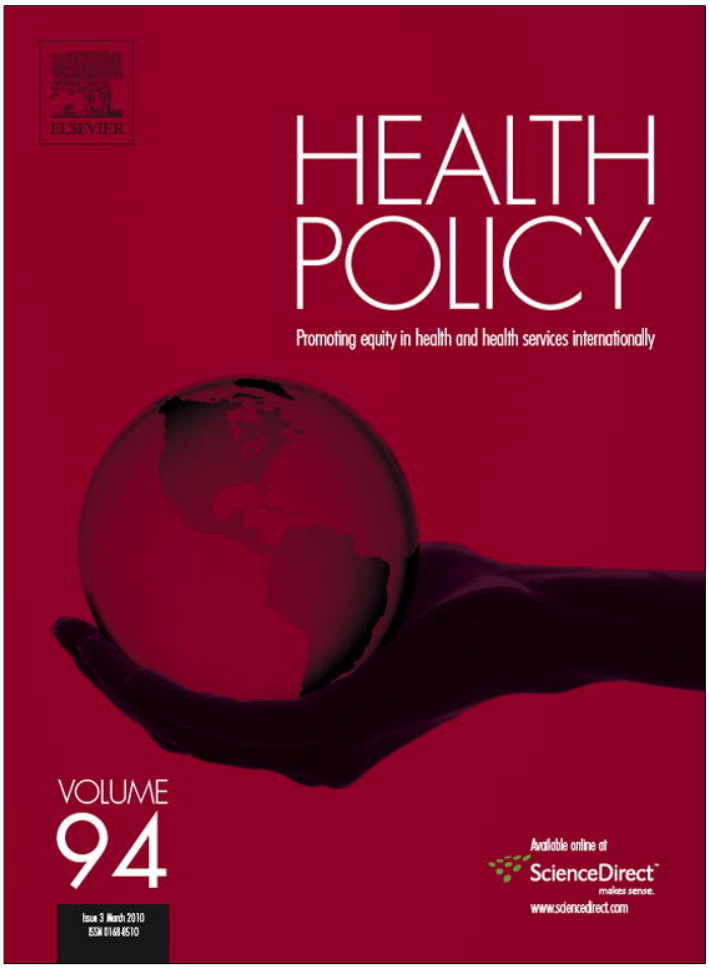

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Review

Interventions to improve team effectiveness: A systematic review

Martina Buljac-Samardzic*, Connie M. Dekker-van Doorn, Jeroen D.H. van Wijngaarden, Kees P. van Wijk

Erasmus MC, Department of Health Policy Management (iBMG), Rotterdam, The Netherlands

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ABSTRACT

Objectives: To review the literature on interventions to improve team effectiveness and identify their 'evidence based'-level.
Methods: Major data bases (PubMed, Web of Science, PsycInfo and Cochrane Library) were systematically searched for all relevant papers. Inclusion criteria were: peer-reviewed papers, published in English between January 1990 and April 2008, which present empirically based studies focussing on interventions to improve team effectiveness in health care. A data abstraction form was developed to summarize each paper. The Grading of Recommendations, Assessment, Development, and Evaluation Scale was used to assess the level of empirical evidence.
Results: Forty-eight papers were included in this review. Three categories of interventions were identified: training, tools, and organisational interventions. Target groups were mostly multidisciplinary teams in acute care. The majority of the studies found a positive association between the intervention and non-technical team skills. Most articles presented research with a low level of evidence. Positive results in combination with a moderate or high level of evidence were found for some specific interventions: Simulation training, Crew Resource Management training, Team-based training and projects on Continuous quality improvement.
Conclusions: There are only some studies available with high quality evidence on interventions to improve team effectiveness. These studies show that team training can improve the effectiveness of multidisciplinary teams in acute (hospital) care.

Contents

* Corresponding author at: Erasmus MC, Department of Health Policy Management (iBMG), PO Box 1738, Office Woudestein J6-63, 3000 DR Rotterdam, The Netherlands. Tel.: +31 104088641; fax: +31 104089094.
E-mail address: buljac@bmg.eur.nl (M. Buljac-Samardzic).

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1. Introduction

The well-known publication of *To Err is Human: Building a Safer Health System* prompted a considerable rethinking of safety in health care [1]. The authors argued that 3–4% of patients hospitalized in the United States were harmed by care received and 44,000–98,000 patients died as a result of medical errors. Their conclusion was that effective teamwork and better communication between caregivers could have prevented half of them. "To promote effective team functioning" became one of the five principles in the 1999 IOM report to create safe hospital systems [1]. The assumption is that effective teamwork leads to higher-quality decision making and medical intervention and, in turn, better patient outcomes [2]. Since the publication of the report, research on team effectiveness in health care has significantly increased.

Research in health care has focused particularly on identifying characteristics of effective teams and developing instruments for measuring their effectiveness [3–5]. Cohen and Bailey define a team as: "A collection of individuals who are interdependent in their tasks, who share responsibility for outcomes, who see themselves and who are seen by others as an intact social entity embedded in one or more larger social systems (for example, business unit or corporation), and who manage their relationships across organizational boundaries" [6, p. 241].

Several models have been developed to conceptualize the aspects of teamwork that influence team effectiveness [3,4,7]. These models can be useful in understanding how interventions effect teams. For example, Lemieux-Charles and McGuire have presented 'The Integrated (Health Care) Team Effectiveness Model' (ITEM) [3]. This model shows that the organizational context in which a team operates (e.g. goals, structure, rewards, training environment) indirectly influences its effectiveness. This particularly has an effect on team processes (e.g. communication, leadership, decision-making), psycho-social traits (e.g. cohesion, norms) and task design (e.g. team composition, autonomy, interdependence). These aspects do have a direct influence on team effectiveness. Finally, team effectiveness can be measured by looking at objective outcomes (e.g. patient satisfaction, quality of care) and subjective outcomes (e.g. effectiveness as perceived by team members).

With respect to measuring team effectiveness, Heinemann and Zeiss have presented an overview of nine state-of-the-art instruments specific to health care teams that measure aspects such as team climate, collaboration, meeting effectiveness, attitude towards teams, team integration, and development of teams [5].

However, there are no (general) overviews of studies on different interventions to improve team effectiveness. Therefore, information on the effectiveness of these interventions is scattered. We do not know which interventions are most effective for which target group and for which outcomes. Nevertheless, health care organisations are spending an increasing amount of money and energy on programs and projects to improve team effectiveness.

To assist health care organisations in their endeavour to improve team effectiveness, synthesise scientific knowledge on relevant interventions, and identify gaps in this research, we performed a systematic review with a focus on two research questions: *(1) Which types of interventions to improve team effectiveness in health care have been researched empirically, for which target groups and for which outcomes? (2) To what extent are these findings evidence based?*

This article presents the findings of this systematic review.

2. Methods

2.1. Data sources

A systematic literature search was conducted using the PubMed, Web of Science, PsycInfo, and Cochrane databases. We restricted the initial search to English articles with abstracts published in peer-reviewed journals between 1990 and April 2008. According to Lemieux-Charles and McGuire, research interest in team effectiveness in health care started around 1990 [3]. Although research on interventions to improve team effectiveness seemed to appear somewhat later, we chose 1990 as a point of departure for the sake of thoroughness. Our search terms were team tool(s), team intervention(s), team building, team development, team training, team innovation, team program, team education, teamwork, team improve(ment) and team management. Rather than combining search terms, every term was used separately in each data base. When the search term consisted of two elements 'AND' was used; e.g. "team AND tool(s)". A summary of the search results is presented in Table 1. The search produced 6508 references, including some duplicate articles due to parallel searches.

2.2. Inclusion/exclusion criteria

Articles included matched the following criteria: (1) peer-reviewed English-language publication; (2) a focus on health care, (3) a focus on how to improve (and not only measure) team effectiveness, and (4) empirically

Table 1
Summary of search.

Database	Hits
Pubmed	3082
Web of Science	1819
PsychInfo	1477
Cochrane	130
Total	6508

researched results. No selection was made based on the design of the study, as long as empirical data was presented. Review articles that focused on interventions to improve team effectiveness were studied only to identify other relevant empirical studies. Because we wanted to include both qualitative and quantitative articles, we did not require clear outcome measurements. Nor did we select studies based on a definition of a team because they were often lacking. Editorial letters, books, and book summaries were excluded.

2.3. Selection process

A three-staged process was followed: (1) screening the title and abstract (authors MB, CD and JW), (2) examining the abstracts (MB, CD, JW, and KW), and (3) summarizing accepted articles (MB, CD, JW, and KW). If the title or abstract did not provide enough information to meet our criteria, the article was referred to the next stage of the process. The first stage resulted in 550 references. In the second stage, each abstract was examined by two researchers, using the same inclusion criteria. When both researchers concluded that an abstract did not match the criteria, it was excluded. When only one of the researcher reached this conclusion, a third researcher was asked to make the final decision. Stage two resulted in 90 articles, which were summarized using a standard format; (1) research question/subject, (2) target group (*n*), (3) methodology (4) intervention (5) results (6) conclusion, (7) general remarks. The search included only one review that focused on interventions to improve team effectiveness, namely interprofessional education. This review was analyzed to identify additional studies; but none was found [9]. After reading the full length articles, 42 articles did not match the inclusion criteria after all. In the end, 48 studies remained.

2.4. Organisation of results

Based on our findings a categorical description of interventions to improve team effectiveness was constructed. Articles were clustered accordingly. Three categories were identified: (1) training, (2) tools, and (3) organisational interventions. *Training* involves a systematic process through which a team is trained (often by facilitators) to master and improve different aspects of team functioning [10]. We identified four types: (1) simulations, (2) training based on Crew Resource Management (CRM), (3) interprofessional training, and (4) team training. *Simulations* attempt to recreate characteristics of the real world. A simulated scenario can have a specific focus on (a segment of) a complex task or be designed to fully simulate a medical or nursing intervention. *CRM* is a management concept used in the aviation industry to improve teamwork. It has been adapted to high risk, complex medical departments such as Emergency Departments and operating theatres. CRM encompasses a wide range of knowledge, skills, and attitudes including communication, situational awareness, problem solving, decision-making, and teamwork [11]. *Interprofessional training* incorporates different learning methods that aim to improve cooperation between different disciplines [12]. *Team training* includes different forms of training that focus on specific aspects of team functioning such as goal-setting and team building. *Tools* are specific instruments that teams can use independently to improve team effectiveness (checklists, goal sheets) through better communication. *Organizational interventions* are actions or changes that focus on the organizational context but are expected to have an effect on team functioning, like integrated care or quality interventions, for example. Each intervention will be described using the same structure: target group, outcomes, and level of empirical evidence (Table 2).

Table 2
Overall information of results.

Interventions	*n*
Training	32
Simulation training	7
Training based on CRM	8
Interprofessional training	6
Team training	11
Tools	8
Organisational interventions	8
Total	48

- The *target group* consists of two categories: sector (acute care versus long-term care) and team composition (mono-, multi-, or interdisciplinary[1]).
- *Outcomes* represent the effect of the intervention. These can be objective outcomes focused on patients (e.g. functional status), teams (e.g. clinical quality of care) and organizations (e.g. cost-effectiveness) or subjective outcomes, namely perceived effectiveness by team members [3].
- The *level of empirical evidence* is based on the Grading of Recommendations Assessment, Development, and Evaluation scale (GRADE).

The GRADE system is used because it gives a general rating of not only the level of evidence, but also the quality of the article. The GRADE rating scale has four levels of quality of evidence: (A) high, (B) moderate, (C) low, and (D) very low [13]. (A) Quality evidence implies that further research is highly unlikely to change the confidence in the estimated effect of the intervention. The category comprises multicentre random control trials (RCT), one large high-quality

[1] Multidisciplinary teams are less well developed as interdisciplinary teams. Members of multidisciplinary teams focus on their own discipline and work in a parallel to each other. Interdisciplinary teams have a high integration of disciplines [5].

multi-centre trial, and high-quality pre- and post-surveys. (B) Quality evidence implies that further research is likely to have an important impact on the confidence in the estimated effect and may change it. This category consists of one-centre RCT, RCT with severe limitations, and pre- and post-surveys. (C) Quality evidence implies that further research is very likely to have an important impact on the confidence of the estimated effect and is likely to change it. This category consists of high-quality qualitative studies, quasi-experimental designs, and pre- and post-surveys with limitations. (D) Quality evidence implies that any estimated effect is very uncertain. This category consists of low-quality qualitative studies and pre- and post-surveys with severe limitations. Levels of evidence of our studies were judged by two researchers. When the two differed in opinion, a third researcher was asked to make the final judgement. Due to the lack of homogeneity across studies, statistical data could not be pooled; the interventions and outcome indicators differed too much.

3. Results

The results of the 48 articles are summarized in Tables 2 and 3. Most were published after 2000, only six between 1990 and 2000. The majority (32) evaluated a type of training to improve team effectiveness, mostly in multidisciplinary teams in acute (hospital) care. The outcome indicators were highly diverse and often related to the so-called non-technical skills of teams such as communication, cooperation, coordination, and leadership [14]. The majority of the studies had a low quality of evidence (C). Most studies comprised a pre- and post-survey, or experimental design, or used qualitative methods. Little statistical evidence directly related to the effectiveness of the interventions was found.

3.1. Training

Of the 32 articles that presented a type of training (simulation-based training, CRM training, interprofessional training, or team training), multidisciplinary teams in acute (hospital) care were the most common target group, although interdisciplinary teams in acute care and long-term (elderly) care were also significantly present. Outcomes were diverse, except for studies on CRM training, which mostly focused on safety by improving attitude and team climate (i.e. shared perceptions of the team's work procedures and practices). Nine articles had a high or moderate quality of evidence, three of which presented training based on CRM.

3.1.1. Simulation training

We identified seven studies on simulations using audio-video, computers, manikins, human bodies, or actors. The scenarios were often combined with educational interventions and/or observation (schemes), which are used for debriefing. Teams in acute (hospital) care were the *target group* for all studies. Most simulations were aimed at team functioning in crisis situations. Both subjective and objective *outcomes* were used focusing on information sharing, perception, or team performance in terms of task completion (number, efficiency, effectiveness). Most studies found a positive association between simulation training and non-technical team skills.

Six of the seven studies had a low or very low quality of *evidence*. One found no association (based on the quantitative data) between the intervention (lecture-based teaching (LBT), simulation-based teaching (SBT), or a combination of lecture and simulation training (LAS)) and team effectiveness. The qualitative data showed a slight indication of a positive effect between the intervention and team effectiveness [15]. One study with a moderate quality of evidence found a positive association between participation in emergency training and patient-actor perception using manikins or patient-actors. Training that make use of patient-actors seemed to yield the best results [17].

3.1.2. Training based on CRM

Eight studies on training were based on one or more principles of CRM. For all studies the *target group* was teams in the acute (hospital) care and often (multidisciplinary) emergency/trauma teams. In half of the studies improving attitudes towards teamwork and safety was an (subjective) *outcome* [23,24,26,29]. All but one found a positive association between CRM training and attitudes. Other (subjective) outcomes consisted of improving communication, collaboration, team behaviour, workload, culture and climate. But also objective outcomes were used; reducing adverse outcomes and medical errors. One article also presented an interesting tool: a briefing checklist for the operating theatre [25].

The quality of *evidence* in this subgroup varied from high (A) to very low (D). Five of the eight studies presented a low or very low quality of evidence. Most found improvements in several aspects of team effectiveness such as culture, attitude, communication (with exception of nurses), team skills, perceived risk for wrong-site surgery, and perceived collaboration. Only one study found no difference in team performance [28]. This study had a low quality of evidence. One study had a high quality of evidence [27] and two had a moderate quality of evidence [23,26]. These found that training based on CRM principles will likely result in improved team behaviour, improved attitudes towards teamwork, improved assessments of institutional support, and reduced medical errors [26,27]. No evidence, however, confirmed that CRM-based training reduces adverse outcomes (except for 'time from decision to performance') or subjective workload [26,27].

3.1.3. Interprofessional training

For five of the six studies on interprofessional training, the *target group* was interdisciplinary teams in long-term (elderly) care. One study [35] had multidisciplinary teams in acute (hospital care) as the target group. The interventions mostly involved many training sessions. Only subjective *outcomes* were measured focusing on learning and retaining information, attitudes, awareness, and team climate.

All studies had a low or very low quality of *evidence*. Two studies found no positive associations and one did not present clear outcomes concerning team effectiveness [30–32]. The other three studies found that interprofes-

Table 3
Summary of results.

Author(s) (year)	Intervention	Target group (*n*)	Outcomes	Quality of evidence
Training				
Simulation training				
Birch et al. [15]	Lecture-based teaching (LBT), simulation-based teaching (SBT), or a combination (LAS)	Multidisciplinary teams in the cure sector (hospitals: obstetric and midwifery) (*n* = 36 participants/6 teams and 18 interviews)	Quantitative results are not significant. Qualitative show improvement in knowledge and confidence for all team members, improvement in transferable skills and less anxiety for SBT group, improvement in communication and teamwork for SBT and LAS group	C Mixed methods; pre-and post-survey and semi-structured interviews
Blum et al. [16]	Simulation-based team training to improve communication skills	Mono-disciplinary (anesthesia) teams in the cure sector (*n* = 22 pilot teams and 10 experimental teams)	No differences in group information sharing (all *p* values > 0.2)	C Experimental study; surveys
Crofts et al. [17]	Emergency training using mannequins or patient-actors	Multidisciplinary teams in the cure sector (*n* = 139 participants/23 team pre- and 132 participants/24 teams post)	Improving patient-actor perception of care (all scores *p* = 0.017 to >0.001) PPH (safety *p* = 0.048, communication *p* = 0.035, respect = 0.077) Eclampsia (safety *p* = 0.214, communication *p* = 0.071, respect *p* = 0.140) shoulder dystocia (safety *p* = 0.532, communication *p* = 0.502, respect *p* = 0.719)	B RCT
DeVita et al. [18]	Crisis TEAM Training (computerized human simulator)	Multidisciplinary emergency teams in the cure sector (*n* > 200 participants)	Improving efficiency and effectiveness of tasks in crisis situations (treatment *p* = 0.002, task completion *p* < 0.001)	C Observational study
DeVita et al. [19]	Computerized human patient simulator	Multidisciplinary emergency teams in the cure sector (*n* = 138 participants)	Improving simulated survival and team task completion (overall survival *p* = 0.002, overall TCR *p* < 0.001) TCR = percentage of required tasks completed	C Observational study
Hunt et al. [20]	Educational intervention during simulated trauma resuscitations (mannequin)	Multidisciplinary trauma teams in the cure sector (*n* = 18 departments)	Improving performance of teams (mean number of tasks, primary survey tasks, secondary survey tasks and procedural tasks all *p* < 0.001) *(deze p waardes kan je verder opsplitsen naar specifieke taken)*	C Pre- and post-survey
Mackenzie et al. [21]	Audio–video data review	Multidisciplinary emergency and trauma teams in the cure sector (*n* = 4 cases in comparison to 49 video records)	Identifies more performance details (*p* < 0.05)	D Observational study

Table 3 (*Continued*)

Author(s) (year)	Intervention	Target group (*n*)	Outcomes	Quality of evidence
Training based on CRM				
Awad et al. [22]	Medical team training (MTT) training session based on CRM	Multidisciplinary OR teams in the cure sector (*n* = one surgical service)	Improving communication of anesthesiologist ($p < 0.0008$) and surgeons ($p < 0.0004$). But not for nurses ($p = 0.7$)	C Pre- and post-survey
Grogan et al. [23]	Aviation-based teamwork training	Multidisciplinary teams in the cure sector (*n* = 489 participants training/463 participants ECC/338 pre- and post-surveys)	Improving attitudes (20 of the 23 items $p < 0.01$) *Er kunnen 23 p values genoemd worden*	B Pre- and post-survey
Leonard et al. [24]	Human factors training	Multidisciplinary teams in the cure sector	Better culture, improving attitude towards teamwork and safety climate	D Case study
Makary et al. [25]	OR briefing program	Multidisciplinary OR teams in cure sector (*n* = 306 participants pre- and 116 participants post)	Reducing perceived risk for wrong-site surgery and improving perceived collaboration among OR personnel ($p < 0.001$)	C Pre- and post-survey
Morey et al. [26]	Formal teamwork training (based on CRM)	Multidisciplinary emergency teams in the cure sector (*n* = 684 participants/6 departments as experimental group and 374 participants/3 departments as control group)	Improving team behavior ($p = 0.012$), reducing medical errors ($p = 0.039$), no differences in subjective workload ($p = 0.668$), improving staff attitudes towards teamwork ($p = 0.047$) and staff assessment of institutional support ($p = 0.040$)	B Quasi-experimental design; pre- and post-survey (control group)
Nielsen et al. [27]	Teamwork training curriculum (based on CRM)	Multidisciplinary teams in the cure sector (*n* = 1.307 participants/7 intervention hospitals and 8 control hospitals)	No differences on adverse outcomes ($p > 0.05$, only one process measure 'time from decision to performance' $p = 0.03$)	A RCT
Shapiro et al. [28]	Simulation-based teamwork training	Multidisciplinary emergency teams in the cure sector (*n* = 20 participants/2 experimental and 2 control teams)	No differences in team performance (quality of team behavior, experimental group $p = 0.07$, comparison group $p = 0.55$)	C High quality observational study
Wallin et al. [29]	Target-focused medical emergency team training using human patient simulators	Multidisciplinary emergency teams in the cure sector (*n* = 15 participants)	Improving team skills but no differences in attitude towards safe teamwork ('junior team member should not have control over patient management' $p = 0.025$, all other items non significant $p > 0.05$)	C Observational study

Interprofessional training				
Clark [30]	Interdisciplinary team training	Interdisciplinary teams in elderly care ($n = 30$ participants)	Program met educational needs of participants and taught lessons for future similar programs (p value not presented)	C Post-survey
Clark et al. [31]	Interdisciplinary clinical team training	Interdisciplinary teams in elderly care ($n = 66$ participants/8 teams pre- and 15 participants/3 teams post)	No significant improvements	C Pre- and post-survey
Cooley [32]	Training on interdisciplinary teams on communication and decision-making skills	Interdisciplinary teams in cure sector ($n = 25$ participants)	Effects of training are minimal	C Mixed methods; high quality observations and post-survey
Coogle et al. [33]	Geriatric interdisciplinary team training (ITT) program	Interdisciplinary team in elderly care ($n = 61$ participants)	Positive changes in team skills ($p < 0.05$) and attitudes ($p < 0.05$) (but, critical amount of training necessary)	C Pre- and post-survey
Lichtenberg et al. [34]	Interdisciplinary team training in geriatrics (ITTG)	Interdisciplinary teams in elderly care ($n = 22$ participants as experiment group, $n = 10$ participants as control group)	Learning and retaining information ($p < 0.0005$) Improving the morale of participants	C Mixed methods; post-survey (control group) and interviews
Watts et al. [35]	Interprofessional learning program	Multidisciplinary teams in the cure sector ($n = 71$ participants/9 teams at t1, 64 participants at t2, and 42 participants at t3)	Improving team climate ($p < 0.001$) and awareness of professional roles	C Pre- and post-survey
Team training				
Berman et al. [36]	Assessment training	Multidisciplinary teams in the care sector ($n = 19$ participants)	Increasing team members' participation ($p = 0.003$), improving staff members' perception of the efficacy of treatment planning and implementation ($p < 0.001$) No differences in team development ($p = 0.254$)	C Pre- and post-survey
Crofts [37]	Leadership program	Multidisciplinary teams in the cure sector ($n = 6$ hospitals)	Impact program variable	C Post-survey and feedback
DiMeglio et al. [38]	Team building intervention	Mono-disciplinary nurse teams in the cure sector ($n = 165$ participants pre- and 118 participants post)	Improving group cohesion ($p < 0.001$), nurse interaction ($p < 0.001$), job enjoyment ($p < 0.05$) and turnover	C Quasi-experimental design; pre- and post-survey
Frankel et al. [39]	Fair en just culture principles, teamwork training and communication, and leadership walkrounds	Multi- and mono-disciplinary teams in the cure sector	No reliable results available	D Case study
Gibson [40]	Goal-setting training program	Mono-disciplinary nursing teams in the cure sector ($n = 120$ participants/51 teams as intervention group and 67 participants/20 teams as control group)	Increasing self-efficacy ($p < 0.05$), individual effectiveness ($p < 0.001$), group efficacy ($p < 0.05$) but not team effectiveness	B Quasi-experimental design; pre- and post-survey (control group)

Table 3 (*Continued*)

Author(s) (year)	Intervention	Target group (*n*)	Outcomes	Quality of evidence
Le Blanc et al. [41]	Team-based burnout intervention program	Interdisciplinary teams in the cure sector (*n* = 260 participants/9 wards as experimental group t1, 231 participants t2, 208 participants t3, and 404 participants/20 wards as control group at t1, 145 participants t2, 96 participants t3)	Decreasing emotional exhaustion and de-personalization (*p* value unknown)	B Quasi-experimental study; pre- and post-survey (control group)
Manzo and Rodriquez [42]	Team building activity	Teams in health care (*n* = 20 participants)	Helps to reinforce the concepts of an effective team at work.	D Observational study
Stoller et al. [43]	Teambuilding and leadership training	Multidisciplinary teams in the cure sector (*n* = 30 participants)	Improving development teamwork and leadership skills ($p < 0.001$)	D Pre- and post-survey
Strasser et al. [44]	Staff training program	Interdisciplinary teams in the cure sector (*n* = 227 participants/15 teams as intervention group and 237 participants/16 teams as control group and 487 patients)	Patient outcomes: improving functional outcome ($p = 0.032$) and no differences in length of stay (LOS) or community discharge.	A RCT
Thompson et al. [45]	Training based on the principles of CAT (cognitive analytic therapy)	Multidisciplinary mental health staff (*n* = 12 participants)	Improving team cohesion and clinical confidence of individual workers	C Interviews
Wilshaw and Bohannon [46]	Training with time out or debriefing approach	Multidisciplinary mental health care teams (*n* = 35 participants)	Improving competences ($p < 0.001$)	D Pre- and post-survey
Tools				
Benett and Danczak [47]	Significant event analysis (SEA)	Multidisciplinary teams in primary care	Changes in practice were made	D Case study
Crofts [48]	Critical case review	Teams in the cure sector (*n* = 45 cases)	Improvement in resolving difficulties and managing and communicating patient case issues	D Case reviews
Evans et al. [49]	Goal attainment scaling (GAS)	Interdisciplinary teams in elderly care (*n* = 102 participants)	Improving team processes and increasing accountability for patient care (*p* value unknown)	D Descriptive study
Lingard et al. [50]	Preoperative team checklist	Multidisciplinary OR teams in cure sector (*n* = 33 participants and 11 interviews)	Improving information exchange and team cohesion	C Observational study and interviews
Lingard et al. [51]	Preoperative checklist and team briefing	Multidisciplinary OR teams in cure sector (*n* = 77 participants and 86 pre- and 86 post-observations)	Reducing number of communication failures ($p < 0.001$) and promoting proactive and collaborative team communication	C Mixed methods; pre- and post-survey and observations
Phipps and Thomas [52]	Daily goal sheets	Multidisciplinary critical care teams in the cure sector (*n* = 26 participants pre- and 22 participants post)	Improving perception of communication from a nursing perspective ($p = 0.05$) and improving care (for surgical service) ($p = 0.04$)	C Pre- and post-survey
Simpson et al. [53]	ICU quality improvement checklist	Multidisciplinary ICU teams in cure sector	Improvement in attention of core issues, team's collegiality and team bonding	D Descriptive study
Verhoef et al. [54]	Rehabilitation Activities Profile	Multidisciplinary teams in cure sector (*n* = 31 participants pre- and 29 participants post)	Improving team members' satisfaction (only in day patient setting)	C Pre- and post-survey

Organisational intervention				
Cendan and Good [55]	Interdisciplinary work flow assessment and redesign	Interdisciplinary OR teams in the cure sector ($n = 4$ participants, 401 operations and 253 turnover time evaluated)	Decreasing OR turnover time ($p < 0.001$)	C High quality observational study
Engels et al. [56]	Continuous quality improvement	Practices in primary care ($n = 24$ practices as intervention group and 21 practices as control group)	Increasing number and improving quality of improving projects undertaken and self-defined objectives met (p unknown)	A RCT
Friedman and Berger [57]	Reconstructing patient care teams	Multidisciplinary OR teams in the cure sector	Decreasing length of stay ($p < 0.001$), maintaining level of patient satisfaction	C Survey data from the past
Henderson et al. [58]	EBP (evidence-based practice) team-based intervention	Multidisciplinary teams in the cure sector ($n = 39$ participants pre- and 38 participants post)	No differences in attitudes towards research and the potential to use research findings	D Pre- and post-survey
Huby and Rees [59]	Integrated care pathways	Multidisciplinary teams in health care	It was not optimal effective in improving integration	C Case study
Ledlow et al. [60]	Animated computer simulation for decision support	Individuals and teams in health care	Developing teamwork and increasing ownership of necessary changes and improvements	C Case study
Macfarlane et al. [61]	Quality team development program	Multidisciplinary teams in primary care ($n = 34$ participants)	Improving teamwork and patient services	C Interviews
Moroney and Knowles [62]	Multidisciplinary ward rounds with standard documentation labels	Multidisciplinary teams in cure sector ($n = 64$ participants)	Improving accuracy of predicted discharge dates, decreasing time to carry out clinical interventions Increasing patient involvement, higher development of nurses, higher job satisfaction and improvement in multidisciplinary team relationships Happier working environment, improving staff retention and reducing absence	C Mixed methods; survey; observations; reflections; data collection

sional training resulted in improvements in team skills, team climate, awareness of professional roles, attitude, learning and retaining information, and morale.

3.1.4. Team training

Eleven studies used different forms of training but focused on specific aspects of team functioning, namely, team building, leadership, team assessments, staff, goal setting, or burnout. The target group and the outcomes (mostly subjective) of this subgroup were diverse due to the different subjects, but in most studies positive results were found.

Although in practice team training is often used for team building, only three articles with a (very) low quality of *evidence* focused on team building [38,42,43]. These studies found improvements in group cohesion, nurse interaction, turnover, competences, and teamwork skills. Two studies did not present clear outcomes [37,39]. Frankel, Leonard and Denham described a combination of interventions – training and tools – within a program [39]. They presented a communication and a leadership tool, namely, the situational briefing model SBAR (Situation, Background, Assessment and Recommendation) and 'Leadership WalkRounds'. SBAR is supposed to help providers organize their thoughts and communication to increase mutual understanding [39]. In a Leadership WalkRound, senior leaders of a health-care organization ask front-line staff about specific events, contributing factors, near misses and potential problems, then prioritize events and discuss possible solutions [39]. The studies did not present precise information on the evaluation of these tools, which makes it difficult to judge their value.

A study with a moderate quality of evidence on a team-based burnout intervention program found that the program is likely to decrease emotional exhaustion and de-personalization [41]. Another B-grade study demonstrated that goal-setting training programs are likely to increase self-efficacy and individual effectiveness. However, there was no evidence that the training increased team effectiveness [40]. A study with a high quality of evidence demonstrated that staff training programs are likely to improve patients' functional outcome [44].

3.2. Tools

Eight articles studied the use of specific tools to improve team effectiveness. These tools are often presented as easy and less extensive to implement compared to other team interventions. Tools can roughly be divided into checklists, goal sheets, and case analysis. Teams were given a training or instruction to use these tools in their daily practice, with the intention of improving communication by making processes, goals and case discussions more explicit. Three types of checklists were identified: preoperative, rehabilitation activities profile, and quality improvement. These checklists had to be completed by the teams at a given moment. Two ways of analysing cases to gather themes for improvement are significant event analysis and critical case reviews [47,48]. The *target group* of most studies was multidisciplinary teams in acute (hospital) care. Various *outcomes* (mostly subjective) were presented: communication failure, team communication, information exchange, team cohesion, satisfaction, team process, accountability, core issues, and patient case issues. All studies had a low or very low quality of *evidence* and showed positive results, especially on communication and team unity.

3.3. Organisational intervention

Earlier interventions were aimed at team processes, psycho-social traits and/or task design, which directly influence team outcomes (see Section 1; ITEM model) [3]. Organisational interventions are mostly aimed at the organisational context which indirectly effects team outcomes. This category contained eight articles. It involves interventions that focus on decision-making, continuous quality improvement, and redesign of care processes. The *target group* in the studies was often less specific, but mostly multidisciplinary teams in acute (hospital) care. Some *outcomes* focused on specific aspects of team effectiveness as perceived by team members (such as teamwork, attitude, satisfaction, work ownership) and others presented a more general focus but with objective outcomes (quality and quantity of improvement projects, integration, discharge dates, turnover time).

Seven of the eight studies had a low or very low quality of *evidence*. Some of these interventions aimed to improve team effectiveness indirectly, such as with interdisciplinary work flow assessment and redesign, or reconstructing patient care teams [55,57]. These interventions seemed to help teams to provide insight in the strong and weak aspects of patient processes and were likely to result in shorter length of stay [57] and operation room turnover time [55]. Other interventions were directly related to improving team effectiveness [60–62]. These interventions seemed to improve teamwork, patient services, ownership, satisfaction, patient involvement, relationships, and work environment. Only one study on continuous quality improvement intervention presented a high quality of evidence [56]. This intervention is likely to result in a higher number of quality improvement projects, a higher quality of these projects, and improve achievement of self-defined objectives.

4. Conclusion/discussion

We began with the question: *Which types of interventions to improve team effectiveness in health care have been researched empirically, for which target groups and for which outcomes?* We identified 48 relevant articles whose studies focused on training, tools, and organisational interventions as primary intervention types. No study, however, evaluated precisely the same intervention. Most looked at training programs, which can be either simulations, training based on CRM, interprofessional training, or (general) team training. The majority of the interventions aimed at improving the effectiveness of multidisciplinary teams in acute (hospital) care. Because different outcomes were used, the findings are difficult to compare or to synthesize across studies. Most studies focused on non-technical team skills as outcome; for example, communication, cooperation, coordination and/or leadership, and most used

subjective outcome indicators (perceived effectiveness by team members, see introduction). The majority of the studies found a positive association between the intervention and non-technical team skills.

Our second research question was: *To what extent are these findings evidence-based?* Most articles (37) presented a low or very low level of evidence (small sample pre- or post-studies, observational studies, case-studies). Only eight articles presented evidence-based on a study with a high or moderate quality of evidence (RCT, or high quality pre- or post-survey). These were mostly training programs: simulation training (1), CRM-training (3), and team-based intervention training (3). Articles with high or moderate quality of evidence found positive associations with team behaviour, attitudes (towards teamwork), self-efficacy, individual effectiveness, emotional exhaustion, de-personalization and perception of care. However, these training programs did not seem to succeed in reducing adverse outcomes, improving subjective workload, reducing length of stay, or reducing community discharge.

A downside of these high quality studies is that they often provide little information about the context in which the intervention was tested, making it difficult to determine if the intervention will also be effective in other settings. As interventions to improve team effectiveness are introduced in complex settings with many variables, research and practice would benefit from mixed-method approaches [63–65]. Using both qualitative and quantitative research methods will help to (1) explain the findings, (2) contextualise the results and (3) build new theories [66]. The authors also suggest assessing the effect of the intervention on different end points by linking the intervention to structure, process, and outcome indicators. New research designs are also emerging, such as Stepped Wedge Trial Design and Evidence-based Co-design, which seem better suited to evaluate interventions to improve team effectiveness than a classic RCT due to the complex and dynamic setting in which such interventions are introduced [67].

There are several gaps in the literature on interventions to improve team effectiveness. Little research has been conducted in long-term care and most studies focus on acute hospital care. Few studies exist on interventions to improve team effectiveness in mono-disciplinary teams in health care. We identified only four such studies in acute care and none in long-term care. More cohesion in outcome measures is needed, as well as replication of same-intervention studies to enable synthesis of findings across different studies. Finally, more high quality evidence needs to be provided using objective outcomes, especially related to tools and organizational interventions to improve team effectiveness.

Several limitations of this systematic review have to be taken into account when interpreting the results and recommendations. Our study was restricted to peer-reviewed articles. By not including books or grey literature, we may have missed relevant publications. Our search was also restricted to a number of key words. They were, however, based on a preliminary search and corroborated during the main search by looking at key words in identified articles. Thus, it is possible, but unlikely that we have excluded relevant key words leading to important publications. However Salas et al. have found similar results concerning team training [8] and [68]. A meta-analysis of research in other sectors than health care found team training to be useful for "improving cognitive outcomes, affective outcomes, teamwork processes, and performance outcomes. . .team training accounted for approximately 12–19% of the variance in the examinded outcomes" [68, p. 926]. Team training also seems to be effective 'across a wide variety of settings, tasks and team types' [68].

For reasons mentioned above, policy-makers should be aware that there is still little high quality evidence available about the effectiveness of the aforementioned interventions, but most evidence points in the same direction. For teams in acute care, there is growing evidence that communication skills and coordination in high risk, complex medical departments can be improved by simulation training and training based on Crew Resource Management. As these are departments where errors due to miscommunication and poor teamwork can have serious consequences which can lead to a high number of adverse events [1], we advise policy-makers to stimulate the implementation of these training methods. Although the evidence for long-term care also seems to indicate that team training, has positive effects for multidisciplinary teams in particular, the evidence is still too weak. More research needs to be conducted before any sound advise about the use of such interventions in long-term care can be given. Furthermore, policy-makers should make sure that, when implementing interventions, they also consult case-studies, for they provide valuable insights in how to implement these interventions.

Finally, before an intervention is used, the specific circumstances of a team should be diagnosed. The right fit between the intervention and the problems, context en characteristics of a team is more important to improve team effectiveness than the underlying level of evidence.

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