A Review of Empirical Studies Investigating Antecedents and Consequences of Collective Learning Behaviors in Hospitals

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Abstract

This study is a systematic review of the field research conducted in medical settings investigating collective learning behaviors. The review was driven by several research foci. Our main interest was in identifying antecedents and consequences of collective learning in hospitals. We also report results on the types of research questions addressed, research designs used, and types of medical teams investigated. Twelve studies met our inclusion criteria. Our findings revealed that highly contextualized studies that use different ways of measuring learning, different ways of conceptualizing medical teams, and different research methodologies, discuss similar antecedents. Variables like leadership behaviors, unit interpersonal climate, and hierarchical position were found to play a role in explaining organizational learning in hospitals across studies. We also found that despite an intense public discourse on the link between collective learning processes and patients' safety and medical organizations' performance, few studies actually report empirical data supporting this relationship.

Keywords: organizational learning, team learning, collective learning, hospitals, systematic review

Résumé

Cette étude est un review systématique de la littérature qui examine les antécédents et les conséquences de l'apprentissage collectif dans les hôpitaux. De même, nous rapportons des résultats concernant le type de questions de recherche adressés, des designs de recherche utilisés et les types d'équipes médicales examinées. Douze études ont rempli les critères d'inclusion. Une série d'antécédents communs sont discutés par des études bien contextuelles qui utilisent diverses modalités d'opérationnalisation de l'apprentissage, de conceptualisation des équipes médicales, mais aussi des méthodologies différentes de recherche. Des variables comme le style de leadership, le climat interpersonnel de l'équipe et la position hiérarchique ont un rôle important pour expliquer l'apprentissage collectif dans les hôpitaux. L'analyse des études prouve que, malgré un discours public intense sur la relation entre l'apprentissage collectif et la sûreté des patients ou la performance des hôpitaux, il y a peu de données empiriques qui soutiennent cette relation.

Mots-clés: Apprentissage organisationnel, apprentissage en équipe, apprentissage collectif, hôpitaux, review systématique.

Rezumat

Acest studiu este un review sistematic al literaturii care investighează comportamente de învăţare colectivă în organizaţii medicale. Review-ul a avut mai multe obiective. Obiectivul principal a fost de a identifica antecedenţi şi consecinţe învăţării colective în spitale. De asemenea, raportăm rezultate cu privire la tipul de întrebări de cercetare adresate, design-uri de cercetare utilizate, şi tipuri de echipe medicale investigate. Doisprezece studii au întrunit criteriile de includere. O serie de antecedenţi comuni sunt discutaţi de studii foarte contextualizate, care utilizează modalităţi diferite de operaţionalizare a învăţării, de conceptualizare a echipelor medicale, dar şi metodologii de cercetare diferite. Variabile precum stilul de leadership, climatul interpersonal al echipei şi poziţia ierarhică au un rol important în explicarea învăţării colective în spitale. Analiza studiilor relevă faptul că, în ciuda unui discurs public intens despre legătura dintre învăţarea colectivă şi siguranţa pacienţilor sau performanţa spitalelor, există puţine date empirice care să susţină această relaţie.

Cuvinte cheie: învăţare organizaţională, învăţare în echipă, învăţare colectivă, spitale, review sistematic

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Introduction

Mistakes and mishaps are a reality in healthcare as in any other industry. In the UK, 10% of the patients admitted to hospitals every year suffer some kind of harm due to adverse medical events (NHS, An Organization with a Memory, 2000). In the US, about 7,000 patients die annually as a result of medication errors only (Kohn, Corrigan & Donaldson, 2000). Half of the adverse events that happen in hospitals are preventable (NHS, 2000), provided that hospitals develop their capacity to learn from their past experiences (Aspden, Corrigan, Wolcott & Erikson, 2004; Aspden, Wolcott, Bootman & Cronenwett, 2006; Woodward, Randall, Hoey & Bishop, 2004; Edwards, 2012).

Learning from medical failures and mishaps

Although organizations can learn from positive experiences, most often they learn by reflecting on what went wrong in a particular situation (Argyris, 2000). This implies that a key step in facilitating collective learning is detecting failures - the mismatch between an intended outcome and the actual outcome. One important progress in exploiting failures as learning opportunities in healthcare was made through implementing anonymous error reporting systems (Mahajan, 2010; Cohen, 2000), but this kinds of formal collective learning instruments are not easily accepted by health professionals (Iedema, Allen, Sorensen & Gallagher, 2011; Waring, 2005). A qualitative study investigating why doctors do not use centralized error reporting systems found that fear of being blamed, a busy agenda, doubts about the utility of it, and also the believe that completing reports is the job of nurses and administrative personnel, were among the most common themes in doctors' discourses (Waring, 2005). Thus formal error reporting systems might not always work as expected in medical organizations. At the same time, field research suggests that collective learning tends to be a rather social, informal process (Edmondson, 1999; 2002), in which a key ingredient is the willingness to openly address the causes leading to failure, so that they would be avoided in the future.

Collective learning implies that people are ready to engage in interpersonally risky behaviors (Edmondson, 2002; 2004a). Admitting one's own failure might be interpreted as incompetence, unprofessionalism or even laziness (Edmondson, 2004b), while discussing someone else's failure might be interpreted as lack of collegiality or even a way of bringing discredit on someone (Leape, 2006). Collective learning is difficult to achieve in any kind of organizations (Singer & Edmondson, 2008), but even more difficult in organizations in which the main objective is to provide medical assistance, and in which patients' lives are at stake (Caroll & Edmondson, 2002). Committing a medical error can have very serious consequences for patients' health and their families' well-being. At the same time, admitting a medical error can have very serious implications for health professionals' careers, and hospitals' reputation.

Medical organizations have often been described as working environments dominated by a culture of fear and defensiveness (Leape, 1994; Waring, 2005; Leape et al., 2009; Firth-Cozens, 2001). Although health professionals often have to team-up in order to perform highly complex tasks that require intensive coordination and teamwork (Rosen et al., 2008; Salas, Rosen & King, 2007), it was found that engaging in effective communication, even in matters relevant to patients' well-being, is rather problematic (Reeves et al., 2009; Leape et al., 2009). In a study investigating communication patterns among health professionals, Reeves et al. (2009) found that it is very common for doctors to directly address residents and nurses, but that it is less likely for residents and nurses to speak openly when interacting with doctors. These characteristics of medical organizations set the premises of a professional context that is more likely to block, rather than nurture collective learning, and suggests that collective learning might have different characteristics in hospitals, in comparison with other professional cultures that are less hierarchical, and in which fear and blame are less of a stigma.

Collective learning processes in organizations

The interest in how organizations capitalize on their own and other organizations' experience in order to improve performance or to innovate was initiated in the late '60s and early '70s (Edmondson, 1996a; Edmondson & Moingeon, 1998). Driven by organizational consultants interested in designing "learning organizations", early theoretical perspectives on organizational learning described it as a macro-level,

organization-wide phenomenon (Fiol & Lyles, 1985; Levitt & March, 1988; Edmondson & Moingeon, 1998). Recent field research found evidence that different units (e.g. teams, departments) within the same organization have different learning rates and display different learning behaviors and processes (Edmondson, 1996b; 1999; 2002; 2003; Sole & Edmondson, 2002; Wong, 2004), supporting the hypothesis that collective learning in organizations is a local, group-level phenomenon (Edmondson, 2002). Recent studies refer to organizational learning when conceptualized as unit-level phenomenon as collective learning, group learning or team learning (Edmondson, 1999; 2002; Knapp, 2012).

Collective learning in real work groups has been defined as the process through which team members reflect upon their actions, and use experience to improve future performance (Edmondon, 1999; 2002; Wong, 2004; Edmondson, Dillon & Roloff, 2007). Evidence from different organizational settings suggest that variables such as leader's values and behaviors (Edmondson, 1999; Wong, Tjosvold, & Lu, 2010), team interpersonal climate (Edmondson, 1999; Carmeli & Gittell, 2009; Kostopoulos & Bozionelos, 2011; Post, 2012), team characteristics (Gibson & Vermeulen, 2003), or task characteristics (Edmondson, 1999; Edmondson, 2002) are related to team learning in work groups. Edmondson (1999) investigated the relationship between a supportive, coaching-oriented leadership style and collective learning in work groups from a manufacturing company. The author found that leaders' coaching behaviors were associated with members' willingness to engage in collective learning behaviors such as asking questions, asking for feedback, sharing information or experimenting. The relationship was found to be mediated by team psychological safety – the shared belief that one can engage in interpersonal risky behaviors such as admitting mistakes or asking for help, without being judged and rejected by coworkers (Edmondson, 1999; 2004a). Psychological safety was also found to mediate the relationship between leadership style and team learning in a sample of 101 teams from multiple industries in China (Wong et al., 2010). Carmeli and Gittell (2009) investigated the link between psychological safety and collective learning – operationalized as learning from failures – in finance, electronic and software companies, and

found evidence that psychological safety predicts learning. In a study of 156 work teams from the pharmaceutical and medical products industries, Gibson and Vermeulen (2003) found that team diversity impacts collective learning, and Edmondson (1999; 2002) reported results of qualitative data suggesting that tasks characteristics might also influence the types of learning behaviors most frequently adopted in real work teams.

Several field research studies found evidence for the link between team learning and team performance (Edmondson, 1999; Wong, 2004; Van der Vengt & Bunderson, 2005). In a study of 57 teams in the oil and gas industry, Van der Vengt and Bunderson (2005) found that collective learning practices predict team's performance. Similar results were found by Wong (2004) studying 78 teams working in a variety of industries, and Edmondson (1999) investing team learning in 53 units in a manufacturing company.

Aims and New Contributions

Our aim was to integrate the results of the existing field research conducted in hospitals and investigating organizational learning as a unit-level, collective process. The final purpose was to capitalize on the findings of the existing data, and develop a conceptual framework that would further inform field research on the topic. Our initial research focus was on identifying antecedents and consequences of organizational learning in hospitals, and possible explanatory mechanisms. When engaged in the review process, it became evident that integrating the findings of such diverse literature would be very difficult without simultaneously considering conceptual and methodological aspects of the papers reviewed. We therefore decided to report and reflect also on aspects such as: the types of research questions addressed, the types of research methods used, the ways of operationalizing collective learning behaviors and processes, and the types of medical teams investigated.

Although other review papers have been published on organizational learning or team learning, they reflect on conceptual aspects (Fiol & Lyles, 1985; Huber, 1991; Edmondson & Moingeon, 1998; Knapp, 2010; Kozlowski, Chao & Jensen, 2010), they integrate research conducted on work groups from a variety of

professional domains (Kayes & Burnett, 2006; Edmondson et al., 2007), or they take a different perspective and report on collective learning as an output instead of a process (Argote & Miron-Spector, 2011).

Our main contribution resides in the fact that we capitalize on the results of a highly contextualized and descriptive literature, and develop a framework that is meant to inform a more positivistic, hypotheses testing approach. Our work is also relevant for organizational development in hospitals, as we identify variables that were found to facilitate organizational learning across different studies, in different types of medical teams.

Working Definition and Inclusion Criteria

We define collective learning behaviors as practices or actions taken by team members, through which they share information and reflect on their collective and individual behaviors within the team, and develop new knowledge and understandings in order to improve team's performance. This definition is consistent with Fiol and Lyles (1985) definition of organizational learning, but sets the target of analysis at the team level, as suggested by the meso-level approach to collective learning in organizations (Edmondon, 1999; 2002). The definition informed the inclusion criteria that we have used in analyzing and selecting the papers reviewed. Given the diverse terminology used when referring to collective learning in organizations in recent research (Knapp, 2010), we decided to include in the analysis studies investigating organizational learning, team learning, group learning and collective learning. We selected papers that investigate collective learning as a process – as opposed to an output of it (Fiol & Lyles, 1985; Huber, 1991; Argyris, 2000; Edmondson, 1999), and also as a group-level phenomenon (Edmondson, 1999; Edmondson, 2002), having a clear interpersonal component – that distinguishes organizational learning from individual learning (Fiol & Lyles, 1985; Senge, 1994; Edmondson et al., 2007, Knapp, 2010). For example, we rejected the study by Pisano, Bohmer and Edmondson (2001) investigating the link between organizational learning and performance in minimally invasive cardiac surgical teams. Although both the

medical setting, and the working definition of organizational learning used in the study qualified it for inclusion, the authors operationalize collective learning as reduction in the procedure time – which we consider to be an output of the learning process, and an indicator of unit performance. The same authors, reported on the same set of data in a different study (Edmondson, Bohmer & Pisano, 2001) focusing on engaging in open communication, collective reflection practices, and experimenting as indicators of team learning. This second study was included in the review. Another example of a study that we excluded is the paper by Waring (2005) investigating why physicians do not use error reporting systems. The author interviewed 28 doctors from different departments, focusing on individual believes and perceptions. Error reporting is described as an isolated, individual behavior, and no investigation or reference is made to how health professionals interact and collectively reflect on how to exploit this in order to improve future performance – the distinctive feature of collective learning in organizations (Fiol & Lyles, 1985; Argyris, 2000; Edmondson, 1999; Edmondson et al., 2007).

Method

A systematic review methodology was used. Systematic reviews are particularly appropriate when the research field is still young, and the existing data need to be integrated in order to inform about the theoretical and methodological issues that should be addressed in the future (Pettigrew & Roberts, 2006).

We used a two steps strategy to identify papers. First, we conducted a systematic search of abstracts published in seven electronic databases: PsycARTICLES, PubMeD, Sage Journals, Taylor & Francis, Science Direct (Psychology, Medicine & Dentistry, Nursing and Health Professions), Emerald, and SpringerLink. We used eight combinations of key words resulted from mixing organizational/team/group/collective learning AND hospital/medicine. The search included papers that were electronically published before May 2012. Whenever the search engine offered this possibility, we restricted the search to articles published in English.

A total number of 1397 titles resulted in the search. After removing the duplicates, 1118 single titles were analyzed using the list of predetermined inclusion criteria. The journal articles considered for review had to: 1) be written in English, 2) be published in peer-reviewed journals, 3) report empirical data, 4) be collected in hospital settings, 5) have exclusively health professionals as study participants or use sources of data (e.g. document analysis) that would allow inferences about health professionals' learning behaviors, and 6) identify or describe learning at group level and refer to it as a process, as opposed to an output. We included studies that used qualitative, quantitative and mixed-methods research.

We excluded papers published in other language except English, papers reporting on the efficiency of medical procedures or treatments, theoretical papers, syntheses or commentary papers on collective learning in organizations, papers presenting empirical data on individual learning and teaching, or on training and professional development of health professionals as individuals, empirical studies on organizational or team learning conducted in other kinds of organizations except hospitals, and papers presenting empirical results of studies conducted in hospitals on other research topics (e.g. health behavior, social work, economy). The selection process is sequenced in Figure 1.
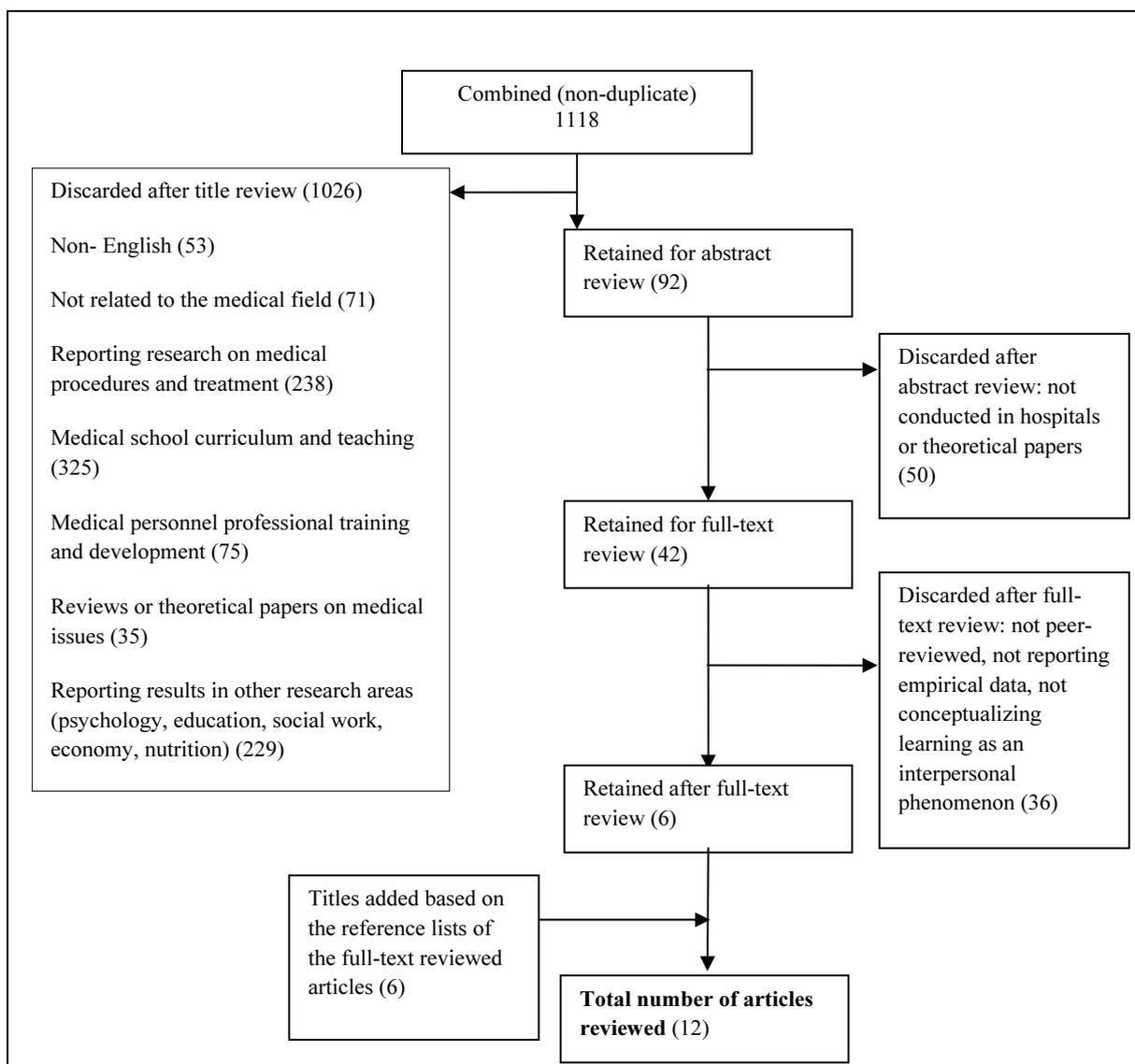

Figure 1. Description of the steps followed in selecting the articles reviewed.

After title review, 92 papers were selected for abstract review. Fifty of them were discarded based on the information provided in the abstracts. The vast majority of papers rejected at this step were theoretical papers or they were presenting empirical data collected in other organizational settings. Forty-two papers were retained for full text analysis, 36 of which were also rejected because they were not reporting empirical data – although this was not clear from the abstract – they were not investigating collective learning activities but individual learning, or they were not published in peer-review journals. Six articles were retained for review at this stage.

Second, we used the reference lists of the 6 articles selected in order to identify additional articles that might have met our predefined criteria and were not identified in the search we conducted in the seven databases mentioned. Forty-eight single titles were identified this way. Twenty-eight of them were rejected after abstract review. The rejected articles were commentary papers, were not studying collective learning as a process, or they were not published in peer reviewed journals. Another 14 titles were rejected after full text review. In the end, 6 papers were selected as meeting our inclusion criteria and were added to the final list. The complete list of the 12 articles, in chronological order, and our findings are presented in Table 1.

Results
Research methods used

Out of the 12 studies that met our inclusion criteria, 2 used exclusively qualitative data collection and analysis methods (Lipshitz & Popper, 2000; Waring, Harrison, & McDonald, 2007), 6 used mixed methods designs (Edmondson, 1996b; Edmondson et al., 2001; Tucker et al., 2002; Edmondson, 2003; Tucker & Edmondson, 2003; Drach-Zahary & Pud, 2010), and 4 used quantitative designs (Nembhard & Edmondson, 2006; Tucker, 2007; Tucker et al., 2007; Hirak et al., 2012). Many of the studies are predominantly exploratory and highly descriptive (e.g. Lipshitz & Popper, 2000; Waring et al., 2007; Tucker et al., 2002; Edmondson, 2003; 1996; Edmondson et al., 2001).

Operationalization of Medical Teams

Seven of the studies report results on mixed medical units, and 5 report results on nurse units. None of them report results on doctors only. When they report results based on data collected in mixed medical units, some studies investigate whole departments (e.g. Lipshitz & Popper, 2000; Drach-Zahary & Pud, 2010), while others report results on long-term, stable teams with very few members. For example Edmondson et al. (2001) and Edmondson (2003) report results from cardiac surgical teams with only five members. Some studies report data on one or two medical departments (Waring et al., 2007; Lipshitz & Popper, 2000), while others report data on multiple teams. For example, Edmondson (2003) reports data on 16 medical departments, while Hirak et al., (2012) report data on 55 medical units. In most cases the medical teams that were investigated were selected based on availability criteria, which also influenced the way collective learning processes were operationalized and measured.

Operationalization of Collective Learning

The number of ways in which organizational learning is measured almost equals the number of studies included in the review. In some cases organizational learning is measured as error communication and analysis (Edmondson, 1996b). Other studies report on collective learning as engaging in second-order problem solving behaviors (Tucker et al, 2002; Tucker & Edmondson, 2003). In some cases, engaging in behaviors like experimenting new methods/ ways of doing things, engaging in open communication, and reflection on current practices are used as main indicators of learning (Edmondson, 2003; Tucker et al., 2007). Overall, most studies select either one or several behaviors and processes previously described in the literature as indicating collective learning. A rather new and interesting perspective is taken by Drach-Zahary and Pud (2010) who describe the efficiency of collective learning in terms of the chain of continuity from the people reporting errors, to those analyzing them, and further on to the people implementing the results of the analysis.

Predictors of Collective Learning

Despite the diversity of methodological approaches and conceptualizations of collective learning and medical teams, there are several antecedents of organizational learning that have been identified and described across multiple studies, such as leadership behavior (Edmondson, 1996b; Lipshitz & Popper, 2000; Edmondson, Bohmer & Pisano, 2001; Edmondson, 2003; Nembhard & Edmondson, 2006; Hirak et al., 2012), unit interpersonal climate (Edmondson, 1996b; Lipshitz & Popper, 2000; Edmondson et al., 2001; Edmondson, 2003; Nembhard & Edmondson, 2006; Tucker, 2007; Hirak et al., 2012), hierarchical status (Edmondson et al., 2001; Tucker et al., 2002; Edmondson, 2003; Nembhard & Edmondson, 2006; Waring et al., 2007), and work and task characteristics (Lipshitz & Popper, 2000, Tucker et al., 2002; Tucker & Edmondson, 2003; Nembhard & Edmondson, 2006; Tucker, 2007).

Leadership Behaviors

Half of the studies reported on the role of leadership behaviors in facilitating or blocking collective learning processes. Edmondson (1996b) conducted a mixed methods study investigating factors influencing error reporting rates in 8 nurses units. She found a high association between unit error rates and coaching behaviors displayed by the head nurse ($r = .74$), and also the quality of the interpersonal climate within the unit ($r = .74$). When exploring the causes of these surprising results using ethnographic interviews and observation, she found that error reporting varied based on actual error rates, but also based on the willingness to report errors. Nurses were more likely to acknowledge errors and report them in the units in which the head nurse was working side by side with all the other nurses, focused on identifying solutions to problems, as opposed to finding someone to blame, was perceived as part of a team and someone who is willing to help if addressed with a problem. This kind of leadership behavior helped creating a work climate in which nurses felt safe to report errors.

Lipshitz and Popper (2000) used ethnographic methods to explore the types of learning mechanisms used in two hospital departments. They suggest that collective learning was facilitated when the head physician was using behaviors through which he invited department members to communicate openly, was receptive to suggestions from them, and was open to discuss his owns doubts and errors.

Edmondson et al. (2001) also used ethnographic methods to explore the factors that lead to the long-term success of a new minimally invasive cardiac surgery procedure. The authors investigated 16 mixed medical units and found that team members were more likely to engage in open communication during the procedure, experiment with new ways of doing things, and were more willing to openly reflect on their performance in the teams in which the head surgeons got involved in selecting team members, communicated the reasons why the team members were selected and the roles and responsibility of each of them, initiated dry runs, asked for feedback and help from team members, encouraged them to experiment new things, and modeled reflection on teams' performance. In a different study, Edmondson (2003) found that these kind of behaviors displayed by the head surgeon were highly correlated ($r = .70$) with easiness to speak up reported by the team members (Edmondson, 2003).

Nembhard & Edmondson (2006) investigated the link between leader's inclusiveness and members' willingness to engage in quality improvement efforts in 44 neonatal intensive care units. Leader's inclusiveness – defined as behaviors displayed by the physician-in-charge through which he or she invites and appreciates all team members' contributions – was found to predict engagement in quality improvement work – defined as the willingness to participate in efforts to improve unit's performance –, at team level ($\beta = .41$). The relationship was found to be totally mediated by psychological safety. Similar results were found by Hirak et al. (2012) in a longitudinal study. The authors investigated the impact of leader's inclusiveness on learning from failures in 55 work units in an Israelian hospital, and showed that leader's inclusiveness impacts psychological safety, which in turn predicts learning from failures measured four months later.

Table 1. Results of the review conducted on 12 papers investigating collective learning processes in medical settings.

	Paper	Research Questions	Research Design	Unit of Analysis	Operationalization of Collective Learning	Findings
1.	Edmondson (1996b)	What unit properties are associated with differences in error rates in nurse units? Is there an association between perceived unit performance and error rates?	Mixed methods design	nurse units	error communication and error analysis	Observed error rates vary across units of the same hospital. Reported error rates depend on actual error rates, but mostly on the willingness to engage in error reporting. Willingness to engage in error reporting is facilitated by a climate of mutual trust among unit members. Coaching behaviors displayed by the head nurse facilitates a working climate in which nurses are not afraid to acknowledge problems and errors. Units that reported higher error rates perceived themselves as having higher performance.
2.	Lipshitz & Popper (2000)	What kinds of organizational learning mechanisms do medical departments use? What kind of organizational culture characteristics sustain these learning mechanisms?	Ethnographic study	department	analysis of, and reflection on practices embedded into day to day activities (e.g. rounds, meetings, periodic reviews)	Different learning practices are used with different intensity and frequency in different departments. Task interdependence seems to be related to engaging in learning practices, especially in surgical departments. Learning practices are facilitated by a climate of transparency and issue orientation. Heads of the units help create such a climate. New knowledge created rarely crosses departments' boundaries, and it is rarely formally documented. New knowledge is embedded in the practices and routines of the department.
3.	Edmondson, Bohmer & Pisano (2001)	What group and organizational factors influence the process of adoption and implementation of a new technology in surgical cardiac units?	Mixed methods design	mixed surgical teams	open communication, experimenting, and reflection	Engaging in collective learning behaviors contributes to the long-term success in adopting and implementing a new surgical procedure; Open communication among health professionals occupying different organizational positions is facilitated by an interpersonal climate of psychological safety. The head surgeon facilitates the development of psychological safe climate, Organizational support is not related to the team's success.
4.	Tucker, Edmondson & Spear (2002)	What kind of problem solving behaviors do nurses use? Why do nurses use the problem solving strategies that they use?	Mixed methods design	nurse units	displaying second order problem solving strategies (e.g. signaling problems to the persons in charge of solving them in order to prevent them in the future)	Nurses engage in first order problem solving in 90% of cases. Nurses adopt two kinds of first order problem solving strategies: 1. do whatever it takes to solve the problem on the spot. 2. ask for help from people you trust, even if they might not be able to/ in charge with providing assistance. Nurses engage in "on the spot" problem solving strategies due to lack of time, due to the reluctancy to address colleagues with higher organizational status, and due to the feeling of competency that it provides.

	Paper	Research Questions	Research Design	Unit of Analysis	Operationalization of Collective Learning	Findings
5.	Edmondson (2003)	What team and organizational factors facilitate the adoption of a new surgical procedure in multidisciplinary surgical teams? What leadership behaviors facilitate open communication in surgical teams?	Mixed methods design	mixed surgical teams	open communication, experimenting, and reflection	Non-threatening leadership behaviors (acknowledges his/her own mistakes, uses self-disclosure, does not overreact when others make mistakes, values members contribution regardless of position, gives explanations for decisions, praises team effort, helps coping with power differences) contribute to success in adoption and implementation of a new surgical procedure. Boundary spanning is highly correlated with implementation success. Interpersonal factors (social and emotional) are more important than technical abilities and organizational support and resources in predicting implementation success.
6.	Tucker & Edmondson (2003)	Under what conditions do nurses respond to system failures by actively seeking to prevent them in the future?	Mixed methods design	nurse units	displaying second order problem solving strategies (e.g. signaling problems to the persons in charge of solving them in order to prevent them in the future)	Nurses do not engage in second order problem solving behaviors due to three main factors: emphasis on individual vigilance and responsibility in hospital settings, time urgency and concerns about unit's efficiency, the feeling of empowerment that one has when she/he manages to solve a problem on the spot.
7.	Nembhard & Edmondson (2006)	How do professional status, leader inclusiveness, unit membership, and psychological safety influence health professionals' engagement in quality improvement?	Correlational design	department	open communication, reflection on past experience	Tenure and professionals status were associated with psychological safety, but not gender and worked hours. The level of psychological safety varies across units, but also across professional status. Health professionals that hold higher organizational positions report higher levels of psychological safety. Leaders' inclusiveness is associated with psychological safety and it moderates the relationship between professional status and psychological safety. Psychological safety mediates the relationship between leaders' inclusiveness and engagement in quality improvement.
8.	Waring, Harrison, & McDonald (2007)	What patterns of behaviors related to patients' safety and organizational learning do surgeons and anesthetists from surgical departments use?	Ethnographic study	department	sharing information and reflection	Doctors prefer adopting single-loop learning solutions due to a culture characterized by high tolerance for risk, and appraisal of those who manage to find on the spot and unorthodox solutions in unusual situations. Finding on the spot solutions is perceived as an indicator of high professionalism. It is considered implicit that doctors take decisions on their own, without consulting other health professionals.

	Paper	Research Questions	Research Design	Unit of Analysis	Operationalization of Collective Learning	Findings
9.	Tucker (2007)	How does psychological safety, problem solving efficacy and felt responsibility influence nurses' involvement in system improvement?	Correlational design	nurse units	open communication, reflection, experimenting	Hours worked/week is positively associated with engagement in system improvement (communicating errors to people in position to fix them, suggesting potential solutions, experimenting solutions) by nurses. Organizational support is negatively associated with system improvement. Psychological safety and problem solving efficacy are positively related with system improvement, while felt responsibility is negatively associated.
10.	Tucker, Nembhard, & Edmondson (2007)	How do improvement project teams help implementing new practices in the departments they work in?	Correlational design	department	open communication, reflection, experimenting	Know-what learning activities (distributing scientific articles to staff, exchange of information with other neonatal intensive care units, reviews of the literature, site visits to other neonatal intensive care units, using workbook with best-practices) were not associated with implementation success. Know-how activities (offering feedback before actual implementation, inviting staff to contribute with ideas, pilot runs, dry runs, project team meetings, and problem-solving cycles) was associated with implementation success. Know-how learning activities mediate between psychological safety and implementation success.
11.	Drach-Zahary & Pud (2010)	What kind of learning mechanisms do nurse units use? How does type of learning mechanisms used impact medication administration errors?	Mixed methods design	nurse units	data collection and analysis, generating solutions, implementing solutions	Integrated learning mechanisms (data reporting, analysis, generating solutions and applying them are done by all members of the unit) are negatively associated with medication administration errors (MAE). Non-integrated learning mechanism (error reporting, analysis, generation solutions and implementation are done by different agents within the unit) are highly associate with MAE. Supervisory learning mechanisms (head nurses identify solutions that are further implemented by the unit) is not associated to MAE. Patchy learning mechanisms (unstructured and inconsistent mechanisms) are positively associated with MAE.
12.	Hirak, Peng, Carmeli & Schaubroeck (2012)	Does leadership inclusiveness and psychological safety facilitate learning from failures in medical teams? Does learning from failures predict unit performance?	Correlational Design (longitudinal)	department	open discussion of failure; reflection on failure; correcting the causes that led to failure	The relationship between leader inclusiveness and learning from failure is mediated by psychological safety. Leadership inclusiveness facilitates psychological safety, which in turn impacts unit performance. This relationship is stronger in groups with low performance.

Interpersonal climate

The quality of the unit interpersonal climate was also found to be associated with collective learning across multiple studies. Climate refers to "the norms, atmosphere, practices, interpersonal relationships, enacted rituals and ways of working developed by a team" (Anderson & West, 1994, p. 81). Edmondson (1996) found that nurses learn from the way error reporting was handled in the past by the unit, and mostly by the head nurse. These experiences led either to a climate of fear and defensiveness, or a climate of safety. The rates of error reported were found to be higher in units in which members perceived that they share a safe interpersonal climate.

Lipshitz and Popper (2000) found that a work atmosphere characterized by openness, integrity and issue orientation was more likely to facilitate asking questions and admitting problems, in opposition to a climate that was perceived as formal and distant.

Edmondson et al. (2001) also found that health professionals were more likely to censure themselves and be afraid to speak openly in surgical units that were lacking a climate of psychological safety. Similar findings are reported by Edmondson (2003). Psychological safety was found to predict members' willingness to engage in quality improvement work in neonatal care units ($\beta = .62$), to mediate the effect of leader inclusiveness, and to moderate the impact of organizational position on quality improvement efforts (Nembhard & Edmondson, 2006). Hirak et al., (2012) also found that psychological safety mediates between leader's inclusiveness and learning from failures measured at a four months distance.

Tucker (2007) investigated the impact of psychological safety on nurses' willingness to engage in system improvement tasks. Using only one item to measure psychological safety, she found a positive relationship between the two variables.

Hierarchical Position

Hierarchical position was also found to impact learning behaviors across several studies. Studies reporting on this matter suggest that low status employees, such as nurses and residents are more reluctant to engage in open communication and collective learning behaviors. Nurses and perfusionists were more reserved in communicating openly in mixed surgical units (Edmondson, et al., 2001; Edmondson, 2003). A supportive leadership style was found to reduce the perception of power differences and increase the chance that low status health professionals would feel safe in displaying learning behaviors within the team (Edmondson, 2003). Similar results were reported by Nembhard and Edmondson (2006) who found that leader's inclusiveness moderates the effect of professional status on psychological safety, which in turn leads to engagement in work improvement in neonatal care units.

In an ethnographic study using interviews and observation with 80 members of a surgical department, Waring et al. (2007) suggest that there might be differences in how different categories of health professionals engage in sharing information activities and reflection on practice activities. The authors found that there is a shared belief among health professionals that certified doctors are more entitled to speak their mind, as opposed to residents and nurses in matters related to patients care, and that there is little communication between different professional groups which leads to undetected errors. They also found that it is more common for doctors to use reflection on adverse events as an individual practice, while residents are more used to rely on their supervisors as partners in this process. Nurses are more likely to participate in collective practices such as incident reporting and briefings.

Reluctance to address doctors, as a result of perceived low professional status, was also suggested as an explanation for why nurses tend to engage almost excursively in on the spot, first level problem solving behaviors and not escalade problems to other high status health professionals that were more likely to be able to help (Tucker et al., 2002).

Work and Task Characteristics

Evidence of the impact of workload and work volume on collective learning behaviors in real medical teams seems to indicate contradictory results. Nembhard and Edmondson (2006) found no relationship between workload – measured as ratio of staff to hospital beds – and engagement in quality improvement efforts in neonatal intensive care units. Similar results

were obtained by Tucker (2007) who found no relationship between perceived workload and nurses' involvement in system improvement in 37 nurse units, but a positive significant relationship between hours worked and system improvement efforts.

Tucker et al. (2002) suggest that one of the reasons why nurses adopt first-order problem solving behaviors over second-order problem solving behaviors is lack of time due to work volume. The same argument is defended also by Tucker and Edmondson (2003).

Although no substantial evidence was found linking task interdependence and learning behaviors, Lipshitz and Popper (2000) suggest, based on qualitative analysis of ethnographic interviews and observation, that task interdependence might play a role in health professionals' willingness to participate in collective learning activities, especially in surgical departments.

Consequences of Organizational Learning

Few studies investigated organization learning as an antecedent for organizational outcomes (Edmondson, 1996; 2003; Edmondson et al., 2001; Hirak, Peng, Carmeli & Schaubroeck; 2012). Edmondson (1996b) found a positive association between detected error rates and perceived unit performance (r = .76). Edmondson et al. (2001) and Edmondson (2003) report on data collected in surgical units, suggesting that collective learning behaviors are related to long time success in adoption and implementation of a new minimally invasive cardiac procedure. Using a longitudinal design, Hirak et al. (2012) also found that self reported data on learning from failures is positively related to perceived department performance three months later.

Discussion

The aim of this study was to identify papers investigating organizational learning as a meso-level phenomenon (Edmondson, 2002) in hospitals settings. Twelve studies met our predefined criteria. The findings revealed a very diverse literature both from a conceptual, and a methodological point of view. We have organized our discussion section in two distinct parts. Firstly, we reflect on the methodological

aspects of the papers reviewed and discuss them considering the current state of the field research on the topic of organizational learning in general. Secondly, we discuss our results comparing them to the findings of other studies conducted in different organizational settings. We end this part by integrating our results in a model explaining collective learning in healthcare organizations.

Overview of the Methodological Aspects

To summarize our findings, studies investigating collective learning in work groups in hospitals address a variety of research questions, use a wide range of research methods, and operationalize learning processes and medical teams in very different ways. Despite the differences, and the contextualized understanding of collective learning from one study to the other, three conclusions can be drawn based on the literature we reviewed.

The first conclusion concerns the increasing number of empirical studies that are conducted on the topic of collective learning. One of the most important critiques brought to the construct, next to the lack of conceptual clarity, is the scarcity of empirical data (Lipshitz & Poper, 2000; Pawlowski, 2001; Kozlowski et al., 2010). Our search of the literature identified 12 studies conducted exclusively in hospital settings. In 2006, Kayes and Burnett's review of team learning processes in real work groups from different organizational settings also reported on 12 studies. Only one of the studies (Edmondson, 2003) that met our criteria of having health professionals as participants and being conducted in hospitals was also included in their review. This indicates that there are more and more studies investigating collective learning in real organizations which might help clarify some of the conceptual issues, and contribute to the development of an evidence-based theoretical model of organizational learning.

The second conclusion is that field studies are switching from an exploratory, qualitative research into testing precise relationships among variables. When analyzing the papers we reviewed in a chronological fashion, one can easily notice how the studies have evolved from open inquiry approach (e.g. Edmondson, 1996b; Lipshitz & Popper, 2000; Edmondson, 2003), into a more positivistic approach, using

quantitative designs to test hypotheses (Nembhard & Edmondson, 2006; Tucker, 2007; Tucker et al., 2007; Hirak et al., 2012). According to Edmondson and McManus (2007) this indicates the maturation process through which theory advances in management and organizational research.

The third conclusion is that recent studies (Hirak et al., 2012) take a cross-level approach on collective learning in organizations (Klein & Kozlowski, 2000). Kozlowski et al. (2010) argue that the tedious progress that the theoretical and empirical work on organizational learning has had over the years, despite the interest from different disciplines, is due to a conceptual error. The authors posit that the macro-level conceptualization of collective learning – which has dominated the field since the '60s – brought little contribution to understanding the phenomenon. They draw on the meso-level perspective on organizational learning (House et al., 1995; Edmonson, 1999; 2002) and the cross level approach to organizational behavior (Kozlowski & Klein, 2000; Klein & Kozlowski, 2000) and propose a framework that simultaneously considers individual and group level inputs and processes, in conceptualizing organizational learning.

Overall, although we took a picture of the research field through the lens of only one professional domain, our findings clearly describes the methodological progress in the field of organizational learning as a result of the meso-level paradigm, and the empirical work initiated in the mid '90s.

A Conceptual Framework of Collective Learning Processes in Medical Settings

Across different studies, several variables were found to be consistently associated with collective learning: leadership style, unit interpersonal climate, and hierarchical position. Some studies suggested that work and task characteristics such as number of hours worked or task interdependence are also related to collective learning. Few studies reported on the relationship between collective learning and healthcare medical teams' performance. Figure 2 presents a framework that integrates the relationships suggested by the studies we have reviewed.

Both qualitative and quantitative data support the role of leaders' in facilitating collective learning in hospitals (Edmondson, 1996b; Lipshitz & Popper, 2000; Edmondson et al. 2001; Edmondson, 2003; Nembhard & Edmondson, 2006; Hirak et al., 2012). These results are consistent with data reported in other industries also (Edmondson, 1999; Cannon & Edmondson, 2001; Edmondson, 2002; Wong et al., 2010). Leaders' facilitate collective learning through creating an interpersonal climate in which members feel comfortable to speak openly. This mechanisms seems to be consistent in the medical field (Nembhard & Edmondson, 2006; Hirak et al., 2012), and in other organizational settings (Edmondson, 1999). A supportive, coaching-oriented leadership style seems to be particularly relevant in medical organizations, especially concerning the employees who occupy low positions in the hierarchy. As Kish-Gephart, Detert, Trevino and Edmondson (2009) argue, there is natural tendency of low status employee to fear engaging in open communication when interacting with a person holding a higher organizational position. Some of the studies we reviewed found that leaders who behave as if they are part of the team and appreciate the contributions of all team's members can reduce the perception of status differences, increase the feeling of safety within the team, and facilitate members' willingness to engage in collective learning behaviors (Edmondson, 2003; Nembhard & Edmondson, 2006).

The relationships are not as clear when it comes to work and task characteristics and collective learning. Some of the studies we reviewed (Tucker & Edmondson, 2003; Tucker, 2007) suggest that work volume or workload might impact collective learning. Although the link is barely mentioned in literature on organizational learning in general, it might be relevant in the medical field. The literature on job demands shows that health professionals are among the employees experiencing the highest levels of workload (Wood & Killion, 2007; Carayon & Gürses, 2005), and it appears plausible that time constraints might prevent them from engaging in collective learning practices.

Studies conducted in different industries suggest that variables such as task complexity (Kayes & Burnett, 2006), or task routineness (Wong, 2004) impact collective learning. Only one study included in our review (Lipshitz & Popper, 2000) identified task related variables –

task interdependence – as possible relevant in understanding learning behaviors in medical teams. One possible explanation for this is the fact that studies conducted in the medical field investigate either very specialized medical teams performing the same specific surgical task (Edmondson, 2003; Edmondson et al., 2001), or medical departments as a whole – performing approximately the same wide range of tasks. In either case, the groups were rather homogenous in terms of task characteristics.

All of the studies that report data on the relation between collective learning and team performance found evidence supporting it (Edmondson, 1996b; Edmondson, 2003; Edmondson et al., 2001; Hirak et al. 2012), which appears to be consistent with findings from organizations performing in other domains (Edmondson, 1999; Cannon & Edmondson, 2001; Wong, 2004). Although organizational learning has often been described as an antecedent of increased patients' safety and quality of care (NHS, 2000; Kohn et al., 2000; Aspden et al., 2004; Aspden et al., 2006; Woodward et al., 2004; Edwards, 2012), only two of the studies reviewed report on the

implications of collective learning for patients directly. Edmondson et al. (2001) and Edmondson (2003), show that collective learning is associated with success in adoption and implementation of a new surgical procedure – number of successful procedures done over a six months period after the first experience with using the new procedure in the hospital. The other two studies (Edmondson, 1996; Hirak et al. 2012) use self reported data to measure team performance. Patients' safety and quality of care, similar to organizational learning, are constructs that are rather difficult to operationalize and measure. Conry et al. (2012) conducted a systematic review of studies describing interventions meant to improve quality of care in hospitals. The authors reviewed 20 papers published between 2000 and 2010, and concluded that programs use very different theoretical backgrounds and different ways of measuring intervention success. Thus the difficulty in capturing complex and multifaceted constructs such as collective learning and quality of care might be an important reason for the lack of empirical data linking the two.
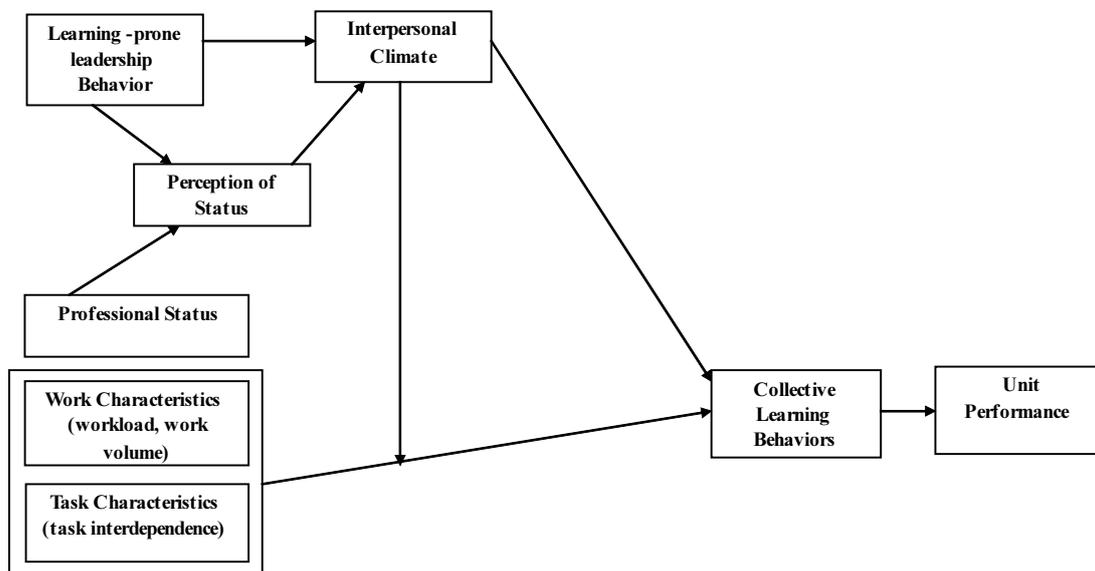

Figure 2. Conceptual Framework of Organizational Learning in Hospitals.

Final Remarks

Several of the antecedents of collective learning are well understood and supported by findings of studies in many industries. Empirical data from work groups in various organizational settings found evidence for the relationship between leadership style or the quality of the

interpersonal climate and collective learning. Studies investigating these relationships in hospitals are mostly qualitative, reflecting the early stages of development of field research in organizational learning in general, and further testing of these relationship using quantitative design are needed in order to refine an evidenced-based model of organizational

learning (Edmondson & McManus, 2007). The impact of professional status seems to be especially relevant in the medical context, but whether its impact can be reduced through the contribution of the leader requires additional exploration. Also, several other work characteristics, task characteristics, and unit characteristics are rather unexplored in medical organizations, although some qualitative data suggests that they might influence learning in medical teams.

Support was found for the link between learning and team performance in a variety of industries, although it is still rather unclear how collective learning impacts the quality of medical services. Another aspect that requires additional exploration is the type of learning behaviors and their relevance for performance. In most cases, learning was used as a global construct and operationalized as a conglomerate of different collective practices: error communication, error analysis, asking for feedback, sharing information, reflecting on actions, experimenting. It is not clear how different learning behaviors considered separately might influence performance.

Our work is not without limitations. Although we conducted a systematic search of several international databases that cover publications with a wide spectrum: psychology, organizational studies, and medicine, our initial selection of papers resulted in only a small number of papers that met our criteria. The papers we selected based on our first strategy made references to other studies that did not result in our initial systematic search of databases. For this reason we decided to apply the second strategy of identifying papers by using the references lists of the studies initially selected. This led us to identifying half the studies we reviewed supporting the hypothesis that there are studies that might have met our criteria that were not listed in the databases we used.

Acknowledgement:

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