may experience communication overload, while those in blue might be insufficiently engaged with the team. Ultimately, the interpretation relies on each person's role within the team and their perception of their position on the sociomap.
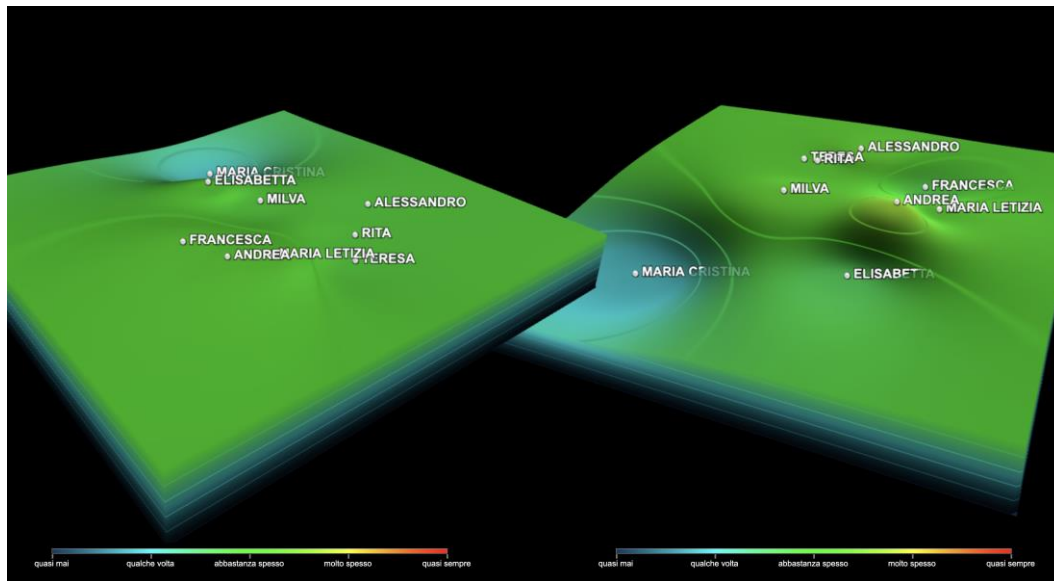
Figure 6. Example of a "sociomap" of the same team in different sessions

The intervention was delivered to seven teams across three departments (Department of Emergency, Department of Medicine and Department of Neuroscience) within a large public healthcare organisation in Northern Italy. Three teams belonged to the Department of Emergency (Team 2, Team 4 and Team 5; 26 individual participants, 41.9%), two teams were from the Department of Medicine (Team 1 and Team 3; 16 individual participants, 25.8%) and two teams were from the Department of Neuroscience (Team 6 and Team 7; 20 individual participants, 32.3%). Each team comprised 6 to 12 members. Team 1 had 7 members (11.3%), Team 2 had 10 members (16.1%), Team 3 had 9 members (14.5%), Team 4 had 6 members (9.7%), Team 5 had 10 members (16.1%), Team 6 had 8 members (12.9%), and Team 7 had 12 members (19.4%).

In total, 62 participants attended at least one of the four team coaching sessions. Specifically, 4 participants (6.5%) completed one session, 12 participants (19.4%) completed two sessions, 16 participants (25.8%) completed three sessions and 30 participants (48.4%) completed all four scheduled sessions. Although the entire team agreed to participate in the intervention, not all members completed all sessions.

Archival data from organisational records regarding participants' sociodemographic and job-related information were provided by the contact persons

from the targeted organisation during the design phase. Twenty-seven participants were nurses (43.5%), 13 were physiotherapists (21%), 8 were healthcare assistants (12.9%), 5 were doctors (8.1%), 4 were speech therapists (6.5%), 3 were healthcare technicians (4.8%), 1 was an educator (1.6%) and 1 was an ambulance driver (1.6%). Three participants (4.8%) were identified as head nurses and 1 participant (1.6%) as a head doctor, while 58 participants (93.5%) held no leadership roles. Organisational tenure ranged from 0 to 35 years ($M = 15.15$, $SD = 10.49$), and ages ranged from 29 to 65 years ($M = 46.9$, $SD = 9.44$). Forty-six participants were female (74.2%) and 16 were male (25.8%).

Measures

Measures were collected one week after the second session (T1) and one week after the fourth and last session (T2). Items referenced the team using "we" (Chan, 1998) and were administered in Italian. Five dimensions of the intervention were measured as follows.

Usability. Six items adapted from Zhou and colleagues (2019) were used to assess the usability of the digital tool. Example items include, "The digital tool was easy to use" and "Overall, I am satisfied with this digital tool". Response options ranged from "1 = strongly disagree" to "5 = strongly agree." Cronbach's α was .90 at T1 and .76 at T2.

Transferability. Three items from Yelon and colleagues (2004) measured the perception of the transferability of the intervention. An example item is, "The skills we developed during the team intervention will help us in our work". Response options ranged from "1 = strongly disagree" to "5 = strongly agree". Cronbach's α was .84 at T1 and .90 at T2.

Integrity. Six items adapted from Vuori and colleagues (2012) assessed the perceptions of the intervention's integrity. Example items include, "Did the facilitators make you feel like your participation was valued?" and "Did you find group discussions useful?". Response options ranged from "1 = not at all" to "5 = all the time". Cronbach's α was .83 at T1 and .82 at T2.

Design. Four items from Holton and colleagues (2000) measured the perception of the intervention's design. An example item is, "The activities and exercises helped us apply learning on the job". Response options ranged from "1 = strongly disagree" to "5 = strongly agree". Cronbach's α was .76 at T1 and .90 at T2.

Acceptance. Three items from Martin and colleagues (2020) assessed the acceptance of the intervention. An example item is, "I would recommend the team intervention to others in a similar situation". Response options ranged from "1 = to a very low extent" to "5 = to a very high extent". Cronbach's α was .88 at T1 and .78 at T2.

Sociodemographic and job-related information was collected through the same

questionnaire. At the end, respondents were asked to create a unique ID code to maintain anonymity while allowing tracking of individuals' answers across different data collection time points.

Data Analysis

The Statistical Package for the Social Sciences (SPSS) statistics software version 25 was used to perform statistical analysis. Frequencies were run to gather information about the sample. Descriptives were run to calculate skewness and kurtosis to test the assumption of normality of difference scores between the observations of continuous variables aimed to be compared. Following George and Mallery (2010), if values of skewness or kurtosis were between -2 and +2, the distribution was assumed to be normal. The parametric paired-samples t-test, assuming normal data distribution, was conducted to compute mean scores and investigate statistically significant within-subjects within-time differences between variables whose difference scores were normally distributed. The nonparametric Wilcoxon signed-rank test, which does not assume normal data distribution, was conducted to compute mean scores and investigate significant within-subjects within-time differences between variables whose difference scores were not normally distributed. To calculate the effect size of statistically significant differences in paired-samples t-test, Cohen's d was computed by dividing the mean difference by the standard deviation of the difference (Cohen, 1998). A repeated-measures t-test was performed to investigate significant within-subjects differences across time in variables with normally distributed difference scores, whereas the Wilcoxon test was conducted to explore within-subjects differences across time in variables with not normally distributed difference scores. The paired-samples t-test and Wilcoxon test were preferred to repeated-measures analysis of variance and Friedman test, respectively, because they are considered to have less error risks when two observations are compared instead of more. The use of the Wilcoxon test was not generalised to both normally and not normally distributed variables as nonparametric tests ensure less statistical power when applied to normal data, whereas the precise identification of the actual existence of meaningful statistically significant differences was one main goal of this study. However, during researchers' exploration of the data set, results did not change substantially when applying paired-samples/repeated-measures t-test to not normal data nor when applying the Wilcoxon test to normally distributed data. The average measure intraclass correlation coefficient (*ICC*; Shrout & Fleiss, 1979) was calculated as an index of inter-rater reliability to assess the level of agreement among team members in their subjective evaluations at both data collection time points. Due to one team having only one participant providing valid data, the intraclass correlation coefficient could be computed for a sample of six teams. Finally, correlation analysis was performed before moderation analysis, which was conducted using the PROCESS macro for SPSS.

Results

The current section reports the main findings of the present study, regarding the recipients' perceptions of the team coaching intervention dimensions, the temporal stability of recipients' perceptions, and the usability of the digital tool as a moderator.

Recipients' Perceptions of the Team Coaching Intervention Dimensions

At T1, 33 recipients (72.7% females, 36.4% nurses, M_{age} = 46.3, M_{tenure} = 15.4) completed the questionnaire, yielding a 53% response rate. At T2, 29 recipients (72.4% females, 37.9% nurses, M_{age} = 49.5, M_{tenure} = 16.4) completed the questionnaire, yielding a 46% response rate. At T1, inter-rater reliability was statistically significant at $p < .05$ for four teams out of six, such as Team 1 (ICC = .99, n = 4), Team 5 (ICC = .93, n = 6), Team 6 (ICC = .87, n = 3) and Team 7 (ICC = .98, n = 8), thus indicating a high level of consistency of evaluations within the teams after the second intervention session. Similarly, at T2, inter-rater reliability was statistically significant at $p < .05$ for five teams out of six, such as Team 1 (ICC = .97, n = 4), Team 3 (ICC = .85, n = 5), Team 5 (ICC = .81, n = 5), Team 6 (ICC = .98, n = 5) and Team 7 (ICC = .98, n = 6), thus indicating a high level of consistency of evaluations across the teams after the fourth and last intervention session.

Table 5 displays the results from paired-sample t-tests at T1. Significant differences were observed between integrity (M = 3.97, SD = .56) and design (M = 3.70, SD = .53); $t(32)$ = 2.65, p = .012. In addition, a significant difference was found between integrity and transferability (M = 3.65, SD = .55); $t(32)$ = 3.12, p = .004. Finally, a significant difference was noted between integrity and acceptance (M = 3.61, SD = .69); $t(32)$ = 3.43, p = .002. The Wilcoxon signed-rank test for usability and acceptance, where the difference score was not normally distributed, revealed no statistically significant difference between their mean scores (Z = -1.782, p = .075). Effect size of statistically significant differences was between small and medium. These findings suggest that, at T1, recipients appreciated the intervention's integrity significantly more than its design, transferability and acceptance.

Table 5. Paired-samples t-test of recipients' perceptions of intervention at T1

	M	SD	95% CI Lower	95% CI Upper	t	df	p	d
Integrity – Usability	.192	.70	-.056	.440	1.578	32	.124	.27
Integrity – Design	.273	.59	.063	.482	2.648	32	.012	.46
Integrity – Transferability	.323	.59	.112	.534	3.121	32	.004	.54
Integrity – Acceptance	.359	.60	.145	.572	3.427	32	.002	.59
Usability – Design	.081	.80	-.204	.366	.578	32	.567	.10
Usability – Transferability	.131	.81	-.155	.417	.935	32	.357	.16
Design – Transferability	.051	.45	-.108	.209	.650	32	.520	.11

	M	SD	Lower	Upper		df		d
Design – Acceptance	.086	.66	-.148	.320	.747	32	.461	.13
Transferability – Acceptance	.035	.55	-.158	.229	.372	32	.712	.06

Note. M = mean. SD = standard deviation. CI = confidence interval. df = degrees of freedom. d = effect size

Table 6 presents the results from paired-samples *t*-tests at T2. Significant differences were found between usability (*M* = 4.03, *SD* = .58) and design (*M* = 3.70, *SD* = .70); *t*(28) = 2.16, *p* = .039. In addition, a significant difference was observed between usability and acceptance (*M* = 3.51, *SD* = .65); *t*(28) = 3.85, *p* = .001. Other significant differences were identified between integrity and design; *t*(28) = 2.63, *p* = .014, and between integrity and acceptance; *t*(28) = 3.92, *p* = .001. Finally, significant differences were found between acceptance and both transferability [*t*(28) = 3.15, *p* = .004] and design [*t*(28) = 2.16, *p* = .039]. The Wilcoxon signed-rank test for integrity and transferability, where the difference score was not normally distributed, indicated a statistically significant difference between their mean scores (*Z* = -2.166, *p* = .03). Effect size of statistically significant differences was between medium and large. These findings suggest that, at T2, recipients appreciated the intervention's usability and integrity significantly more than its design, acceptance and transferability.

Table 6. Paired-samples t-test of recipients' perceptions of intervention at T2

			95% CI					
	M	*SD*	*Lower*	*Upper*	*t*	*df*	*p*	*d*
Usability – Integrity	.037	.65	-.212	.285	.303	28	.764	.05
Usability – Transferability	.251	.69	-.013	.514	1.949	28	.061	.36
Usability – Design	.328	.82	.017	.639	2.161	28	.039	.40
Usability – Acceptance	.526	.74	.246	.806	3.852	28	.001	.71
Integrity – Design	.291	.60	.065	.518	2.631	28	.014	.48
Integrity – Acceptance	.490	.67	.234	.745	3.921	28	.001	.73
Transferability – Design	.078	.44	-.088	.244	.957	28	.347	.17
Transferability – Acceptance	.276	.47	.096	.455	3.147	28	.004	.58
Design – Acceptance	.198	.49	.011	.386	2.165	28	.039	.40

Note. M = mean. SD = standard deviation. CI = confidence interval. df = degrees of freedom. d = effect size

Temporal Stability of Recipients' Perceptions

Nineteen recipients (78.9% females, 47.4% nurses, M_{age} = 49, M_{tenure} = 17.9) completed the questionnaire at both T1 and T2. The repeated-measures *t*-test revealed no statistically significant effects of time on examined perceptions with normally distributed difference scores, such as design [*t*(18) = .84, *p* = .407] and integrity [*t*(18) = .63, *p* = .535]. Similarly, the Wilcoxon signed-rank test indicated no statistically significant effects of time on transferability (*Z* = .709, *p* = .478), acceptance (*Z* = -1.803,

p = .071) and usability (Z = -.400, p = .689). These findings suggest that recipients' perceptions of the team coaching intervention dimensions remained consistent over time throughout the implementation process.

Usability of the Digital Tool as a Moderator

A moderation analysis was conducted to investigate whether the usability of the digital tool moderated the relationship between the perceptions of the team coaching intervention dimensions – i.e., integrity, design and transferability – and the overall acceptance of the digital intervention at the end of the intervention, meaning after the fourth and last session.

Table 7 presents the mean scores and the intercorrelations of recipients' perceptions at T1 and T2, both at individual and team levels of analysis with aggregated data. Individual-level correlation analysis showed positive and statistically significant – either $p < .05$ or $p < .01$ – associations among almost all the recipients' perceptions of the intervention dimensions both at T1 and T2, with Pearson's r ranging from .41 to .78. Only the perception of the usability of the digital tool did not appear to be associated with the other perceptions of the intervention dimensions. Some main differences can be observed in the team-level correlation analysis, where integrity at T1 did not appear to be associated with other perceptions of the intervention dimensions, and usability at T2 appeared to be negatively associated with transferability (r = -0.75, $p < .05$) and acceptance (r = -0.85, $p < .05$).

Table 7. Correlations among perceptions of intervention dimensions at T1 and T2

	M_{T1}	SD_{T1}	M_{T2}	SD_{T2}	1	2	3	4	5
Individual level									
1.Usability	3.78	.61	4.03	.58	-	.27	.17	.07	.18
2.Integrity	3.97	.56	4.00	.59	.28	-	.64*	.58*	.42**
3.Transferability	3.65	.55	3.78	.58	.02	.42*	-	.78**	.71**
4.Design	3.70	.53	3.70	.70	.01	.41*	.65*	-	.73*
5.Acceptance	3.61	.69	3.51	.65	.16	.55**	.63**	.44*	-
Team level									
1.Usability	3.79	.27	4.00	.18	-	-.52	-.75*	-.70	-.85*
2.Integrity	3.98	.38	3.99	.32	.07	-	.87*	.84*	.64
3.Transferability	3.70	.28	3.82	.34	-.02	.70	-	.88*	.86*
4.Design	3.78	.26	3.76	.50	.10	.41	.85*	-	.80*
5.Acceptance	3.66	.34	3.60	.38	-.09	.71	.84*	.64	-

Note. Correlations at T1 are reported in the lower semi diagonal, whereas correlation at T2 are reported in the higher semi diagonal. M = mean. SD = standard deviation. * = $p < .5$. ** = $p < .01$

Then, moderation results revealed that only the relationship between transferability and acceptance was moderated by usability (n = 19). Particularly, there was a significant interaction effect of transferability and usability (B = .47, p < .05) on acceptance. Figure 7 shows that the transferability of the intervention was significantly associated with the acceptance of the intervention, but only when the usability of the digital tool was high [R^2 = .50, $F(3,15)$ = 6.21, p < .01]. This finding suggests that the individual perception of the ease of use and effectiveness of the digital platform play a crucial role in facilitating the successful implementation of interventions, ensuring that participants can apply the learned skills in their work environment, ultimately leading to greater acceptance of the intervention.
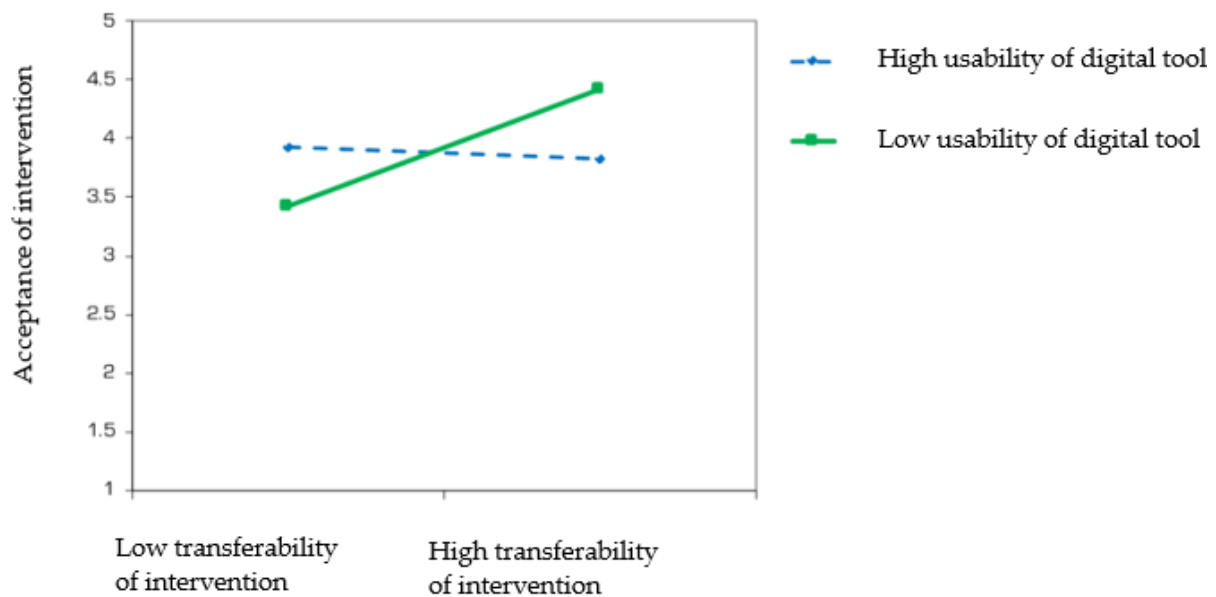

Figure 7. Usability of the digital tool as moderator

Discussion

This study (Giusino et al., 2023) investigated specific process dimensions of a digital-based intervention that was implemented in a hospital with the aim of fostering communication among team members. The study contributes to the literature on team communication interventions by providing insights into the relevance of monitoring aspects of the implementation, and particularly, the recipients' perceptions of the intervention and of the actors involved, such as transferability, design, integrity, acceptance and usability of the intervention. Although there is a growing literature on digital interventions for group communication, there is a lack of research on how the implementation process affects the relevance and acceptance of these interventions. These process measures are crucial for understanding why a given digital intervention may be relevant in a specific working environment and how to ensure that the digital intervention can be perceived as useful and that its contents can be transferred to the

workplace. Moreover, in this case, digital intervention relies on specific intervention techniques such as sociomapping and coaching, thus providing interesting insights into the further development of these techniques as intervention mechanisms in healthcare organisations. The importance of these observations is amplified given the current changes within hospital environments, notably the consolidation of healthcare processes across different departments and their digital transformation, alongside the consequences of the Covid-19 pandemic on healthcare personnel and facilities in both rural and urban regions (Knop et al., 2021).

In this perspective, we examined recipients' perceptions of a digital team coaching intervention at two time points – T1 and T2 – and assessed the temporal stability of these perceptions. At T1, 33 recipients participated, while 29 participated at T2, with 53% and 46% response rates, respectively. The results indicated that at both time points, recipients appreciated the intervention's integrity and usability more than its design, transferability and acceptance. Furthermore, no significant changes in recipients' perceptions were observed over time.

The first aspect to discuss relates to the preference of team coaching intervention participants for usability and integrity. From this perspective, the scarcity of medical professionals, increasingly burdened with more complex and managerial responsibilities, has spurred the development of a broader organisational strategy. This strategy delegated traditional tasks to other team members, such as nurses and healthcare assistants (Knop et al., 2021). Although the roles of general practitioners and nurses are converging in some areas, the success of this multi-actor approach hinges on several factors, including effective communication among team members (Mohr et al., 2011). The facilitators may have also been crucial in nurturing a group dynamic that encouraged team members to discuss communication patterns openly. Essentially, the ability to openly discuss these aspects in sessions led by a supportive coach, who can foster an open and stigma-free atmosphere, and through a user-friendly digital solution, may shed light on the reasons behind these preferences. Reflecting and contemplating better communication through graphical maps could help clarify role definitions, streamline task delegation and ultimately lead to better patient outcomes. These aspects align with previous studies demonstrating the importance of a training facilitator's skills in promoting an open atmosphere. The quality of questions, attention to detail and linking to practical examples are all pivotal for participant engagement and learning outcomes (Wavre & Kuknor, 2023). Defining learning curves – e.g., current and desired communication and action plans – through graphical outputs, which can be reviewed and discussed in groups, might have been instrumental in leveraging peers' and facilitators' feedback to create a supportive learning environment. In the present study, such elements linked to the facilitator's skills and the type of atmosphere the participants perceived during the coaching sessions are among the most relevant online. Future studies that want to investigate the impact of online training coaching sessions should continue to include these process aspects in their evaluations.

As a result, aspects such as design, transferability and acceptance, although positively evaluated, become secondary in importance. For instance, elements of the intervention's design may have been seen as less important because it often focuses on aesthetic aspects, which might be perceived as secondary to the actual content and function of the intervention. While a visually appealing design can enhance user experience, it might not have been considered as crucial as the core components of the intervention. Recipients might have encountered difficulties seeing how the intervention could be generalised or adapted to their specific situations, which could have led them to value transferability less than other aspects. Furthermore, acceptance might not have been highly valued because recipients may have focused more on the immediate experience of engaging with the intervention rather than considering their overall acceptance. Alternatively, recipients may have had mixed opinions about the intervention, which could have contributed to lower average scores for acceptance.

Another aspect to discuss concerns how the digital tool was perceived as highly usable, with a user-friendly and intuitive interface that greatly enhanced the user experience and reduced the learning curve and potential frustrations. Participants quickly became familiar with the digital tool, including how to read the maps and develop improvement actions consistent with the workplace. The efficient and effective engagement with the content is attributed to the digital tool, which increases satisfaction and motivation, ultimately resulting in better outcomes. The high usability of the digital tool is a crucial factor that should not be overlooked, as it can significantly affect the success of the intervention.

One potential explanation for the favorable perceptions of the team coaching intervention among recipients may be related to the uses of visualisation tools, which have been identified as critical mechanisms for effective workplace interventions (Abildgaard & Nielsen, 2018; von Thiele Schwarz et al., 2017). Recipients may have appreciated the graphical indicators used by the digital tool, such as colours, heights and distances, which could aid in comprehending sociomaps and provide a visual representation of abstract concepts, such as communicating with colleagues. Furthermore, the digital nature of the team coaching intervention may have provided benefits or affordances that would not be as readily accessible in other forms of team interventions, such as group scores and visualisation, as well as the ability for individuals to participate remotely if they are not physically present during the sessions.

Our moderation analysis indicated that the usability of the digital tool moderated the relationship between a vital team coaching intervention dimension – i.e., transferability – and the overall acceptance of the digital intervention. This result suggests that when the digital tool is easy to use and efficient, participants are more likely to perceive the intervention as transferable to their work environment, leading to greater acceptance. One possible explanation is that a user-friendly digital tool enhances the participants' experience, allowing them to focus on the content and applicability of the intervention rather than being distracted or frustrated by technical difficulties. Put differently, the innovative element, namely, the ability to visualise the

geographic distribution of communication among team members, and to decipher the patterns and volume of information shared within the team through colours, heights and distances on the geographic plane, can, if easily comprehended, facilitate a guided group discussion on a topic as intricate and elusive as communication between colleagues and superiors. The digital tool enables a more effective visualisation of fairly complex information, allowing participants to grasp the content more thoroughly and, consequently, contemplate strategies for transferring actions to the workplace to address any identified deficiencies. This increased focus on the intervention's content may help participants better understand and apply the learned skills in their work setting, ultimately improving their perception of the intervention's transferability. This result highlights the importance of investing in developing and improving digital tools that are both user-friendly and effective in facilitating the successful transfer of learned skills to the workplace. By ensuring that digital tools are easy to use and support the intervention's objectives, professionals can lead to greater acceptance and satisfaction among participants. This, in turn, can contribute to improved team dynamics, increased productivity and enhanced well-being in the workplace.

The findings of this study have several implications. From a theoretical point of view, it contributes to the existing literature on digital interventions for group communication by shedding light on the importance of process dimensions, such as recipients' perceptions of the intervention and its various components – e.g., transferability, design, integrity, acceptance and usability – and the implementation process. It emphasises the need for further research on the effects of implementation processes on the relevance and acceptance of digital interventions. In addition, it highlights the potential of combining specific intervention techniques, like sociomapping and coaching, as intervention mechanisms in healthcare organisations, thus encouraging further development and research on these techniques. From a practical perspective, the results highlight the importance of prioritising the usability and integrity of a digital-based team coaching intervention. Participants perceived these aspects more favorably than design, transferability and acceptance. Therefore, developers and facilitators of such interventions should focus on creating user-friendly digital tools and maintaining consistency throughout the intervention process to ensure its effectiveness. Second, the temporal stability of recipients' perceptions suggests that once a team coaching intervention is well received, its positive impact can be sustained over time. This underlines the value of investing in developing high-quality interventions that meet the needs and expectations of participants from the outset. Finally, the study reveals a significant association between transferability and acceptance of the intervention when the usability of the digital tool is high. This implies that when a digital tool is easy to use, participants are more likely to perceive the intervention as applicable to their work context and be open to adopting the changes it proposes. Consequently, designers and practitioners may prioritise the development of user-friendly digital tools to enhance the likelihood of successful implementation and adoption of team communication interventions.

The study's limitations should be recognised, including the small sample size, the lack of a control group and the reliance on self-reported evaluations. The study focussed solely on recipients' perceptions of the intervention without measuring its effects on team communication patterns. Thus, while the findings offer valuable insights into the perceived qualities and dimensions of the intervention, they do not provide direct evidence of its impact on the intended outcomes. Another limitation is that the generalisability of the results is limited to the specific context of digital interventions aimed at improving team communication in healthcare settings. Therefore, caution should be taken when applying the findings to other workplaces or organisations.

Despite these limitations, the study provides valuable recommendations for managers and practitioners seeking to implement digital-based workplace interventions to improve team communication. The study also contributes to filling a gap in the literature by exploring the potential of a digital-based intervention combined with an online coach involved with the goal of promoting better communication among team members, which represents a novel approach compared to traditional in-person interventions. Moreover, it sets the stage for future research on the implementation processes of digital interventions and their effects on recipients' perceptions and the interventions' relevance and acceptance.

Conclusion

The implementation of the team coaching intervention at the targeted healthcare organisation could be deemed as successful. Overall, findings suggested that recipients' perceptions of intervention characteristics were positive. Also, recipients' perceptions did not change from second to fourth session, suggesting they remained stably satisfied with the intervention over time. However, this study only focussed on recipients' perceptions as explanatory process factors of intervention effectiveness, whereas the realist evaluation approach includes more, such as contextual conditions and working mechanisms. These types of process factors were then investigated in a separate study (Giusino et al., in preparation), which is introduced in the next chapter of the present dissertation.

Study 4. Digital Team Coaching Intervention Using Social Network Visualisation: Evaluation of Two CMO Configurations

Abstract. Digital workplace interventions using social network visualisation and team coaching hold potential to promote teamwork within organisations. However, knowledge regarding the contextual conditions and the explanatory mechanisms of their effectiveness is still scarce. To contribute filling this gap, this study aimed to conduct the realist evaluation of a digital team coaching intervention using social network visualisation. Two context-mechanism-outcome (CMO) configurations were elaborated. The first CMO configuration corresponded to the hypothesis of a moderating role of transfer and action plan implementation in the relationship between manager support and teamwork, team coordination, interpersonal conflict at work, and team performance. The second CMO configuration corresponded to the hypothesis of a mediating role of transfer and action plan implementation in the relationship between peer support towards training transfer and the same outcome variables. Main findings revealed that the positive relationship between manager support and team coordination and team performance was weaker when participants reported higher levels of implementation of action plans developed as part of the intervention. Peer support towards training transfer had positive direct effects on transfer, teamwork, team coordination, and team performance. It could be concluded that teams implementing action plans developed during the intervention might need less support from immediate managers in order to coordinate collective efforts and accomplish good collective performance. Moreover, peer support towards training transfer may constitute a relevant contextual factor contributing to the intervention effectiveness. Practitioners willing to implement the examined intervention might design the implementation environment according to this study results.

Background

In the last decades, considering the importance of teamwork in the workplace, a number of interventions have been developed and tested with the aim of promoting teamwork quality and effectiveness. Traditional evidence-based approaches to team development and improvement (Grote & Kozlowski, 2023; Lacerenza et al., 2018) have primarily focused on in-presence team training, team building, and team debriefing. Team training refers to a structured approach to improving the teamwork skills, with a focus on the shared understanding of roles, responsibilities, and goals. Team

building has a stronger focus on improving the relationships within the team, encompassing, for instance, activities and exercises to promote trust, respect, and mutual understanding among team members. Team building corresponds to a process of reflection and discussion among the team members after a task or event to identify what went well, what could have been improved, and how to apply lessons learned to future situations. While these interventions have demonstrated some effectiveness (McEwan et al., 2017), they have often neglected the complex social dynamics and interrelationships that might influence teamwork patterns within teams. In this regard, for example, effective and high-quality team communication in the workplace – meaning, communication that is clear to the receivers, and timely and relevant to the tasks it refers to – has to be regarded as an impactful variable, as it has been associated with improved team performance in terms of innovation, budget performance, efficiency, and goal achievement (Bui et al. 2019).

In recent years, digital interventions have emerged as an alternative powerful tool to foster desirable workplace outcomes. Digital interventions can be defined as planned, structured, science-based actions or initiatives aiming to achieve a certain goal – e.g., fostering teamwork – by exploiting the potential offered by digital technologies (e.g., Stratton et al., 2022). They may correspond to either interventions originally designed to occur in physical presence and subsequently adapted to the digital formats offered by online teleconferencing platforms, or interventions explicitly meant to be available for computer or smartphone apps only. Whereas the majority of the results about digital interventions' effectiveness in promoting desirable workplace outcomes mostly refer to individual-level employee well-being and effectiveness (ibidem), less is known about the effectiveness of digital interventions in improving teamwork. In this realm, one innovative approach is the use of social network visualisation, coupled with group-level coaching, to promote effective teamwork within organisations (Bahbouh, 2012; Bahbouh & Lasker, 2014). By leveraging digital technologies, social network visualisation can provide a deeper understanding of the social dynamics occurring within workplace teams, so that targeted interventions can be designed to address teamwork challenges effectively. The use of social network visualisation as a digital intervention tool offers unique opportunities to identify teamwork patterns, map existing and potential relationships, and pinpoint areas where teamwork breakdowns may occur. The visualisation provides valuable insights into the structure and dynamics of social networks within teams, enabling stakeholders to identify key individuals, opinion leaders, and potential bottlenecks in the team workflow (Bahbouh & Lasker, 2014). Moreover, group-level team coaching can be incorporated into the intervention (Bahbouh & Willis, 2022), so that workers can receive tailored feedback, guidance, and support to improve their teamwork skills, enhance communication, collaboration, and coordination, and foster a culture of learning and knowledge sharing.

To date, very few studies are available regarding the effectiveness of group-level coaching-based digital interventions utilising social network visualisation within workplace team settings. Bernardová (2012) carried out a study within the military

aviation sector, highlighting the potential of social network analysis and visualisation as a tool for psychodiagnostics. Using social network analysis tools, Franc and colleagues (2019) found a positive effect of quality and frequency of team leaders' communication on sales team performance in a large financial institution. Findings from Tetour (2019) supported the effectiveness of social network visualisation as an intervention tool among teams in the hospitality sector. Finally, Zakharchyn and Kosmyna (2015) argued in favour of the application of sociometric methods to model optimal personnel behaviour within private enterprises. Despite the value hold by each of these studies, to the best of our knowledge none of them has performed evaluations of real-world or contextualised effectiveness of interventions based on social network visualisation and team coaching. That is, the available research has not taken into account their explanatory mechanisms or the reasons why such interventions worked as intended for the targeted recipients. This study (Giusino et al., in preparation[4]) aimed to fill this gap by deploying a realist evaluation approach to workplace interventions' effectiveness, in particular, a digital team coaching intervention using social network visualisation to promote desired and effective teamwork patterns (Bahbouh, 2012; Bahbouh & Lasker, 2014; Bahbouh & Willis, 2022). This approach can indeed provide insights into when and how interventions work.

The objective was to contribute with an evidence base that can guide future implementation efforts from practitioners in organisations willing to promote the quality of teamwork. This contribution appears to be especially relevant in light of the fact that nowadays teamwork and leadership are performed virtually more and more (Bell et al., 2023), with remote work, hybrid work, and other new trending forms of work organisation being accelerated after the Covid-19 pandemic.

This study deployed a realist approach towards the evaluation of workplace interventions (Nielsen & Abildgaard, 2013; Nielsen & Miraglia, 2017; Nielsen & Randall, 2013; Nielsen & Shepherd, 2022; Roodbari et al., 2021a, 2021b, 2023) and aimed to investigate the contextual factors, the underlying mechanisms, and the connected outcomes of a digital team coaching intervention that utilises social network visualisation. It did so by developing and testing two specific context-mechanism-outcome (CMO) configurations that were considered relevant to the implemented intervention. On the basis of the intervention's contents and goals, relevant outcomes of the intervention were considered in this study, such as improved teamwork and team coordination, reduced interpersonal conflict at work, and improved team performance. Here, these variables are defined as follows. Teamwork can be defined as the process through which a group of individuals working together towards a common goal puts collective efforts to produce higher performance than the sum of individual inputs (Salanova et al., 2006). Team coordination refers to the process of synchronising and integrating the efforts of team members to achieve a

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common goal (Salanova et al., 2011). Interpersonal conflict at work indicates negative interactions between individuals in the workplace (Friedman et al., 2006), such as arguments with colleagues or being treated poorly by a supervisor. Finally, team performance refers to the ability of a group of individuals to work together effectively towards a common goal or objective (Callea et al., 2014; Dawson et al., 2006). The final selection of the relevant intervention's outcomes to be investigated in this study is the result of extensive discussions among the authors, informed by their expertise as well as knowledge on the intervention's contents and goals and psychometric measures available within the extant academic literature.

CMO Configuration #1: The Moderating Role of Transfer and Action Plan Implementation between Manager Support and Team Outcomes

In line with previous studies (Christensen et al., 2019; Helland et al., 2021; Nielsen et al., 2010), one important contextual factor that is known to positively affect workplace interventions' effectiveness is manager support. Manager support can be defined as the extent to which the immediate manager of a team looks after their team members, asking whether team members have problems at work, helping to make team members' work easier, and listening to team members when they have problems (Holton III et al., 2000). Here, manager support is conceived as an omnibus context factor – that is, existing in the workplace regardless of the intervention being implemented. Within the realist evaluation literature, for instance, the systematic review by Roodbari and colleagues (2021a, 2021b) and the Integrative Process Evaluation Framework by Nielsen and colleagues (2023), the support from the immediate manager is an example of a context factor that facilitates the effectiveness of workplace interventions, as it provides workers and teams with the necessary social resources that sustain their participation in the intervention itself as well as the application of what they acquired during the intervention into their everyday work – managers, for instance, can support the use of new skills and knowledge in the team. In addition, the influence of manager support on intervention effectiveness can be optimised when it interacts with two well-known intervention's working mechanisms, namely transfer and action plan implementation. Here, transfer is defined as the degree to which intervention recipients transfer their learning to the actual work context, using the knowledge gained in the intervention, managing to apply the intervention contents in their everyday work, and transferring the skills learned in the intervention back to their actual job (Grohmann & Kauffeld, 2013). On the other hand, action plan implementation is defined as the extent to which intervention recipients implement the action plans developed throughout the intervention, continuously working and revisiting them (ibidem). Nielsen and Shepherd's (2022) Integrated Training Transfer and Effectiveness Model and Nielsen and colleagues' (2023) Integrative Process Evaluation Framework suggested that, for workplace interventions to be effective, participants need to transfer their learning to

the work context and implement the action plans that they developed as part of the intervention activities. To summarise, the realist evaluation perspective claims that workplace interventions are effective when recipients have support from their managers, transfer new skills and knowledge to workplace, and implement action plans in order to make the intervention work as intended.

On the basis of the above, and considering the key outcomes identified for the digital team coaching intervention being investigated, the following statement is proposed.

CMO configuration #1: *If* intervention recipients perceive high levels of support from their immediate manager, *as a result* they will show better teamwork and team coordination, less interpersonal conflict at work, and better team performance at post-intervention, *when* they transfer learnings and implement the developed action plans to a greater extent.

Previous research provides extensive empirical evidence that manager support can improve teamwork and team outcomes. Nielsen and Randall (2009) stressed the importance of managers' active support when implementing teams in the workplace. Gilley and colleagues (2010) concluded that effective managers that exhibit certain skills and behaviours (i.e., involving employees in decision-making, coaching others, communicating effectively, motivating others, and helping employees grow and develop) can build teams and significantly improve team performance, with support from managers being an important factor in successful teamwork. Consistently, Nielsen and colleagues (2010) found that training managers may enhance the effects of implementing teamworking. Given such a corpus of evidence referring to the positive relationship existing between manager support and desirable team outcomes, this study assumed that a positive relationship occurs between manager support, on the one hand, and teamwork (TW), team coordination (COR), and team performance (TP), on the other hand. Also, a negative relationship was assumed between manager support and interpersonal conflict at work (ICW), which constitute an undesirable team outcome. Within this frame, a moderating role of transfer and action plan implementation was hypothesised, as shown in Figure 8.
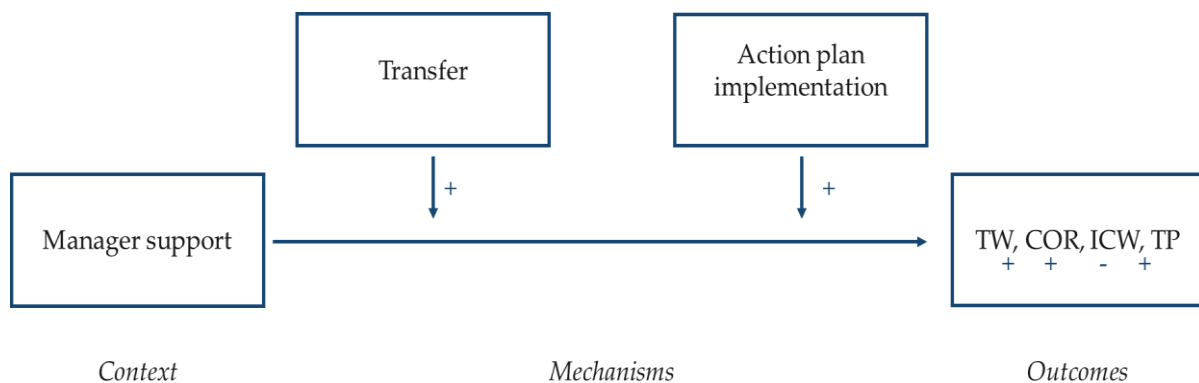

Figure 8. Hypothesised moderation model

CMO Configuration #2: The Mediating Role of Transfer and Action Plan Implementation between Peer Support Towards Training Transfer and Team Outcomes

Another important contextual factor that facilitates workplace interventions' effectiveness is peer support towards training transfer (Nielsen et al., 2023). Peer support towards training transfer can be defined as the extent to which intervention recipients' colleagues support the use of new skills and knowledge acquired as part of the intervention activities, appreciating, encouraging and expecting the efforts to apply them into everyday work (Holton III et al., 2000). Here, peer support towards training transfer is conceived as a discrete context factor – that is, existing in relation to the intervention that is being implemented in the workplace. Nielsen and colleagues' (2023) Integrative Process Evaluation Framework suggested that, for workplace interventions to be effective, recipients' peers and colleagues need to support the use of new skills and knowledge as well as the implementation of action plans developed during the intervention itself. Thus, if recipients' colleagues support the transfer and action plan implementation of the intervention, then the recipients themselves are able to transfer and implement the intervention, which would in turn maximise the intervention's effectiveness in generating the expected outcomes, as also suggested by Nielsen and Shepherd's (2022) Integrated Training Transfer and Effectiveness Model. In other words, if recipients actually transfer and implement the intervention during their everyday work, this might be because of their peers' support to do so.

On the basis of the above, and considering the key outcomes identified for the digital team coaching intervention under examination, the following statement is proposed.

> CMO configuration #2: *If* intervention recipients perceive high levels of peer support to apply action plans that they developed throughout training sessions to everyday work life, *then* they are more likely to make transfer and implementation of such action plans, and *as a result* they will show better teamwork and team coordination, less interpersonal conflict at work, and better team performance at post-intervention.

This study explored the role of transfer and action plan implementation as explanatory mechanisms within the relationship between peer support towards training transfer and team outcomes, such as teamwork (TW), team coordination (COR), interpersonal conflict at work (ICW), and team performance (TP). A mediating role of transfer and action plan implementation was hypothesised, as it is shown in Figure 9.
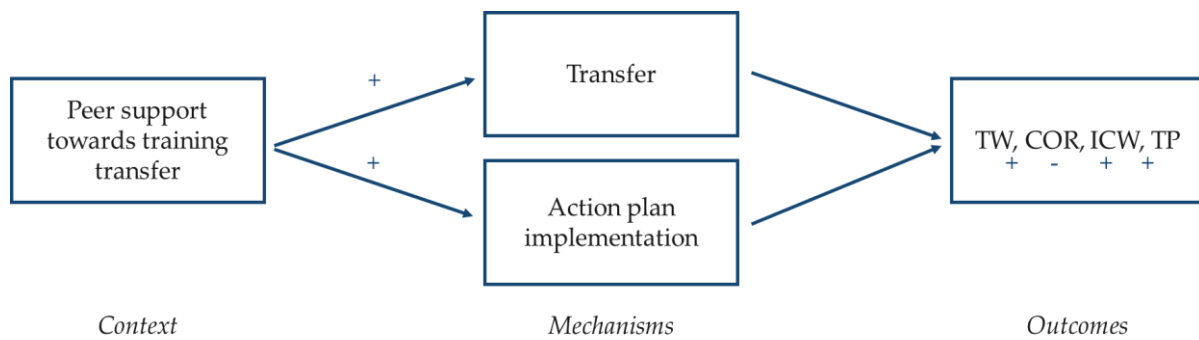
Figure 9. Hypothesised mediation model

Methods

The implemented intervention (Bahbouh, 2012; Bahbouh & Lasker, 2014) is a group-level digital software-based intervention that serves the analysis and promotion of desired and effective teamwork patterns. According to the main classifications of workplace interventions' levels (i.e., individual, group, leader, and organisation; Nielsen et al., 2018), group-level workplace interventions refer to formal or informal, planned, structured, science-based, behavioural, or psychological actions or initiatives aiming to bring about changes in team states, processes, and dynamics, such as communication, cohesion, mutual support among colleagues, work group social climate, or collective decision-making and performance (ibidem). The intervention under study falls within the group level.

The number of intervention sessions usually ranges from three to four, with each of the sessions lasting from one and a half to three hours and being structured according to five subsequent phases, such as (1) online survey-based relational data collection about current and desired teamwork patterns, (2) visualisation of the sociomaps that the software generates based on participant's responses to the survey – e.g., current and desired frequency of communication, current and desired quality of interaction, stress levels among the team members, sources of stress, and so on, (3) team discussion and team coaching activities that are guided by the visualisation of the sociomaps, (4) action plan development based on the resolutions made through the team coaching activities, and (5) review of the developed action plans.

The term "sociomap" here refers to landscape-like graphical representations of specific teamwork patterns.

This intervention is both a diagnostic and an intervention tool, including action plan development, aiming to promote team awareness, team dynamics, and team patterns. Its success implies a collective effort within the targeted teams. By visualising social networks and providing targeted coaching activities, this intervention seeks to promote efficient collaboration and improve overall team performance. Based on social network analytical theory and methods (Bahbouh, 2012; Bahbouh & Lasker, 2014), the delivered intervention deploys a software for collection, elaboration, and visualisation of complex relational data. By processing participants' responses to valid

and reliable Likert-type single-item questions regarding teamwork (Rozehnalová, 2013), its algorithm generates graphical representations, named sociomaps, of current and desired teamwork structures existing within the team. The intervention is based on team coaching workshops, defined as direct interactions with a team intended to help members make coordinated and task-appropriate use of their collective resources in accomplishing the team's work (Bahbouh & Willis, 2022). These workshops are guided by the visualisation of sociomaps to stimulate team reflexivity and self-awareness, with an aim to formulate individual and team action plans, solutions, and strategies that would lead to the desired and effective communication flow within the team. As in the example in Figure 10, the landscape-like sociomap shows how team members are interconnected based on their perceptions of teamwork variables in their team. Mutual positions among members reflect their current or desired pattern. Individual height and colour represent the average pattern intensity of the given person in the team. During sessions, participants are provided with an overview of the intervention's framework and key concepts, like teamwork and team effectiveness, by means of slideshows. Guided by the visualisation of the generated sociomaps, workshops are conducted based on team coaching principles. A collective discussion is set up on current and desired teamwork, with the aim to formulate strategies for improvement. The workshops aim to discuss the situation of the team and to develop an action plan about how to modify aspects of teamwork that team members desired to change. Particularly, participants are offered the opportunity to share their thoughts about behaviours or work situations that should stop, start, or continue to enhance teamwork effectiveness within the team. Also, each participant can provide individual feedback to colleagues about their work style, what they do well and what they can improve. The teams develop action plans during the sessions and progress is monitored against the developed action plan and is discussed within the workshops. Sessions include topics such as team dynamics, importance and quality of teamwork, and mutual feedback and progress. The last session is usually a final debriefing, which briefly retraces previously addressed milestones and also includes a concluding purpose sharing to maintain the communicative efficiency achieved. Teamwork measures are collected at each session to generate updated sociomaps and allow comparisons among sociomaps from different sessions to enrich the shared reflections and discussions.
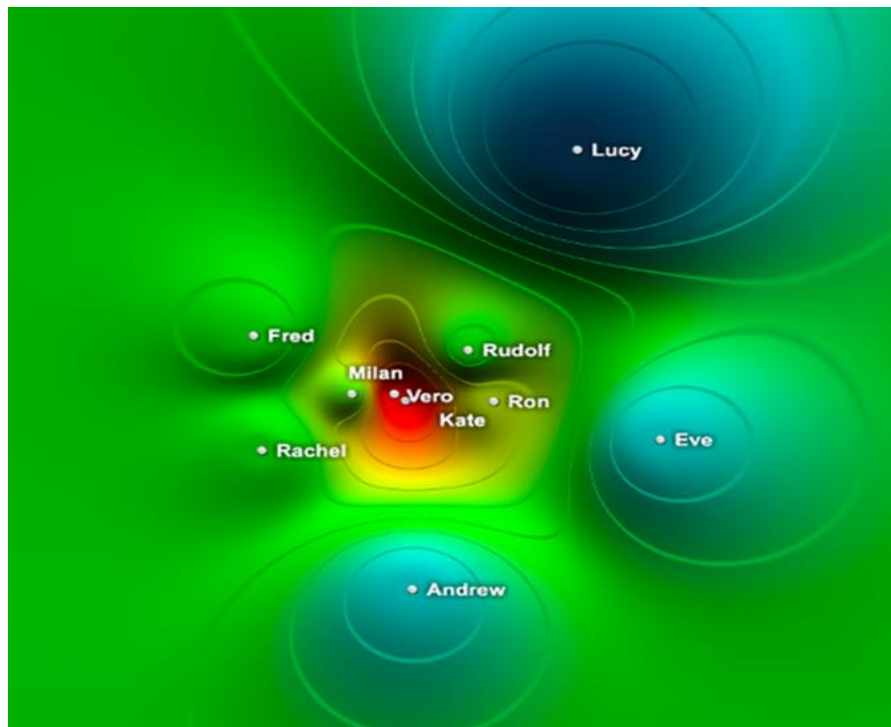
Figure 10. Example "sociomap"

Intervention Implementation

In this study, the intervention implementation was part of a broader research and innovation project about multilevel interventions to promote mental health in the workplace (De Angelis et al., 2020). The project aimed to design, develop, implement, and validate assessment, intervention, and evaluation toolkits to promote mental health in the workplace across Europe. Following a team analysis as indicated by Lacerenza and colleagues' (2018) stepwise framework for team interventions in order to ensure the intervention fit (Andersen et al., 2021; Peters et al., 2020) and identify key team-level needs to be addressed – see Study 2 in the present dissertation as well as Giusino and colleagues (2022a, 2022b) – the intervention was introduced across four distinct organisations based in two European countries, namely Italy and the Czech Republic. Sessions were delivered by trained psychologists from academic research groups. The Italian segment of this intervention was conducted within two disparate organisations; a sizable public healthcare organisation and a modestly scaled enterprise specialising in private education. The healthcare organisation, owing to its structure, facilitated the intervention between May and December 2021 – one session every two months and a half, four sessions in total – via an online platform distributed across seven teams emanating from three individual departments. Most participants in this organisation were women (74%) and the average age was 47 years, with team sizes ranging between 6 and 13 members, thereby resulting in an aggregate of 62 participants. The private education enterprise held the intervention online between February and April 2022 – one session per month, three sessions in total – within seven

separate departments, each forming a team of 6 to 23 individuals, totalling 101 participants. This subset of participants comprised entirely of women, with an age demographic concentrated between 25 and 34 years. Similarly, in the Czech Republic, two distinct corporate organisations facilitated the intervention; one being in the retail sector, the other in the IT industry. The retail sector organisation opted for an online intervention delivery method, implemented between May 2021 and February 2022 – one session every four months, three sessions in total –, thereby engaging 15 teams from six departments. These teams, comprised of 4 to 17 members each, amassed a total of 118 participants, of which 41% were women, falling within the age bracket of 30 to 40 years. The IT organisation, in contrast, adopted a hybrid delivery format – two online sessions, one in-person session – for the intervention, implemented between March 2022 and January 2023 – one session every three months, three sessions in total –, reaching out to 11 teams – 3 to 11 members per team – from 11 departments, with a collective total of 104 participants. This participant subset included a minimal female representation (15%), with no data available regarding the age demographic. In all involved organisations, intervention recipients were recruited based on voluntary subscription upon information from their managers. For each intervention group, the only inclusion criterion was that participants had to come from the same team or work process – not necessarily the whole team, but also part of it. As recommended by Nielsen and colleagues (2013), feasibility of the intervention project was ensured by establishing a Steering Committee in each organisation. Its members planned and implemented a structured organisational communication strategy and facilitated employee participation by encouraging their teams to partake in the intervention. Researchers maintained constant communication with contact persons from the targeted organisations to ensure a smooth conduction of activities.

To summarise, the intervention extended its reach to a total of 40 teams from 27 unique departments, involving team sizes varying between 3 and 23 members. Consequently, the intervention engaged a total of 385 participants, with a dominant representation of female individuals within the age spectrum of 25 to 47 years.

Measures

Data collection was survey-based, as data were collected though online questionnaires, distributed with the help of contact persons or project representatives at the targeted organisations. Before filling out the questionnaires, participants could read a detailed Informed Consent Form explaining the aim of the study and their rights as participants of the research. This study received ethical approval and complied with standard requirements.

Data were collected longitudinally with a multi-wave research design across three time points. Context measures – i.e., manager support and peer support towards training transfer – were collected three months after the start of the intervention (T1). Working mechanisms – i.e., transfer and action plan implementation – were measured

six months later than context measures (T2), during the intervention period. Finally, outcome variables – i.e., teamwork, team coordination, interpersonal conflict at work, and team performance – were measured at a post-intervention data collection time point (T3) occurring three months later than collection of working mechanisms. Time lags between data collection points were conditional on the research design of the broader project that this study was part of. Time lag between the end of the intervention and T1 aimed to allow sufficient time for the participants to experience and perceive the support provided by their managers and peers. Time lag between T1 and T2 aimed to permit participants to engage with the training materials, apply their learning, and implement action plans. Finally, the purpose of time lag between T2 and T3 was to allow sufficient time for the intervention to produce, manifest, and stabilise its intended outcomes.

Quantitative psychometric measures were collected for context factors, working mechanisms, and outcome variables. Where not otherwise specified, Italian and Czech translations of the validated psychometric scales deployed were carried out by trained researchers for administration at the targeted organisations, following a conventional back-translation procedure.

Context factors were measured as follows.

Manager support. Three items based on Holton III and colleagues (2000) were developed, for instance, "Our immediate manager asks us if we have problems or troubles at work". Response options ranged from "1 = strongly disagree" to "5 = strongly agree". Cronbach's α for reliability was .94.

Peer support towards training transfer. Three items based on Holton III and colleagues (2000) were developed, for instance, "We appreciate each other's efforts to use new skills we have learned in training". Response options ranged from "1 = strongly disagree" to "5 = strongly agree". Cronbach's α for reliability was .90.

Working mechanisms were measured as follows.

Transfer. Three items based on Grohmann and Kauffeld (2013) were developed, for instance, "In our everyday work, we often use the knowledge we gained in the training". Response options ranged from "1 = strongly disagree" to "5 = strongly agree". Cronbach's α for reliability was .88.

Action plan implementation. Three items based on Grohmann and Kauffeld (2013) were developed, for instance, "We have implemented the planned action plans". Response options ranged from "1 = strongly disagree" to "5 = strongly agree". Cronbach's α for reliability was .86.

Outcomes were measured as follows.

Teamwork. Three items from Salanova and colleagues (2006) were used, for instance, "My work team has clear working objectives". Response options ranged from "0 = never" to "6 = always". Cronbach's α for reliability was .72.

Team coordination. Three items from Salanova and colleagues (2016) were used, for instance, "We co-ordinate with one another to complete the necessary tasks". Response options ranged from "0 = never" to "6 = always". Cronbach's α for reliability was .79.

Interpersonal conflict at work. Nine items from Friedman and colleagues (2000) were used. This is a two-dimensional scale, encompassing task conflict and role conflict. Four items were from the task conflict sub-scale, for instance, "How often do you work with disagree about opinions regarding the work being done?". Five items were from the role conflict sub-scale, for instance, "There are often feelings of hostility among parties". For the purposes of this study, interpersonal conflict at work was computed as a single variable. Response options ranged from "1 = not at all" to "5 = a lot". Cronbach's α for reliability was .95.

Team performance. Fifteen items from the Aston Team Performance Inventory by Dawson and colleagues (2006) were used. This is a four-dimensional scale, encompassing team support, team autonomy, team reflexivity, and team participation. Three items were from the team support sub-scale, for instance, "Team members are generally warm and supportive to each other". Four items were from the team autonomy sub-scale, for instance, "In this team we set our own goals". Four items were from the team reflexivity sub-scale, for instance, "The methods used by the team to get the job done are often discussed". Finally, four items were from the team participation sub-scale, for instance, "Everyone in the team contributes to decision making". For the purposes of this study, team performance was computed as a single variable. For the Italian organisations involved, the Italian validation by Callea and colleagues (2014) was used, whereas a translation was created by trained researchers for the Czech organisations. Response options ranged from "1 = completely disagree" to "5 = completely agree". Cronbach's α for reliability was .81.

Participants

The final set of data that could be used to conduct the analyses planned in this study included a sample composed of 317 respondents (response rate = 82%). Of these, 101 (31.9%) were from the private IT Czech organisation, followed by the private retail Czech organisation (n = 100, 31.5%), the Italian educational organisation (n = 69, 21.8%), and the large public healthcare organisation in Italy (n = 47, 14.8%). One-hundred and twelve were males (35.3%) and 73 were females (23%). The majority (34.7%) was between 25 and 34 years old, holding a master or equivalent level of education (20.5%), a permanent full-time employment (45.1%), between 3 and 4 years of organisational tenure (18%), and with no leadership responsibilities (42.9%).

Data Analysis

Quantitative statistical analysis was performed merging data from all the four organisations involved in the study. Descriptives were run to obtain frequencies, means, and standard deviations. The internal consistency of scales was assessed using Cronbach's α. Pearson's r was calculated to conduct correlation analysis, aiming to explore the relationships among the variables under examination. These analyses

were performed using the IBM SPSS Statistics software version 23. Then, moderation analysis was conducted to test CMO configuration #1 (H1), whereas mediation analysis was conducted to test CMO configuration #2 (H2). These analyses were performed using the Jamovi software version 2.3.26. Eight moderation models and eight mediation models were run, as many as there were combinations among the hypothesised predictors – i.e., contextual factors –, moderators or mediators – i.e., working mechanisms –, and outcomes. The threshold of acceptable statistical significance was set at $p < .05$.

Results

The current section reports the main findings of the present study, regarding the correlation analysis, the moderation analysis which was performed to test CMO configuration #1 (H1), and the mediation analysis which was performed to test CMO configuration #2 (H2).

Correlation Analysis

Correlation analysis, as shown in Table 8, highlighted statistically significant bivariate relationships between manager support and each of the intervention's outcomes, such as, teamwork ($r = .56$, $p < .01$), team coordination ($r = .41$, $p < .01$), interpersonal conflict at work ($r = -.32$, $p < .05$), and team performance ($r = 52$, $p < .01$). Also, peer support towards training transfer was statistically significantly associated with transfer ($r = .44$, $p < .01$), action plan implementation ($r = .38$, $p < .01$), and teamwork ($r = .35$, $p < .05$). Finally, action plan implementation was statistically significantly associated with teamwork ($r = .41$, $p < .05$), team coordination ($r = .41$, $p < .05$), and team performance ($r = .45$, $p < .01$).

Table 8. Correlation matrix for the study variables

Variables	n	M	SD	1	2	3	4	5	6	7	8
1. Manager support	128	3.76	1.05	-							
2. Peer support	128	3.58	.81	.37**	-						
3. Transfer	78	3.10	.82	.07	.44**	-					
4. Implementation	76	3.04	.81	.09	.38**	.44**	-				
5. Teamwork	102	4.51	.81	.56**	.35*	-.01	.41*	-			
6. Coordination	102	4.44	.84	.41**	.21	.10	.41*	.63**	-		
7. Interpersonal conflict	99	1.94	.73	-.32*	-.13	-.16	-.32	-.57**	-.59**	-	
8. Team performance	105	3.89	.68	.52**	.25	.12	.45**	.62**	.65**	-.61**	-

Note. n = sample size. M = mean. SD = standard deviation. * = $p < .05$ (2-tailed). ** = $p < .01$ (2-tailed)

Moderation Analysis

As shown in Table 9, two statistically significant interactions were found.

Table 9. Estimates from the moderation models

	B	SE	Z	p
Outcome: Teamwork				
Manager support * Transfer	-.17	.23	-.76	.44
Manager support * Implementation	-.27	.15	-1.75	.08
Outcome: Team coordination				
Manager support * Transfer	-.45	.25	-1.78	.07
Manager support * Implementation	-.48	.17	-2.81	.00
Outcome: Interpersonal conflict at work				
Manager support * Transfer	-.05	.28	-.18	.85
Manager support * Implementation	.31	.19	1.63	.10
Outcome: Team performance				
Manager support * Transfer	-.13	.28	-.47	.63
Manager support * Implementation	-.40	.18	-2.21	.02

Note. SE = standard error. *Z* = moderator's value

First, the model including manager support as a predictor, action plan implementation as a moderator, and team coordination as an outcome variable was statistically significant. There was a statistically significant interaction ($p < .05$) between manager support at T1 and action plan implementation at T2 (B = -.48, Z = -2.81) in the model including team coordination at T3 as an outcome variable. The effect of manager support on team coordination was statistically significant ($p < .001$) at low levels of action plan implementation (B = 1.14, Z = 4.39), as shown in Figure 11.
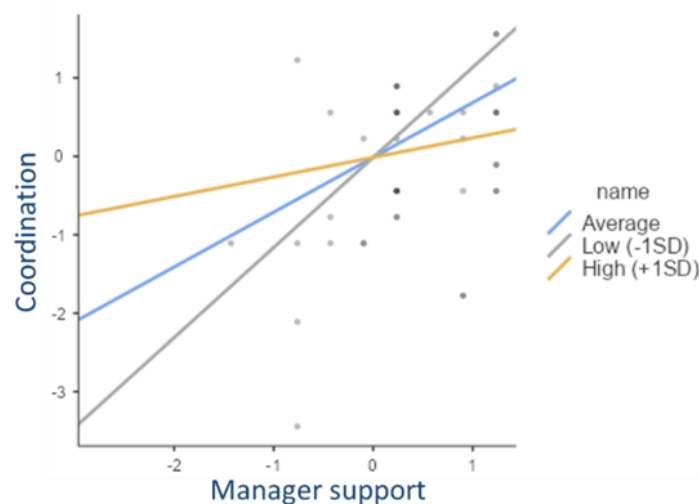

Figure 11. Moderation effect of action plan implementation in the relationship between manager support and coordination

Second, the model including manager support as a predictor, action plan implementation as a moderator, and team performance as an outcome variable was statistically significant. There was a statistically significant interaction ($p < .05$) between manager support at T1 and action plan implementation at T2 ($B = -.40$, $Z = -2.21$) in the model including team performance at T3 as an outcome variable. The effect of manager support on team performance was statistically significant ($p < .001$) at low levels of action plan implementation ($B = .94$, $Z = 3.69$), as shown in Figure 12.
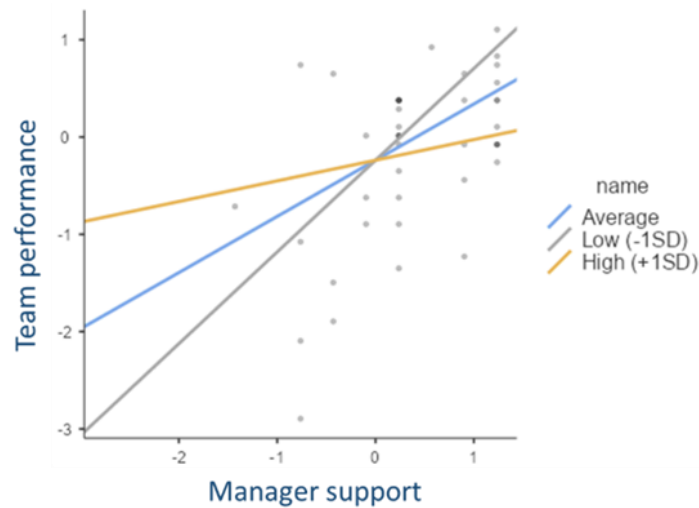

Figure 12. Moderation effect of action plan implementation in the relationship between manager support and team performance

So, two models turned out to be statistically significant, while six interactions were not significant. Thus, no statistically significant interaction effects were found in the majority of the hypothesised moderation models – i.e., six out of eight.

Overall, these findings partially supported CMO configuration #1.

Mediation Analysis

As shown in Table 10, no statistically significant indirect effects were found in any of the hypothesised mediation models – i.e., eight out of eight.

Table 10. Estimates from the mediation models

Effect	B	SE	Z	p
Peer support, Transfer, Teamwork				
Indirect	-.27	.17	-1.58	.11
Direct	1.29	.28	4.58	.00
Total	1.01	.29	3.46	.00
Peer support, Implementation, Teamwork				
Indirect	.09	.11	.81	.41

Direct	.91	.30	3.01	.00
Total	1.01	.29	3.46	.00

Peer support, Transfer, Coordination

Indirect	-.23	.17	-1.34	.18
Direct	1.05	.34	3.11	.00
Total	.82	.33	2.47	.01

Peer support, Implementation, Coordination

Indirect	.11	.13	.855	.39
Direct	.70	.34	2.04	.04
Total	.82	.33	2.46	.01

Peer support, Transfer, Interpersonal conflict at work

Indirect	-.00	.13	-.05	.95
Direct	-.44	.35	-1.25	.20
Total	-.45	.32	-1.39	.16

Peer support, Implementation, Interpersonal conflict at work

Indirect	-.12	.13	-.93	.35
Direct	-.32	.33	-.97	.32
Total	-.45	.32	-1.39	.16

Peer support, Transfer, Team performance

Indirect	-.06	.14	-.47	.63
Direct	.87	.35	2.43	.01
Total	.80	.33	2.43	.01

Peer support, Implementation, Team Performance

Indirect	.19	.15	1.23	.21
Direct	.61	.32	1.86	.06
Total	.80	.33	2.43	.01

Note. SE = standard error. Z = mediator's value

However, statistically significant direct effects were found within the positive relationships between peer support towards training transfer at T1 and transfer at T2 ($B = .56$, $Z = 2.14$, $p < .05$, $n = 46$, $r = .44$), peer support towards training transfer at T1 and teamwork at T3 ($B = 1.29$, $Z = 4.58$, $p < .001$, $n = 42$, $r = .35$), peer support towards training transfer at T1 and team coordination at T3 ($B = 1.05$, $Z = 3.11$, $p < .01$, $n = 42$), and peer support towards training transfer at T1 and team performance at T3 ($B = .87$, $Z = 2.43$, $p < .01$, $n = 43$).

Overall, these findings partially supported CMO configuration #2.

Discussion

The aim of this study (Giusino et al., in preparation) was to conduct a realist evaluation (Nielsen & Abildgaard, 2013; Nielsen & Miraglia, 2017; Nielsen & Randall, 2013; Nielsen & Shepherd, 2022; Roodbari et al., 2021a, 2021b, 2023) of a digital team

coaching intervention using social network visualisation (Bahbouh, 2012; Bahbouh & Lasker, 2014; Bahbouh & Willis, 2022), which was implemented across four organisations from two European countries. Building on the CMO configurations approach and the question of "what works for whom, and under which circumstances" (Nielsen & Miraglia, 2017; Roodbari et al., 2021a, 2021b, 2023), the empirical analysis attempted to identify under which contextual conditions and for which recipients the intervention was most effective in producing the expected outcomes. To do so, the moderating role of transfer and action plan implementation – conceived as important working mechanisms – was investigated in the relationship between manager support – conceived as an omnibus context factor – and a range of key intervention outcomes, such as teamwork, team coordination, interpersonal conflict at work, and team performance. Moreover, the mediating role of transfer and action plan implementation was investigated in the relationship between peer support towards training transfer – conceived as a discrete context factor – and the same outcome variables, which were considered to be relevant with respect to the intervention's contents and goals.

Although the expectations were only partially supported, the main findings nevertheless provided some interesting and useful insights that are worth discussing. First, moderation analysis highlighted significant effects of manager support on team coordination and team performance, thus supporting the role of manager support as a contextual factor that is relevant to the intervention's effectiveness, as also argued by previous studies (e.g., Christensen et al., 2019; Helland et al., 2021; Nielsen et al., 2022). However, the effects of manager support on team coordination and team performance were significant at low levels of action plan implementation. This suggests that, among workers that participated in the delivered intervention, the positive relationship between manager support, on the one hand, and team coordination and team performance, on the other hand, was stronger when action plans developed throughout the intervention were being implemented less. Conversely, such relationship becomes weaker when the intervention participants report higher levels of action plan implementation. In other words, when participants report higher levels of action plan implementation, the influence of manager support on team coordination and team performance tends to disappear. One possible interpretation of this result is that teams implementing action plans developed during the intervention might need less support from their immediate managers in order to coordinate their collective efforts and to accomplish good collective performance. It might be speculated that the implementation of the action plans for improvement of teamwork, crafted in a shared fashion within the participative environment of the workshops held as part of the intervention, might help the teams to "emancipate" from the necessity of receiving support from their immediate managers when having to deliver good team coordination and good team performance. In this sense, the action plans' implementation might be thought of as contributing to the autonomy and independence of the teams from the support of their immediate managers. After all, the team coaching workshops aim typically to increase autonomy of the team, as

all team members are equally handled and invited to speak out and participate in the team action planning. This process typically promotes their engagement and ownership. However, for future research, it would also be interesting to investigate what role the managers had regarding the action plans in each team – information that was not available for this study. It might be that, in some teams, managers were responsible for setting the plans into action and that thereby is some kind of management support in it. A further explanation may be due to the leadership style of the managers. For instance, the situational leadership theory developed by Hersey and Blanchard (1969) emphasises the need for leaders to adapt their leadership style based on the readiness or maturity of their followers. The theory posits that effective leaders are those who can flexibly adjust their leadership behaviours to meet the evolving needs of their team members. It may be possible that the teams observed in the research had a high readiness level. Or, on the other hand, notwithstanding their readiness levels, their managers could have had a delegating or absent role concerning the implementation of plans related to non-technical skills.

Furthermore, a second interesting result was highlighted by mediation analysis. No significant indirect effect was found in the relationship between peer support towards training transfer and the intervention outcomes – that is, no mediations. However, the findings revealed a few significant direct effects of peer support towards training transfer on transfer, teamwork, team coordination, and team performance respectively. Therefore, transfer and action plan implementation might not necessarily act as explanatory mechanisms within the hypothesised models, but peer support towards training transfer may still constitute a relevant contextual factor contributing to the effectiveness of the examined intervention in determining at least some of the outcomes considered, which is in line with previous literature from the realist evaluation research stream (e.g., Nielsen et al., 2023).

The above results should be taken with caution in light of the limitations of this study. For instance, due to contingencies and diverse organisational needs, some extent of variability occurred in the intervention implementation protocols across the four involved organisations in terms of number of sessions and delivery format. Although implementation differences were slight and did not substantially alter the nature of the intervention, future studies might aim to compare the intervention effects and CMO configurations across different implementation protocols, which may also provide insights into cross-country differences – e.g., between Italy and the Czech Republic. However, this was deemed impossible in this study due to the high turnover and participants' dropout rates across intervention sessions, which resulted in a small sample size and impaired the statistical power of the analyses. However, this issue was difficult to manage since, at least in the large public healthcare institution in Italy, team rotation was a regular organisational procedure that workers had to undergo, whereas both corporate organisations in the Czech Republic went through mergers and acquisitions during the intervention implementation. While it had only minor effects on the set-up of teams in the IT company, it led to major restructuring in the retail company where the majority of teams was reformed. Also,

the generalisability of findings beyond Italian and Czech organisations in the healthcare, retail, IT, and education sectors remains questionable. In terms of external validity, it is also to be considered that the study was conducted during the Covid-19 pandemic, which might have impacted on the way in which workers usually interact. It might be interesting to conduct future studies outside of the pandemic context, but also, in future working life, with more remote work and different ways of organising work, it would be recommended to follow how these affect interactions and outcomes at work. Moreover, the quantitative data that have been used are subjected to self-report bias (Stone et al., 2002) and might provide more narrow insights as compared to nuanced findings that might be looked for by future qualitative studies. In addition, interpersonal conflict at work – a multidimensional construct composed of task conflict and role conflict – and team performance – composed of team support, autonomy, reflexivity, and participation – were computed as single variables and it cannot be excluded that this might have affected the findings. Future studies might delve deeper into this issue by performing differential analyses per each dimension of such constructs, which was however out of the scope of this study. Finally, as mentioned earlier, the digital team coaching intervention was delivered as part of a larger project on multilevel interventions, in the frame of which further interventions were offered during the same time, which might have impacted the results of this study. Nonetheless, the intervention examined here was the only intervention at the group level.

While it has some limitations that should be acknowledged, this study also shows some strengths that are worth highlighting. A first strength of this study resides in its longitudinal design, which allows to make some degree of speculations regarding the causal relationships among the variables investigated. Moreover, in terms of its approach to evaluating workplace interventions, the realist approach presents advantages over the traditional pre-post randomised controlled approach in that it answers not only the question of whether an intervention works – i.e., what the effects are, if any –, but also how it works as intended – i.e., in which context, through which mechanisms, and for which people. This aspect should be of interest to practitioners willing to implement digital team coaching interventions to promote teamwork in their organisations. These professionals are hereby provided with practically relevant knowledge about the omnibus and discrete contextual conditions under which such interventions might be effective – i.e., manager support and peer support towards training transfer – as well as its working mechanisms – i.e., transfer and action plan implementation, so that they can design the implementation environment accordingly, as well as evaluate and adjust the intervention accordingly with the results from the evaluation. For example, when embarking on a digital team coaching intervention project to improve teamwork, practitioners might take particular care of sensitising recipients' managers and peers on the matter in order to ensure their support. Similarly, they might ensure that recipients have the proper opportunities to transfer what they learned during the intervention into their everyday work, as well as to implement the action plans that they developed as part

of it. A further advantage of the realist evaluation, in which no control groups are deployed as this methodological practice is out of scope in this kind of approach, is the prevention of spillover effects between experimental and control groups, as well as the possibility to offer the intervention to all participants interested, not to exclude anyone, thus being less problematic in terms of ethical standards (Nielsen & Miraglia, 2017).

Conclusion

To the best of the authors' knowledge, previous studies have not conducted realist evaluations of digital interventions using social network visualisation and team coaching. Thus, knowledge about the explanatory conditions and working mechanisms involved in the effectiveness of such interventions is still scarce. This study contributed to filling this gap and added to the broader realist evaluation literature and theory. It also aimed to guide future implementation efforts from practitioners. This contribution seems relevant to todays' changing world of work, which is more and more relying on the deployment of – either in-presence or remote – teamwork, and where digital interventions might be needed more than ever.

General Discussion

The present doctoral dissertation reported on a three-year research project that investigated a team-level digital-based workplace intervention based on team coaching and social network visualisation (Bahbouh, 2012; Bahbouh & Lasker, 2014). The investigation was carried out through a sequence of four interdependent studies, grounded on Lacerenza and colleagues' (2018) stepwise framework for team interventions, the IGLO model (Day & Nielsen, 2017; Nielsen & Christensen, 2021; Nielsen et al., 2017), the JD-R model (Bakker & Demerouti, 2017; 2018; Schaufeli, 2017), and the realist evaluation approach (Nielsen & Abildgaard, 2013; Nielsen & Miraglia, 2017; Nielsen & Randall, 2013; Nielsen & Shepherd, 2022; Roodbari et al., 2021a, 2021b, 2023). Study 1 was a systematic literature review with a realist synthesis approach about workplace digital interventions at multiple levels, highlighting the need for more research about group-level digital workplace interventions. Study 2 was a qualitative needs assessment exercise that verified the fit between the targeted organisations and the selected intervention. Following the tailored implementation of the intervention, Study 3 analysed recipients' positive perceptions of intervention characteristics, with usability and integrity being appreciated the most, and acceptability being appreciated the least. While the intervention was considered usable and recipients felt valued during sessions, training did not fully meet their expectations. Also, recipients' perceptions did not change from second to fourth session, suggesting they remained stably satisfied with the intervention over time. Finally, Study 4 tested two relevant CMO configurations and suggested that teams implementing action plans developed during training might need less support from immediate managers to coordinate collective efforts and accomplish collective performance. Moreover, peer support towards training transfer was confirmed as a relevant contextual factor contributing to intervention effectiveness. Overall, this multifaceted and complex research project offers a nuanced examination of team-level digital interventions within the contemporary workplace, unveiling valuable insights and opportunities for further refinement and application.

Of course, conclusions should not be drawn from this project's findings without considering a number of limitations. The studies were all based on subjective data collected via self-report measurement techniques, whereas no objective indicators of explored variables were utilised, which makes the interpretation of results prone to biases. Also, research and intervention activities were mostly implemented in a healthcare setting, which limits the generalisability of findings. Furthermore, one notable weakness of the project lies in the link between Study 1 and the subsequent studies; while the systematic literature review shows a stronger focus on digital interventions for workplace mental health, the needs assessment exercise and the implementation and evaluation studies concentrate more on team issues and a digital-based intervention to promote team communication at work. However, the scope of this doctoral project was subordinate to the scope of the larger project it was

tied to (i.e., De Angelis et al., 2020), which was an EU-H2020 project on multilevel interventions to promote mental health in small- and medium-sized enterprises and public organisations. In addition, the impact that teamwork and team communication can have on workers' mental health should not be underestimated (e.g., Bronkhorst et al., 2015; Eguchi et al., 2012; Hopkinson et al., 2021). For example, Bronkhorst and colleagues (2015) indicate that group relationships between co-workers are important in explaining the mental health of healthcare workers. Similarly, Eguchi and colleagues (2012) suggest that promotion of communication in the workplace was associated with reduced psychological distress among workers. Finally, Hopkinson and colleagues (2021) have suggested that effective communication in nursing teams is associated with job satisfaction, an indicator of work-related psychological well-being of healthcare workers. Therefore, while the focus of the project oscillates somewhat between workplace mental health and teamwork, the two topics are actually strictly intertwined, and digital interventions addressing the latter in terms of team communication have the potential to affect dimensions of the former as well.

On the other hand, the project has a number of strengths too, that contribute to its academic and practical value. First and foremost, in line with mainstream literature in the field of workplace interventions (e.g., Nielsen et al., 2010; Nielsen & Noblet, 2018; von Thiele Schwarz et al., 2021), the project followed a stepwise framework for team interventions (i.e., Lacerenza et al., 2018), going from the review of previous evidence to the assessment of team needs, and from the tailored implementation of interventions to the evaluation of implemented actions. This approach ensures a structured, well-organised and methodical exploration of team-level digital interventions, addressing unique needs and challenges faced by organisations nowadays. This framework not only offers a clear path for developing and implementing interventions but also aligns the research with the best practices in the field, enhancing its credibility and relevance. Complementary to that, the adoption of a realist approach towards evaluating interventions (Nielsen & Abildgaard, 2013; Nielsen & Miraglia, 2017; Nielsen & Randall, 2013; Nielsen & Shepherd, 2022; Roodbari et al., 2021a, 2021b, 2023) allowed the project to engage with the complexity of real-world contexts and the intricacies of intervention mechanisms, shedding light on the contextual factors that influence the effectiveness of team interventions. This realist lens enhances the project's ability to unearth the underlying mechanisms and reasons behind the outcomes observed, making it insightful and adaptable to practical settings.

Secondly, the deployment of a mixed-method approach, encompassing both qualitative and quantitative techniques for collecting empirical data, as evidenced throughout the four studies, represents a methodological strength. This approach amalgamates the strengths of both qualitative and quantitative research methods, enriching the research comprehensiveness and depth. It allows for a nuanced understanding of the multifaceted dynamics at play within digital workplace interventions. The mixed-method approach also enables the research project to triangulate findings, thereby bolstering the overall robustness and validity of the

research outcomes. In sum, the synergistic use of Lacerenza and colleagues' (2018) stepwise framework for team interventions, a realist perspective and a mixed-method approach collectively underpin the strengths of this doctoral project, ensuring that it stands as a theoretically grounded, methodologically sound, and practically impactful contribution to the understanding and enhancement of digital-based team interventions in contemporary organisations.

More specifically related to the setting where the present research project took place, another strength is the project's prevalent contextualisation within the healthcare domain. Teamwork is topical in healthcare, which is a complex, demanding, diverse, interdisciplinary, critical, and specialised sector. Here, the importance of effective teamwork is understood considering its positive relationships with indicators of patients' health, safety, and well-being (Rosen et al., 2018). In turn, if patients' health and safety is ensured, this allows to avoid unnecessary human and social costs, as well as economic and financial burdens to the wider healthcare system. In addition, healthcare teams have been heavily hit by the recent Covid-19 pandemic outbreak, often in ways that can be described as unprecedented (Zajac et al., 2021). Therefore, conducting empirical research into factors of effective teamwork in the healthcare sector might provide unedited insights of both theoretical and practical relevance. Previous literature has shown the crucial role of communication as a main factor for several indicators of team effectiveness (Marlow et al., 2018) and this has not been different in research about team communication in the healthcare sector (Evin et al., 2018; Fowler et al., 2021; Hopkinson et al., 2021; Molleman et al., 2010). For instance, Hopkinson and colleagues (2021) have suggested that effective communication in nursing teams is associated with quality of patients' treatment, an indicator of job performance in the healthcare domain.

Additional strengths of the presented research reside in the contents of the specific intervention that was implemented throughout Study 3 and Study 4, that is, a team-level digital-based workplace intervention based on team coaching and social network visualisation (Bahbouh, 2012; Bahbouh & Lasker, 2014). First, the intervention taps into relevant dimensions of team communication in the workplace. As argued by previous contributions to the literature (e.g., Franc et al., 2019; Grote & Kozlowski, 2023), communication as a factor of team effectiveness should not be considered per se. Rather, it is the quality of communication that determines the extent to which communication impacts the work of the team in a desirable manner. Particularly, high-quality communication is defined in terms of its (1) clarity – that is, communication should be understandable for its receivers, (2) timing – that is, communication should be delivered neither too early nor too late with respect to the tasks it refers to, (3) relevance – that is, communication should constitute a meaningful contribution to those tasks, and (4) frequency – that is, communication should occur neither too often nor too infrequently, in order to avoid, on the one hand, information overload and unmanageability, and, on the other hand, failing to provide timely information about the tasks it relates to. Given the questions administered to generate sociomaps – for instance, "How often do you communicate with your colleagues

about work-related topics?", "How often would you like to communicate with your colleagues in order to work most effectively?", "How important is communication with your colleagues to deliver high-quality outputs?", "Evaluate the quality of work communication, taking into account its relevance, content, and timeliness" –, it can be seen that the implemented intervention addresses not only the quantity but also the quality of communication in teams. Moreover, the use of digital sociomaps itself constitutes an interesting aspect of such intervention. Previous empirical studies (Abildgaard & Nielsen, 2018; von Thiele Schwarz et al., 2017) have shown beneficial impacts of material artifacts and visual devices on intervention effectiveness. Then, the delivered intervention and the presented research extend the scope of these strategies' potential to digital artifacts, offering insights into the design of workplace digital intervention environments.

Overall, this research project holds several implications both for theory and practice. The project contributes to supporting Lacerenza and colleagues' (2018) stepwise framework for team interventions, the IGLO model (Day & Nielsen, 2017; Nielsen & Christensen, 2021; Nielsen et al., 2017), the JD-R model (Bakker & Demerouti, 2017; 2018; Schaufeli, 2017), and the realist evaluation approach (Nielsen & Abildgaard, 2013; Nielsen & Miraglia, 2017; Nielsen & Randall, 2013; Nielsen & Shepherd, 2022; Roodbari et al., 2021a, 2021b, 2023) as useful and actionable theoretical frameworks that can be recommended for continued deployment in future research. Also, the project's findings advance the available knowledge regarding team-level digital-based workplace interventions, particularly focussing on possible boundary conditions of their effectiveness, such as contextual factors and working mechanisms, in spite and because of previous academic literature having paid little attention to the matter. In so doing, the project answers recent literature's call for performing the evaluation of workplace intervention processes and working mechanisms beyond the mere evaluation of outcomes (ibidem). Realist evaluations of digital-based workplace interventions are not frequently mentioned in literature, with Havermans and colleagues' (2018) process evaluation of a digital platform-based implementation strategy aimed at work stress prevention in healthcare representing a rare exception. Particularly, such approach had not yet been applied to investigate group-level digital interventions. Therefore, this research contributes to meeting the need for a deeper understanding of what intervention elements work and why, in which circumstances, settings, and for whom they are especially successful or, rather, fail. For the same reason, practitioners – encompassing employers, policymakers, human resource managers, work and organisational psychologists, and various professionals in the workplace – are hereby provided with suggestions on how to design, develop, implement, and evaluate digital-based interventions to promote teamwork.

Finally, despite its valuable contributions, this project still leaves some open questions and thus paves the way for future research in the field of digital-based interventions for teams in the workplace. Building upon the four studies described in this dissertation, future studies might attempt to perform similar research starting

from different methodological choices and explore whether more robust conclusions can be achieved. In particular, reviewing previous literature based on a search string more focussed on teamwork and team interventions, as well as the collection of less subjective and self-reported data, might be considered. Future studies might also try to expand the knowledge gathered throughout this project's studies by, on the one hand, examining additional factors for the effectiveness of the same digital team coaching intervention delivered – for example, recipients' perceptions of different intervention characteristics, the impact of other context factors and working mechanisms –, and, on the other hand, exploring the same factors in relation to a different digital-based team-level intervention. Finally, other organisational sectors and settings and working populations might be targeted in future studies. In conclusion, the present doctoral project not only contributes to filling some gaps from past academic research, but hopefully inaugurates constructive directions for further scientific investigation.

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