



Review

Methodological strategies in resilient health care studies: An integrative review



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ARTICLE INFO

Keywords:

Resilient healthcare
Resilience engineering
Organizational resilience
Adaptation
Multi-level study

ABSTRACT

Resilient healthcare research focuses on everyday clinical work and a system's abilities to adopt or absorb disturbing conditions as opposed to risk management approaches, which are based on retrospective analyses of errors. After more than a decade of theoretical development and a large quantity of empirical work, the field of resilience is beginning to recognize the methodological challenges related to operationalizing and designing studies of complexity. This paper reviews a sample of empirical articles on studies of resilient healthcare to describe and synthesize their methodological strategies. The review found that data collection by resilient healthcare studies has predominantly been conducted at the micro level (e.g. frontline clinical staff). Data sources at the meso level (i.e. hospital/institution) have been limited, and no studies were found that collected macro-level data. We argue that the methodological focus in the field should increase its embrace of complexity and the adaptive capacities of the system as a whole by integrating data sources at the micro, meso, and macro levels. To improve the methodological designs, we argue that the resilience construct, in which the complexity of multiple levels is integrated, must be developed. Improving the transparency and quality of future resilient healthcare research might be accomplished by reporting thorough descriptions of analytical strategies, in-depth descriptions of research design and sampling strategies, and discussing internal and external validity and reflexivity.

1. Resilient healthcare

This integrative review focuses on the methodological strategies employed by studies on resilient healthcare. Resilience engineering (RE), which involves the study of coping with complexity (Woods and Hollnagel, 2006) in modern socio-technical systems (Bergström et al., 2015); emerged in about 2000. The RE discipline is quickly developing, and it has been applied to healthcare, aviation, the petrochemical industry, nuclear power plants, railways, manufacturing, natural disasters and other fields (Righi et al., 2015). The term 'resilient healthcare' (RHC) refers to the application of the concepts and methods of RE in the healthcare field, specifically regarding patient safety (Hollnagel et al., 2013a). Instead of the traditional risk management approach based on retrospective analyses of errors, RHC focuses on 'everyday clinical work', specifically on the ways it unfolds in practice (Braithwaite et al., 2017). Wears et al. (2015) defined RHC as follows.

The ability of the health care system (a clinic, a ward, a hospital, a

county) to adjust its functioning prior to, during, or following events (changes, disturbances or opportunities), and thereby sustain required operations under both expected and unexpected conditions. (p. xxvii)

After more than a decade of theoretical development in the field of resilience, scholars are beginning to identify its methodological challenges (Woods, 2015; Nemeth and Herrera, 2015). The lack of well-defined constructs to conceptualize resilience challenges the ability to operationalize those constructs in empirical research (Righi et al., 2015; Wiig and Fahlbruch, forthcoming). Further, studying complexity requires challenging methodological designs to obtain evidence about the tested constructs to inform and further develop theory (Bergström and Dekker, 2014). It is imperative to gather emerging knowledge on applied methodology in empirical RHC research to map and discuss the methodological strategies in the healthcare domain. The insights gained might create and refine methodological designs to enable further development of RHC concepts and theory. This study aimed to describe and synthesize the methodological strategies currently applied in

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<https://doi.org/10.1016/j.ssci.2018.08.025>

Received 10 October 2016; Received in revised form 13 August 2018; Accepted 27 August 2018

Available online 05 September 2018

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empirical RHC research in terms of the empirical fields, applied research designs, methods, analytical strategies, main topics and data collection sources at different systemic levels, and to assess the quality of those studies. We argue that one implication of studying socio-technical systems is that multiple levels in a given system must be addressed, as proposed by, for example, Rasmussen (1997). As such, this study synthesized the ways that RHC studies have approached empirical data at various systemic levels.

2. Methodology in resilient healthcare research

‘Research methodology’ is a strategy or plan of action that shapes the choices and uses of various methods and links them to desired outcomes (Crotty, 1998). This study broadly used the term ‘methodological strategy’ to denote an observed study’s overall research design, data collection sources, data collection methods and analytical methods at different systemic levels. The methodological issues discussed in the RHC literature to date have concerned the methods used to study everyday clinical practice, healthcare complexity and the operationalization of the constructs measuring resilience.

2.1. Methods of studying healthcare complexity

RE research is characterized by its study of complexities. In a review of the rationale behind resilience research, Bergström et al. (2015) found that RE researchers typically justified their research by referring to the complexity of modern socio-technical systems that makes them inherently risky. Additionally, in the healthcare field, references are made to the complex adaptive system (CAS) perspective (Braithwaite et al., 2013). CAS emerged from complexity theory, and it takes a dynamic approach to human and nonhuman agents (Urry, 2003). Healthcare is part of a complex socio-technical system and an example of a CAS comprising professionals, patients, managers, policymakers and technologies, all of which interact with and rely on trade-offs and adjustments to succeed in everyday clinical work (Braithwaite et al., 2013).

Under complexity theory, complex systems are viewed as open systems that interact with their environments, implying a need to understand the systems’ environments before understanding the systems. Because these environments are complex, no standard methodology can provide a complete understanding (Bergström and Dekker, 2014), and the opportunities for experimental research are limited. Controlled studies might not be able to identify the complex interconnections and multiple variables that influence care; thus, non-linear methods are necessary to describe and understand those systems. Consequently, research on complexity imposes methodological challenges related to the development of valid evidence (Braithwaite et al., 2013).

It has been argued that triangulation is necessary to study complex work settings in order to reveal actual phenomena and minimize bias leading to misinterpretation (Nemeth et al., 2011). Methodological triangulation has been suggested, as well as data triangulation, as a strategic way to increase the internal and external validity of RE/RHC research (Nemeth et al., 2011; Mendonca, 2008). Data triangulation involves collecting data from various sources, such as reports, policy documents, multiple professional groups and patient feedback, whereas methodological triangulation involves combining different qualitative methods or mixing qualitative and quantitative methods.

Multiple methods have been suggested for research on everyday clinical practice and healthcare complexity. Hollnagel (2014) suggested qualitative methods, such as qualitative interviews, field observations and organizational development techniques (e.g. appreciative inquiry and cooperative inquiry). Nemeth and Herrera (2015) proposed observation in actual settings as a core value of the RE field of practice. Drawing on the methods of cognitive system engineering, Nemeth et al. (2011) described the uses of cognitive task analysis (CTA) to study resilience. CTA comprises numerous methods, one of which is the

critical decision method (CDM). CDM is a retrospective interview in which subjects are asked about critical events and decisions. Other proposed methods for studying complex work settings were work domain analysis (WDA), process tracing, artefact analysis and rapid prototyping.

System modelling, using methods such as trend analysis, cluster analysis, social network analysis and log linear modelling, has been proposed as a way to study resilience from a socio-technical/CAS perspective (Braithwaite et al., 2013; Anderson et al., 2013). The functional resonance analysis method (FRAM) has been employed to study interactions and dependencies as they develop in specific situations. FRAM is presented as a way to study how complex and dynamic socio-technical systems work (Hollnagel, 2012). In addition, Leveson et al. (2006) suggested STAMP, a model of accident causation based on systems theory, as a method to analyse resilience.

2.2. Operationalization of resilience

A vast amount of the RE literature has been devoted to developing theories on resilience, emphasizing that the domain is in a theory development stage (Righi et al., 2015). This process of theory development is reflected in the diverse definitions and indicators of resilience proposed over the past decade e.g. 3, (Woods, 2006, 2011; Wreathall, 2006). Numerous constructs have been developed, such as resilient abilities (Woods, 2011; Hollnagel, 2008, 2010; Nemeth et al., 2008; Hollnagel et al., 2013b), Safety-II (Hollnagel, 2014), Work-as-done (WAD) and Work-as-imagined (WAI) (Hollnagel et al., 2015), and performance variability (Hollnagel, 2014). The operationalization of these constructs has been a topic of discussion. According to Westrum (2013), one challenge to determining measures of resilience in healthcare relates to the characteristics of resilience as a family of related ideas rather than as a single construct.

The applied definitions of ‘resilience’ in RE research have focused on a given system’s adaptive capacities and its abilities to adopt or absorb disturbing conditions. This conceptual understanding of resilience has been applied to RHC [6, p. xxvii]. By understanding resilience as a ‘system’s ability’, the healthcare system is perceived as a separate ontological category. The system is regarded as a unit that might have individual goals, actions or abilities not necessarily shared by its members. Therefore, RHC is greater than the sum of its members’ individual actions, which is a perspective found in methodological holism (Ylikoski, 2012). The challenge is to operationalize the study of ‘the system as a whole’.

Some scholars have advocated on behalf of locating the empirical basis of resilience by studying individual performances and aggregating those data to develop a theory of resilience (Mendonca, 2008; Furniss et al., 2011). This approach uses the strategy of finding the properties of the whole (the healthcare system) within the parts at the micro level, which is found in methodological individualism. The WAD and performance variability constructs bring resilience closer to an empirical ground by framing the concepts as observable things that could be operationalized and (possibly) managed by studying the individuals in a given healthcare system at the micro level (Hollnagel, 2014).

Research on operationalizing resilience in RHC is exemplified by two main theoretical models: ‘four cornerstones of resilience’, as introduced by Hollnagel et al. (2013b), and the more recent ‘organizational resilience’, put forth by Anderson et al. (2017). The four cornerstones model describes a system’s resilience in terms of how well it can respond, monitor, anticipate and learn (Hollnagel et al., 2013). A Resilience Analysis Grid (RAG) comprises operationalized questions related to the four systemic abilities to measure how well an organization performs on each of the four potentials (Hollnagel, 2011). The organizational resilience model conceptualizes WAD as interplay and alignment between demand and capacity. Its focus is on the organization, teams and units. Operationalized measures are suggested for each of the model’s constructs (Anderson et al., 2017); however, a unified

conceptual framework of resilience is missing, and all efforts to develop concepts and models of resilience lack extensive empirical testing. Similarly, approaches are needed to ensure that resilience is operationalized as a multi-stakeholder phenomenon (Wiig and Fahlbruch, forthcoming).

3. The review

3.1. Design

This review used the integrative review method because it allows for the inclusion of diverse methodologies and summarizes the literature to generate knowledge on a particular phenomenon (Whittemore and Knafl, 2005). We applied Whittemore and Knafl (2005) principles for performing an integrative literature review comprising the following stages: (a) formulate review questions; (b) design search strategies and inclusion criteria to select articles; and (c) extract, categorize and analyse data derived from the selected articles in light of the review questions. The final stage involved (d) data evaluation and quality appraisal of the studies reported in the articles.

3.2. Literature search

3.2.1. Search strategy

The systematic searches were designed to screen for peer-reviewed studies. One of the within authors searched MEDLINE, and the Academic Search Premier and CINAHL databases were searched in February of 2016, in which specific electronic searches of the journals *Reliability Engineering & System Safety*; *Safety Science*, *Cognition, Technology and Work*; and *BMJ Quality & Safety* were performed. The following search terms were used to systematically search all of the databases: ‘resilience’, ‘resilient’, ‘resilience engineering’, ‘functional resonance analysis method’, ‘health’ and ‘health care’. A detailed description of the electronic search strategy is provided in Appendix A. Book chapters on resilient engineering and resilient healthcare ($n = 6$) in scientific anthologies were screened for empirical research (Hollnagel et al., 2006, 2013a, 2008, 2011; Wears et al., 2015; Nemeth and Hollnagel, 2014). In addition, ten literature review articles were screened for peer-reviewed empirical research (Bergström et al., 2015; Righi et al., 2015; Bergström and Dekker, 2014; Nemeth et al., 2008; Patterson and Deutsch, 2015; Benn et al., 2008; Fairbanks et al., 2014; Cuvelier and Falzon, 2011; Jeffcott et al., 2009; Hill and Nyce, 2010).

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.ssci.2018.08.025>.

3.2.2. Inclusion criteria

Only peer-reviewed studies published in English were analysed. No limitations were set regarding publication year. The inclusion criteria were devised to yield an overview of the methodological designs used in the field; therefore, articles reporting qualitative and/or quantitative studies were included. Research conducted in all healthcare settings was considered at the primary, secondary and tertiary levels. Articles were determined as representative of the RHC field when the terms ‘resilience’ or ‘resilient’ occurred in the text in reference to a conceptual understanding of resilience related to RHC or RE. Because the purpose was to synthesize methodological strategies, only the articles that described the studies’ data collection methods were included (such as observation, interview or survey), and only primary data studies were included.

3.2.3. Article selection

The article selection process was conducted according to the inclusion criteria, as documented in the PRISMA flow diagram (Fig. 1). First, we screened all article titles, one of the within authors read the abstracts, and ineligible articles were excluded. Full-text articles were then obtained for the remaining items, and a data extraction sheet was

developed to guide article selection. Two other authors independently assessed the full-text articles for eligibility using a standardized procedure and coded them as ‘no’, ‘maybe’ or ‘yes’. When the assessors did not agree, agreement was reached by discussing the articles in accord with the predetermined criteria. The full search selection results are available upon request.

3.2.4. Search results

Altogether, 232 articles were identified through the database searches. Additional searches in scientific anthologies and literature reviews found 71 more articles. After removing the 31 duplicates, the remaining 272 items were screened. The title screening and abstract reading excluded 189 records that did not meet the inclusion criteria. Then, 83 full-text articles were read and assessed using the inclusion criteria; 61 of these articles did not meet the inclusion criteria and were excluded. Twelve of the excluded articles published in scientific anthologies described the empirical data, but they did not describe the data collection methodology. Two book chapters were excluded because the primary study was already included in the review. Three book chapters were excluded because they reported on studies that had used secondary data not designed to study resilience. Other reasons for exclusion were not conducted in a healthcare setting ($n = 7$), no collection of empirical data ($n = 7$), and not considered to be resilient healthcare research ($n = 30$). Ultimately, 22 articles were reviewed; six of them were from scientific anthologies, and 16 were from peer-reviewed journals. The articles that met the criteria pertaining to empirical setting, main purpose and topic, research design, data collection methods, data sources and data analysis are presented in Table 1.

3.3. Quality appraisal

The purpose of the quality appraisal was to synthesize tendencies and the strengths and weaknesses of the methodologies described in the articles. There is no ‘gold standard’ for reviews to assess quality, and evaluations of quality depend on the characteristics of the sample under observation (Whittemore and Knafl, 2005). In this study, the articles were mostly qualitative; therefore, Malterud’s (2001) guidelines for assessing qualitative research were deemed suitable. These guidelines assess the articles’ authors’ strategies to describe their methodologies, reflect on their findings and interpretations, discuss internal and external validity and explain their consideration and handling of researcher bias. According to Malterud (2001), these strategies are crucial for producing knowledge that could be shared and applied beyond the study setting. Two of the within authors co-authored some of the articles in the sample, and, to lessen the risk of researcher bias, two other authors performed the quality appraisal.

3.4. Data analysis

The constant comparison method described by Whittemore and Knafl (2005) guided the data analysis. The constant comparison method converts extracted data into systematic categories and analyses the emergent patterns, themes and relationships among the categories (Whittemore and Knafl, 2005). In the first phase, two authors extracted information from the 22 articles into a matrix of six predetermined categories (Table 2). A different author coded and subcategorized the data. For example, the category ‘topic of interest’ was sorted into subcategories ‘the resilient system’ and ‘individuals enacting resilience’, and these subcategories were further divided into subtopics. This data reduction process facilitated the comparisons of the articles’ contents in terms of trends and strategies.

In the next phase, one of the within authors organized the data in tables to enhance the ability to visualize patterns. The data were organized by key elements to find meaningful patterns, as demonstrated in Table 4 of Section 4.5. Inspired by Yin’s (2014, p. 92) model of case study design and data collection sources, we structured the data



PRISMA 2009 Flow Diagram

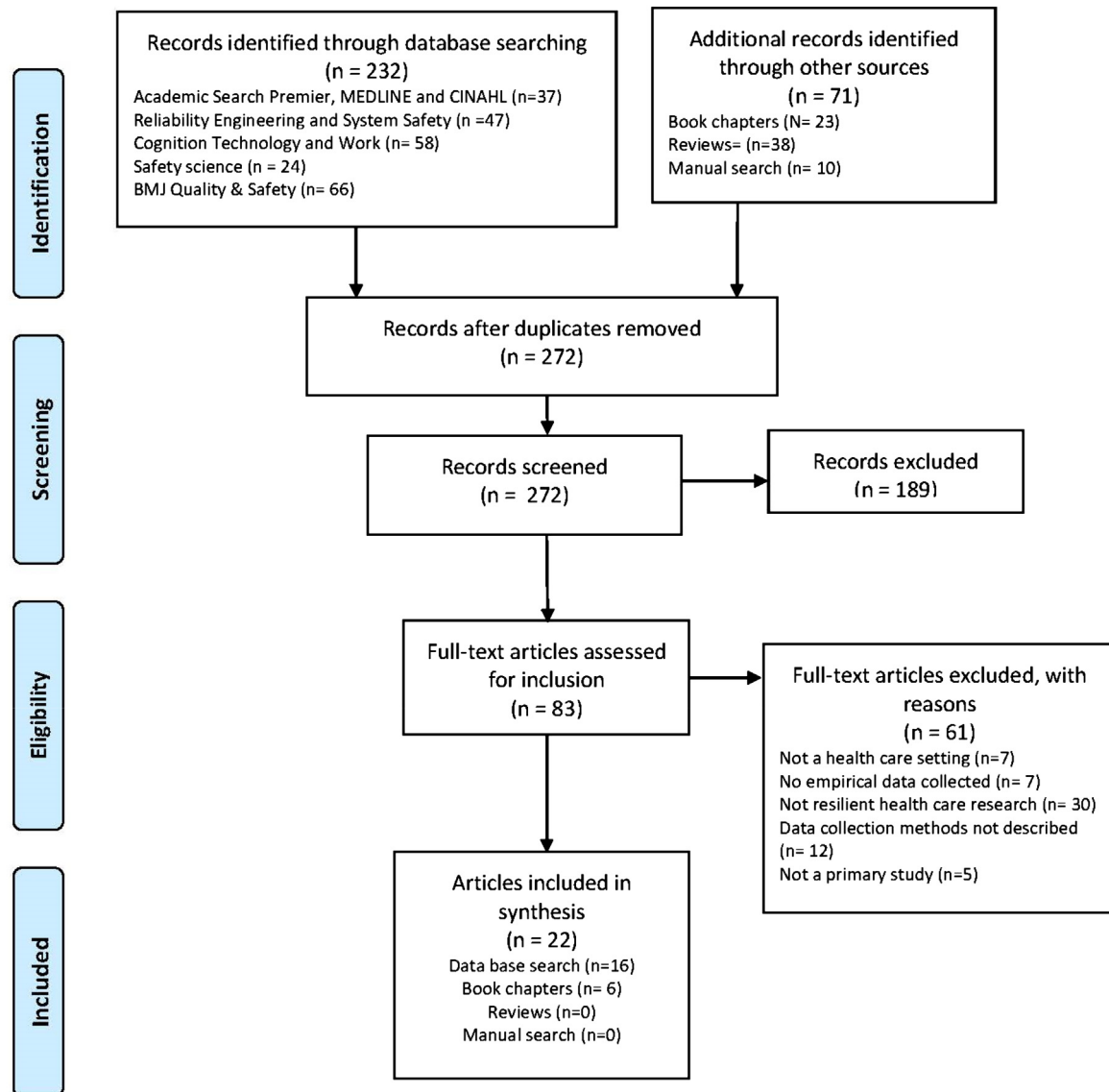


Fig. 1. PRISMA Flow diagram of the articles in the review.

collection sources by systemic level with their topics of interest. In the final phase of the analysis, subheadings were created to categorize the themes into general methodological strategies, which were validated using the primary data sources. All of the authors verified the analysis.

4. Review results

4.1. Quality assessment

Articles that included comprehensive descriptions of theoretical frameworks were considered strong because by mentioning these frameworks, readers can gain insight into researchers' perspectives on their data. Since nearly all RHC studies mention their respective theoretical frameworks, it can be considered an overall strength. Some articles did not describe the study's overall design (Sheps et al., 2015; Nyssen and Blavier, 2013; Clay-Williams et al., 2015), and others were

unclear in their descriptions of the overall study design (Patterson et al., 2007; Wears et al., 2006; Sheps and Cardiff, 2013; Nakajima, 2015). Description of data collection strategies (such as theoretical or purposive sampling) or the reasons for choosing a particular data collection strategy were missing in some studies (Nemeth et al., 2011, 2007; Clay-Williams et al., 2015; Wears et al., 2006; Nakajima, 2015; O'Keefe et al., 2015; Laugaland et al., 2015; Brattheim et al., 2011). Other shortcomings were a lack of discussion about the consequences of the chosen sampling strategy (Nyssen and Blavier, 2013; Patterson et al., 2007; Ekstedt and Ödegård, 2015; Smith et al., 2013; Miller and Xiao, 2007) and presentation of the sample with insufficient depth to understand the study site and context (Sheps et al., 2015; Smith et al., 2013; Dekker et al., 2013).

Only four articles fully described the analytical principles of the study and explained the strategies used to validate the results (Smith et al., 2013, 2014; Suján et al., 2015; Paries et al., 2013). Three articles

Table 1
The articles analysed in the review.

No.	Author	Settings and origin	Aim and main topic	Research design	Data-collection methods	Data collection sources	Data analysis
1.	Clay-Williams et al. (2015)	Intensive care units in Australia and Denmark	The study investigates the use of FRAM to identify process elements that are likely to conflict with the current methods of working	Study in two hospitals	Case 1. Group discussions with HCP, ward quality researcher, guided by FRAM. Case 2. FRAM model developed by researcher and discussed with senior ICU consultant, senior nursing staff and surgical staff	HCPs' experiences. ICU guidelines	FRAM models to analyze and visualize the system. Software tool FRAM model visualizer
2.	Ekstedt and Odegård (2015)	Cancer care in primary and hospital care. Palliative care, advanced home care and children's care in Sweden	The study provides an understanding of how health care professionals anticipate, detect and handle gaps in continuity of cancer care	Qualitative study across various specialties in three counties	10 focus groups and 2 individual interviews with a total of 34 cancer care professionals with physicians, nurses, managers, administrators	HCPs' and managers' understanding.	Interview data analyzed with qualitative content analysis to identify central themes
3.	Laugaland et al. (2015)	Care of elderly in hospital and primary care. Geriatric, medical and surgical wards in Norway	The study illustrates how clinical environments adjust discharge practices to sustain new demands imposed by a system reform	Ethnographic study at three hospital wards in two hospitals and with primary care stakeholders	Observation of 20 discharge processes including conversations (HCPs, patients and next of kin). 57 in-depth interviews with nurses, head nurses, doctors, general practitioners, patient coordinators. Discharge and system reform is described	HCPs' adaptations and experiences, next of kins' and patients' experiences	Not described
4.	Nakajima et al. (2015)	Tertiary emergency care in Japan	The study illustrates the distinction between WAD and WAI in the case of incorrect blood transfusion and describes the cases in a safety-II perspective	Study of two cases	Investigation of two cases of incorrect blood transfusions, FRAM analysis, in situ simulation	HCPs' performance. Investigation results	FRAM model to analyse investigation results, visualization
5.	O'Keefe et al. (2015)	Acute care hospitals in Australia	The study describes how nurses make decisions about protecting their own health and safety in the dynamic context of providing patient care	Qualitative study in three hospitals	45 interviews with nurses, observation of 68 work shifts	HCPs' decision stories and decision making	Thematic analysis of interviews using NVivo software
6.	Patterson and Wears (2015)	Hospital pharmacy. Origin not stated	The study demonstrates system adaptation in response to intensified demand	Qualitative case study with one case	Observation, short interviews	Pharmacists' adaptations and performance. Contextual information on changes in work load	Not described
7.	Sheps et al. (2015)	Critical incident investigations (CI), Canada	The study investigates CI in two health authorities to build the capacity to learn from CI	Design not described. Pre- and post-workshop groups, qualitative data	Introduced RE concepts in workshops for management and HCPs (intervention). Analysed 20 CI reports completed prior and 20 CI reports completed after workshops	Management and HCPs' understanding. Critical incident investigations	NVivo textual analysis to determine shift in perspective in CI reports
8.	Sujan et al. (2015)	Emergency care in England	The study describes delivery of safe care and vulnerabilities of handover across care boundaries	Qualitative study at three hospitals and two ambulance services	Process walks, informal observation, process mapping sessions with staff. Audio recording of 270 handovers. Semi-structured interviews with 39 health care professionals	HCPs' conversation, experiences and adaptations. Handover process, statistics on hospital beds, ED attendances, etc.	Discourse analysis of conversations. Thematic analysis of interviews supported by NVivo software. Workshop to validate findings
9.	Laugaland et al. (2014)	Geriatric, medical and orthopedic wards in Norway	Study identifying hospital discharge functions, variability and performance shaping factors to explain variability in outcomes	Observational qualitative case study at two hospitals in seven wards	FRAM guided by observation of 20 patients and 173 conversations with patients, next of kin and health care professionals	HCPs' and patients' perceptions, interactions, coordination and dialogue. Next of kins' perception. Copies of discharge summaries	FRAM.

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Table 1 (continued)

No.	Author	Settings and origin	Aim and main topic	Research design	Data-collection methods	Data collection sources	Data analysis
10.	Ross et al. (2014)	Inpatient diabetes care in acute admission wards in England	Study describing how inpatient diabetes care is delivered and how resilience is created and/or breaks down	Qualitative study at two wards in one hospital ward	In-depth interviews, Critical Decision Method, with 32 diabetes specialist and non-specialist staff	HCPs and ward managers actions interactions and problem-solving	Thematic analysis. NVivo software used
11.	Smith et al. (2014)	Electronic health record systems in USA	Study describing safety practices to successfully manage electronic health records	Qualitative study of two health care systems	Semi-structured interviews, Critical Decision Method with 56 informants (information technology managers, chief medical information officers, physicians, patient safety officers)	HCPs, experiences, managers and IT officers at the hospital level	Framework analysis using RE emergent themes. Use of Atlas.ti software
12.	Dekker et al. (2013)	Obstetrics in labor wards and operating theaters in Scandinavia	Study describing complexity of obstetrical interventions (compliance-based routines).	Qualitative study at two hospitals.	Field study (observations and informal interviews), semi-structured interviews and focused interviews in debriefing sessions. Critical incident	HCPs' experiences, perceptions and practices.	Thematic and theory-based analysis
13.	Nyssen and Blavier (2013)	Robotic surgery in operating rooms. Origin not stated	The study illustrates how a socio-technical system adapts to introduction of robotic surgery	Design not described, a mix of observational studies and an experimental study	Field observations and audio records of verbal communication between surgeons. Experiment including 40 medical students	Performance and communication between HCPs	Content analysis of audio records
14.	Paries et al. (2013)	Intensive care units in Switzerland	The study describes the functioning of an ICU	Qualitative study at one large unit	Observations, interviews, work analysis, focus groups, review of documents, system design and performance indicators	HCPs' workload management and work practice. Adverse event reports documents performance indicators, system design, work demands	Interpretative RE framework used in observation
15.	Smith et al. (2013)	Primary care providers within cancer. Origin not stated	The study explores system barriers and resilient actions in the diagnostic evaluation of cancer	Qualitative study	Semi-structured interviews with 26 primary care providers (physicians, physician assistants, nurse)	HCPs' strategies. Electronic medical records of cancer patients	Framework analysis, rating of the content by clinicians (validation)
16.	Bratheim et al. (2011)	Surgical care process. Norway	The study explores the characteristics and sources of process variability in a abdominal aortic aneurysm surveillance programme	Qualitative case study of one university hospital and two community hospitals	Observation and semi-structured interviews of 29 patients and semi-structured interview with 15 HCPs (nurse, surgeons, radiologist)	Encounters between patients and surgeons. Patients' and HCPs' experiences	Work pattern scenarios, content analysis, NVivo software, flow chart
17.	Nemeth et al. (2011)	Ambulatory emergency care. Origin not stated	The study identifies and describes risk to patients in ambulatory and emergency care	Qualitative pilot study in an emergency department and outpatient clinics at two urban medical centers	Observation, informal interviews, artifact analysis, cognitive task analysis (CDM interview)	HCPs' responses, critical incident. Key features of the ED, work demands	Work domain analysis, process tracing, graphical visualization
18.	Cuvertier and Falzon (2011)	Paediatric anaesthesiology service in France	The study describes the variability anaesthesiologists deal with in pediatrics to understand different strategies used	Qualitative case study	6 semi-structured interviews with anaesthesiologists, CDM Method	HCPs' description of 22 critical incidents and their strategies	Content analysis
19.	Miller and Xiao (2007)	Surgical unit. Origin not stated	The study describes the strategies to respond to high patient demand pressures	Qualitative study in one hospital using a grounded theory approach	Interview with three nurses, two schedulers and one medical director, photographs, documents	HCPs' experiences, organizational charts, reports, medical directors experiences	Grouping of themes based on content, statistical analysis (affinity diagrams) was used to assess consensus of the thematic content. Thereby themes associated with the boundary of acceptable performance were subdivided. Counting of frequency of themes in different classifications

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Table 1 (continued)

No.	Author	Settings and origin	Aim and main topic	Research design	Data-collection methods	Data collection sources	Data analysis
20.	Nemeth et al. (2007)	Acute health care (pediatric ICU) in United States	Study exploring rules and expertise in a major urban hospital	Ethnographic fields study	Direct observation, video records, floor plan diagram	Handoffs exchanges among pediatric fellows	Process tracing and conversation analysis of audio and video records. Use of computerized language analysis software
21.	Patterson et al. (2007)	Health care incident reports, in United States	The study describes effective collaborative crosschecking and the limitations of the strategy in relation to incidents	Qualitative case study	Reported health care incidents, critical decision making interview (HCPs) and direct observation (nurse)	HCPs' strategies, incident reports	Not described
22.	Wears et al. (2006)	Emergency department. Origin not stated	The study illustrates general issues common in the introduction of an automated drug-dispensing unit in a complex work environment	Qualitative case study	Interviews with HCPs, pharmacists, computer specialist, and manufacturer's representative	Experiences of HCPs and designers. Error report and system description	Event time sequence, flow charts of event and causal factors

(HCP) Health care professionals, (FRAM) Functional Resonance Analysis Method, (CDM) Cognitive Decision Making.

did not at all describe data analytical strategies (Patterson et al., 2007; Laugaland et al., 2015; Patterson and Wears, 2015), and the remaining articles' descriptions of the principles and procedures of data organization and analysis were not described well enough to document the systematic procedure that followed.

High ratings were achieved by four articles (Miller and Xiao, 2007; Smith et al., 2014; Laugaland et al., 2014; Cuverlier and Falzon, 2011), all of which discussed the study design, study limitations, internal and external validity, the findings in light of relevant theory and the relevance of the study and its results to theory and practice. Shortcomings of the other articles included lack of design scrutiny and discussion of validity. None of the articles described the researchers' previous understandings or explained how to deal with the influence of pre-conceived opinions/expectations, which reflected poor reflexivity. However, moderate ratings regarding reflexivity were assigned to articles that included information on researcher background, affiliation, preliminary hypotheses and researcher perspectives. Moreover, the research gap at which a study aimed and its contributions to the development of RHC theory and/or practice could have been better expressed. Table 3 shows the quality assessment scores of the 22 analysed articles.

4.2. Empirical settings

The empirical settings were defined as the contexts in which the RHC studies were conducted. The most prevalent settings were inpatient hospital environments with emergency/acute care services ($n = 7$). Other hospital settings were surgical units, intensive care units, orthopaedic wards, geriatric wards, anaesthesiology, paediatrics, obstetrics and rural medical hospital wards. Primary care and outpatient settings included home care, pharmacies, primary cancer care, ambulatory outpatient care and primary care providers. Four articles reported studies conducted in multiple settings across organizational boundaries: cancer care (Ekstedt and Ödegård, 2015), elder care (Laugaland et al., 2015; Laugaland et al., 2014) and emergency care (Sujan et al., 2015). Three articles were on studies not conducted in a particular setting; instead, they used critical incident reports or electronic healthcare records as cases. The studies were conducted in Western and non-Western healthcare settings.

4.3. Qualitative case studies that used diverse qualitative methods

All of the articles used qualitative research designs. Most of the studies lacked a description of the overall methodological approach. The articles that described a methodological approach reported studies using applied case study designs ($n = 6$), ethnography ($n = 2$) and one of them took a grounded theory approach. There were no survey research designs, and none of them employed a clear mixed-methods design. The article by Nyssen and Blavier (2013) reported on the only study of observational data in an experimental design; however, the overall design is not explicitly defined as 'mixed methods', and the data are insufficiently interpreted to form a complete picture of the problem. None of the studies strictly applied an experimental design, and, although the article by Sheps et al. (2015) reported on a study that tested the effects of an intervention, the method they used to do so is elusive and not clearly explained as an experiment.

One methodological strategy reported in the articles to handle complexity of RHC studies was to approach the empirical field with a diversity of methods. Most of these studies used methodological triangulation with more than one qualitative method. Qualitative interviews ($n = 16$) and observations ($n = 13$) were the main methods. The types of interview methods included the critical decision-making method (Patterson et al., 2007; Smith et al., 2014; Cuverlier and Falzon, 2011; Ross et al., 2014), debriefing interview (Dekker et al., 2013) and focus group interviews (Ekstedt and Ödegård, 2015; Paries et al., 2013). Other qualitative methods were audio and/or video recordings in

Table 2
Predetermined categories used to analyse the sampled articles' contents.

Categories	Criteria
Setting	Healthcare setting(s) and origin
Main topic	The main subject of a study on individuals, a system or an organization (practice, care or departmental unit) (Yin, 2014). The main topics were extracted from the study's purpose
Research design	The authors' descriptions of the strategies that directed the study design (Creswell, 2013), which could have been case study, qualitative (various qualitative approaches, such as ethnography, grounded theory or phenomenology), cohort, experiment, survey, combinations of designs or a mixed-method approach
Data collection methods	Qualitative or quantitative methods, and methods used to describe systems
Data analysis	The principles and procedures of the data organization and analysis (Malterud, 2001)
Data collection sources	Empirical data collected at the micro, meso, or macro level. The organization of healthcare at these levels was derived from Robert et al. (Robert et al., 2011) as follows: micro level (clinical care) comprised data collected from healthcare professionals, patients, next-of-kin or medical journals; meso-level (hospital/institution) data included data on organizational structures, systems, strategies, executives/boards or organizational designs; and macro-level (national healthcare system) which comprised data such as national strategy or policy documents

natural settings, workshop interventions (Sheps et al., 2015) and simulations (Nakajima, 2015). A variety of methods and tools were used in context mapping of systems and work processes, such as FRAM (Clay-Williams et al., 2015; Nakajima, 2015; Laugaland et al., 2014), photographs (Miller and Xiao, 2007), process walks and process mapping sessions (Sujan et al., 2015) and artefact analysis (Nemeth et al., 2011).

4.4. Studies on resilience using healthcare professionals' perceptions and behavioural data

All 22 articles collected data at the micro level by sampling healthcare professionals. Ten of the articles' studies had additional data sources at the meso level; however, these data sources were limited. The micro-level data collected from nurses, physicians, clinical assistants, or pharmacists examined their perceptions or behaviours in terms of, for example, experiences, attitudes, decision processes, problem-solving, communications, interpersonal interactions, understandings, sense-making, opinions, performances, interactions, coordination, responses, adjustments, adaptations, strategies, work behaviours and/or task management. Other data sources at the micro level were clinical ward managers (Ross et al., 2014), patients (Laugaland et al., 2015; Brattheim et al., 2011; Laugaland et al., 2014), next-of-kin (Laugaland

et al., 2015; Laugaland et al., 2014) and incidents in error reports and medical journals (Sheps et al., 2015; Wears et al., 2006; Nakajima, 2015; Smith et al., 2013; Paries et al., 2013; Patterson and Wears, 2015). Most of the studies used healthcare professionals as their only data source, which eliminated the possibility of data triangulation among multiple perspectives.

The meso-level data were limited (e.g. one manager's perspective or one clinical guideline). They included perspectives and strategies of executives at the hospital/institution level (Sheps et al., 2015; Ekstedt and Ödegård, 2015; Miller and Xiao, 2007; Smith et al., 2014), and they were employed as contextual data on an organization or clinical setting, such as healthcare professionals' work demands, clinical guidelines, organizational strategies, statistics on numbers of hospital beds, attendance and organizational charts. None of the articles reported studies that used macro-level data.

4.5. Four methodological strategies of RHC studies

The articles were categorized by the studies' systemic level and main topic, which revealed four methodological strategies (A, B, C, D) employed to investigate RHC (Table 4).

Data were collected at micro or micro and meso levels. Although

Table 3
Quality assessment of the included studies.

Author(s)	Aim	Reflexivity	Method and design	Data collection and sampling	Theoretical framework	Analysis	Findings	Discussion	Presentation	References
<i>Articles retrieved from journals</i>										
(1), Clay-Williams et al. (2015)	3	1	3	2	3	2	2	2	2	2
(2), Ekstedt and Ödegård (2015)	3	2	3	2	3	2	3	2	3	3
(5), O'Keeffe et al. (2015)	3	2	3	2	2	2	3	2	3	3
(6), Patterson and Wears (2015)	2	1	2	3	2	1	2	2	2	2
(8), Sujan et al. (2015)	3	2	3	3	3	3	3	2	3	2
(9), Laugaland et al. (2014)	3	2	3	3	3	2	3	3	3	3
(10), Ross et al. (2014)	3	2	3	3	3	2	3	2	3	3
(11), Smith et al. (2014)	3	2	2	2	3	3	2	3	2	3
(12), Dekker et al. (2013)	3	2	3	2	3	1	2	2	3	2
(15), Smith et al. (2013)	3	2	2	2	3	3	3	2	3	2
(16), Brattheim et al. (2011)	3	2	3	2	3	2	2	2	2	3
(17), Nemeth et al. (2011)	2	2	2	2	3	2	2	1	1	3
(19), Miller and Xiao (2007)	3	2	2	2	3	2	3	3	2	3
(20), Nemeth et al. (2007)	3	2	3	2	3	2	3	2	3	2
(21), Patterson et al. (2007)	3	2	2	2	3	1	2	1	2	2
(22), Wears et al. (2006)	2	2	1	2	2	1	1	1	1	2
<i>Chapters retrieved from scientific anthologies</i>										
(3), Laugaland et al. (2015)	3	2	3	2	3	1	2	2	3	2
(4), Nakajima (2015)	2	1	1	2	2	1	2	2	1	1
(7), Sheps et al. (2015)	3	1	2	1	3	2	2	2	3	3
(13), Nyssen and Blavier (2013)	2	2	2	2	2	2	2	2	2	2
(14), Paries et al. (2013)	3	2	3	3	3	3	3	2	3	2
(18), Couverlier and Falzon (2011)	3	2	3	3	3	2	3	3	2	2

3 = Criteria's are met, 2 = Criteria's are partially met, 1 = No criteria's are met/ or no information available.

Table 4
Categorization based on systemic level (micro/meso) and main topic (based on Yin's, 2014, p. 92).

System level	Main topic	
	The resilient system <i>n</i> = 13	Individuals enacting resilience <i>n</i> = 9
Micro level and meso level	A Articles 1, 8, 6, 11, 14, 17, 22	B Articles 2, 7, 19
Micro level	C Articles 3, 4, 9, 10, 12, 13	D Articles 5, 15, 16, 18, 20, 21

some of the studies took multi-level perspectives [e.g. Wears et al., 2006; Laugaland et al., 2015], none of them simultaneously examined data at all three levels, and, in that sense, none of them used a multi-level approach.

In sum, the RHC studies aimed to investigate topics related either to the resilient system or to individuals enacting resilience. Studies falling under strategies A and C had the objectives to study the resilient system. Those studies focused on three aspects: system complexity and adaptation (Wears et al., 2006; Laugaland et al., 2015; Patterson and Wears, 2015; Laugaland et al., 2014), system functioning (Nemeth et al., 2011; Clay-Williams et al., 2015; Nakajima, 2015; Dekker et al., 2013; Paries et al., 2013) and safe practices (Sujan et al., 2015; Smith et al., 2014; Ross et al., 2014). Studies falling under strategies B and D had the objectives of studying individuals enacting resilience who perform roles as members of the healthcare organization. The studies analysed topics that fell into five aspects: individual strategies (Cuvelier and Falzon, 2011; Patterson et al., 2007; Smith et al., 2013; Miller and Xiao, 2007), sense-making (Sheps et al., 2015; Ekstedt and Ödegård, 2015); decision-making (O'Keeffe et al., 2015), performance variability (Brattheim et al., 2011) and expertise (Nemeth et al., 2007).

4.6. Analytical strategies

The studies reported by the 22 reviewed articles mainly used qualitative analytical strategies intended to describe, classify or interpret data collected from individuals. All of the studies used RHC theories to guide the research goals and interpretations of results (theory driven/deductive approach). Although data-driven analytical strategies were employed, none of the studies took purely inductive approaches that might have found other ways to represent resilience enactment and resilient systems. Other analytical strategies were strategies used to visually represent data collected from organizations or practices, e.g. graphical visualizations and data displays (Jeffcott et al., 2009). Some of the articles displayed the studies' empirical data to represent systems, work processes or incidents. The data were visualized using FRAM (Clay-Williams et al., 2015; Nakajima, 2015; Laugaland et al., 2014), flowcharts (Wears et al., 2006; Brattheim et al., 2011), time sequences (Wears et al., 2006), process tracing (Nemeth et al., 2011; Nemeth et al., 2007) and/or work domain analysis (Nemeth et al., 2011).

5. Discussion

This integrative review aimed to describe and synthesize methodological strategies applied to published RHC studies in terms of their applied research designs, methods, analytical strategies, main topics and sampling sources at different system levels.

5.1. The resilient system and individuals enacting resilience

This study documents that the reviewed articles on RHC studies broadly apply four methodological strategies (see Table 4). There are some methodological challenges related to three of these strategies. Research on the resilient system (e.g. system complexity and system

adaptation) is methodologically challenging when a researcher unreasonably relies on data collected from individuals without analysing data on the organization, contingencies, system demands or practice. When data are collected at a level lower than the level of analysis, justifications should explain the reasons for and value of aggregating micro-level data, supported by theories explaining how the relevant mechanisms and constructs were combined across levels (Costa et al., 2013). Extrapolating individuals' resilience characteristics to a system involves the questionable assumption that resilience is linked across individuals, teams and organizations. Righi et al. (2015) stated that these multi-level mechanisms are currently not well understood. This methodological challenge is related to strategy C.

Second, aiming to study individuals enacting resilience (e.g. individual strategies, sense-making, decision-making, performance variability or expertise) challenges the current rationale of RHC studies. Additionally, limiting the study of resilience to individuals in the sharp end of the system is an inadequate methodological approach to study healthcare as a complex adaptive system, particularly considering the RHC research rationale, which reflects the inherent complexity of the healthcare system (Bergström et al., 2015; Braithwaite et al., 2017) and RHC defined as a system's ability to adapt (Wears et al., 2015). It also is important to note Bergström and Dekker's (2014) argument that this approach to resilience might reduce individuals' resilience to an adaptive capacity, on which the complex and high-risk system must rely, thus ignoring systemic properties. This could lead to founding safety strategies on a fallacy because they are, in essence, relying on individuals' adaptive abilities to face danger and complexity. Strategies B and D face this methodological challenge.

We share Ylikoski's (2012) perspective that RHC would benefit if resilience were described in terms of its component parts and activities (i.e. individuals' perceptions and behaviours) without replacing or eliminating the higher-level variables (i.e. meso- and macro-level issues). Ylikoski (2012) stated, 'the reductive research strategy has been the single most effective research strategy in the history of modern science' (Ylikoski, 2012, p. 24); thus, using individuals as data sources is inevitable in the study of resilience. However, this does not mean that micro-level explanations should 'stand alone' and that system properties should somehow be eliminated (Ylikoski, 2012). To increase the validity of RHC theory, the system *as a whole* must be considered, along with improved integration of the three levels of data sources. Thus, building upon strategy A and collecting macro-level data in addition to meso- and micro-level data is a preferred strategy to study the system as a whole.

5.2. The need to improve reflexivity and methodological analysis

The trunk of the epistemological tradition of RHC branches into a qualitative descriptive empirical approach to generate best practice evidence and a social scientific tradition to generate reflective and analytical knowledge. In the latter tradition, many extended case studies have included empirical data to reflect on conceptual topics; however, these articles were excluded from this review because they lacked methods sections. Although we acknowledge the value of descriptive empirical accounts and social scientist perspectives, we argue

that the generalizability of the knowledge gained must be improved. To realize this goal, greater care must be taken to ensure that the research processes are systematic and transparent (Malterud, 2001).

This study's quality appraisal using Malterud's criteria (Malterud, 2001) revealed that descriptions of analytical strategies were lacking or inadequate. This lack corresponds to the RE research literature in general, which Righi et al. (2015) found: About 33% of the empirical papers in their study did not describe data collection methods or discuss the reliability and validity of the results. However, clear and thorough documentation of systematic analytical procedures distinguishes a scientific approach from superficial conjecture, promotes transparency and allows researchers to share their findings with others (Malterud, 2001). Thus, to improve trustworthiness and transferability (generalizability) of qualitative research on RHC, clear and complete descriptions of analytical strategies are necessary.

The 22 reviewed articles all applied a described theory, which we considered a strong point under Malterud's criteria (Malterud, 2001). Nevertheless, whereas to theorize is to explain, to explain is not necessarily to theorize. Some types of explanation might not necessarily belong to an established theory (Kaplan, 1964). Hollnagel (2014) stated that researchers must be aware that a given theory might be biased when a researcher does not look beyond the concepts and is not aware of 'what-you-look-for-is-what-you-get' (confirmation bias) in the quest for empirical support of a theory. Thus, reflexivity is needed for innovation, and, to improve reflexivity, it is important that preconceptions, meta-analytical positions and theoretical frameworks clearly articulate a study because that articulation contributes to the requisite transparency of RHC studies. Researchers also must reflect on the role of a theory during analysis and the ways that their motives, backgrounds and research perspectives influence their research process (Malterud, 2001).

5.3. Diversity in the face of complexity

Nemeth and Herrera (2015) proposed that documenting resilience through observation is the primary method for studying resilience, but we found that the RHC studies used various qualitative methods to investigate resilience. The core of RHC methodology is the application of diversity in the face of complexity, and the use of methodological triangulation enhances the credibility (internal validity) of results (Lincoln and Guba, 1985). Consequently, the complexity of healthcare suggests that inadequate use of data triangulation might undermine the credibility of research findings: e.g. patients and nurses might have different knowledge that can be used together to understand healthcare complexity instead of focusing on one or the other. Triangulation of methods and data sources certainly is a daunting task that includes the risk of ending up with a fragmented and incomplete picture of complexity (Costa et al., 2013). To enable data triangulation, the use of theoretical frameworks with clearly defined constructs might prevent researchers from getting lost in the data and help them to synthesize it.

In addition, multi-stakeholder perspectives are vital to holistic RHC research and important to data triangulation. Different stakeholders have different perspectives and information on resilience; thus, focusing only on healthcare professionals' perspectives might yield incomplete knowledge on resilience. For example, it is well established that patients provide useful feedback on safety (Masso Guijarro et al., 2010; King et al., 2010), and, although patients and healthcare professionals address different issues, both types of experience correlate with clinical safety and effectiveness outcomes (Doyle et al., 2013). The value of patients' and caregivers' perspectives to clinical practice also is acknowledged in macro-level political incentives and, therefore, they should be integrated more fully as data sources in RHC studies and theory development.

5.4. Research on multiple levels

It is important to note that, as Bergström and Dekker (2014) pointed out, any attempt to draw boundaries around a system is an analytical sacrifice because the emergence of resilience depends upon that system's boundaries. Drawing a system boundary at the micro level breaks down the CAS to horizontal understanding of its subsystems, which might create an incomplete picture and mask interactive complexity (Braithwaite et al., 2013). In research on complexity, collecting data only at the micro level sacrifices the overall understanding of the ways that management strategies and macro-level contextual factors, such as political and national strategies, influence healthcare organizations' structures and work demands (Bergström and Dekker, 2014). Although positive organizational outcomes on resilient performance have been described at the departmental level, this has not always been the case at the organizational level above the individual components of the organization. Adaptations might make sense locally, but the outcomes are not necessarily successful at a higher level. Resilient performances at the micro level could, ironically, lead to brittleness at the organizational level. Thus, to understand resilient systems, outcomes across levels and across departments must be addressed (Berg and Aase, forthcoming). This implies the need for multi-level studies to help us better understand the distribution of resilience throughout an entire system, vertically across its levels and horizontally across its institutional borders, to further develop RHC theories.

Despite acknowledgement of the socio-technical and complex adaptive system perspectives, the current lack of multi-level studies on resilience is not surprising because it is a daunting task to construct resilience across levels, and addressing the macro-level aspects have been particularly challenging in RE (Bergström et al., 2015). According to Costa et al. (2013) researchers should conduct multi-level studies only when theory supports the multi-level relationships and there are appropriate methodological procedures to analyse them. Otherwise, theory-building might be erroneous.

It is reasonable that the lack of methodological guidance for multi-level research on resilience contributes to the lack of multi-level studies on RHC. To guide multi-level studies, definition and operationalization of resilience must be consistent to develop and test a theoretical framework, and construct development is a prerequisite of any attempt to operationalize. Although a few unified concepts, such as 'anticipation', 'trade-off', 'sense-making' and 'adaptation', can be identified across levels, expressions of resilience still exist, mostly at the organizational level (Berg and Aase, forthcoming). Therefore, a theoretical framework must include expressions of resilience at multiple levels. For example, adaptation might occur at all levels, but with different expressions and in various ways at each level.

The theoretical model of organizational resilience put forth by Anderson et al. (2017) included data sources at multiple levels with the locus of resilience at the organizational level. The model theorized adaptations in clinical care (micro level) dealing with misalignments between demand and capacity. The demands were standards set by regulators and policymakers at the macro level, and demand and capacity pertained to the hospital organization at the meso level. Expanding the model to the macro level would mean also exploring the ways that macro-level structures adapt: e.g. their policy strategies in response to misalignments between WAD and WAI. Contingencies for these adaptations at the macro level would be feedback and learning systems that provide information about misalignments from clinical microsystems to higher systemic levels.

5.5. Methodological implications

To move beyond single case-based RHC studies and enhance the robustness of research designs, we recommend the following for future resilience research.

5.5.1. Construct development

- Develop an initial state-of-the-art theoretical framework for RHC through a meta-narrative synthesis of relevant constructs to empirically test at the micro, meso and macro levels. Theoretical concepts and applied constructs in the empirical RHC literature should be included in any synthesis.
- Delphi studies should be used to structure expert knowledge in the RHC field focusing on existing and emerging applications as well as prioritization of constructs and operationalization (see (Hasson et al., 2000) as an example of research guidelines).
- Application of robust analytical approaches, e.g. grounded theory, to establish resilience constructs.

5.5.2. Multi-method and multi-level approaches

- Applied methods in RHC, such as interviews, observations and video and audio recordings, should be triangulated to improve internal validity. FRAM, flowcharts, process mapping and work domain analysis should be applied to analyse and visualize processes within and between levels.
- Data sources should more often be triangulated across levels. Data sources at the micro level are healthcare professionals' enactments of resilience: e.g. resilient strategies, sense-making, decision-making, adaptations and expertise. Patients, caregivers and managers add vital knowledge to enacted resilience. Data sources at the meso level are about ways that healthcare institutions organize and adapt everyday clinical work, e.g. procedures, rules, capacity, demands, work schedules, management strategies, feedback and learning systems. Data sources at the macro level are structural, such as policy and regulatory adaptation and contingencies: e.g. policy strategies, standards and demands, and feedback and learning systems.
- Participatory research approaches, such as experienced-based co-designs inspired by service design theory and practice, should be applied to bring system users at all levels (patients, professionals, managers and policymakers) together and enable multi-level data collection and triangulation (Donetto et al., 2015).

5.5.3. Research quality

- In-depth descriptions of analytical methodology are needed in articles that report on RHC studies: e.g. the ways that themes and theoretical constructs were derived from the data, the processes of validation, the role of theory in the analysis and the handling of potential researcher bias (Malterud, 2001).
- In-depth descriptions of research design, sampling strategies and internal and external validity must be included in RHC studies (Malterud, 2001).
- Improved robustness is needed to move towards research designs that better establish the influences of resilience between levels: e.g. mixed-methods designs, multi-centre studies, collaborative approaches (including patients and stakeholders) and comparative and longitudinal studies.
- We call for a larger share of the RHC literature to attend to patient and caregiver perspectives of and contributions to resilience. The current focus in all healthcare research is on user perspectives, and RHC studies should echo this emphasis.

5.6. Limitations

This study's review has several limitations that need to be addressed. First, it does not cover all RHC studies; we aimed instead to perform a systematic search and analysis of particular peer-reviewed articles on studies that used scientific and empirical primary data. Additional RHC studies could be found in conference proceedings, grey

literature and scientific anthologies, for example. The limited number of articles included in this review might be considered a weakness that suggests a need for caution when generalizing the findings to all RHC studies. However, strategies were applied to increase the internal validity and reliability of the review, such as systematic search strategies, descriptions of procedures and systematic data analysis. Independent assessments of quality and eligibility were performed by two of the authors to reduce researcher bias. Further, it is important to acknowledge that this review represents the researchers' interpretations of the reviewed articles and studies, and other authors might have other perspectives and arrive at different conclusions. We believe that a synthesis of methodological strategies in RHC would provide new insights into ways to ensure scientific rigor in future research.

6. Conclusion

This integrative review of 22 articles reporting on studies of resilience in healthcare settings found that the methodological strategies included qualitative research designs, diverse qualitative methods and analytical strategies directed towards individual data and system data. Currently, resilience in healthcare focuses on the resilient system and individuals enacting resilience. Data are collected at the meso and micro levels of a system mostly using healthcare professionals as data sources. Inpatient hospital and emergency/acute care settings are the most studied empirical contexts, and more research on primary care and cross-sectional studies are needed.

The RHC field is undoubtedly relevant for the improvement of quality and safety for healthcare institutions, professionals and patients. Studies of resilience in healthcare contributes to knowledge regarding how healthcare systems and its professionals adjust to stress, pressures and complexities. This study adds to that knowledge by analysing a sample of the increasing number of empirical studies within RHC.

To improve the validity of RHC research, RHC research needs to be lifted from its current state of descriptive and qualitative approaches focused on individuals towards an integrated theoretical understanding of key resilience characteristics across different system levels through more robust research designs. After more than a decade of RHC research, it is appropriate to start applying the insights gained from methodological discussions within RE to the field's empirical research. According to complexity theorists, changing environments surround resilient organizations, and organizational behaviours are extremely dependent on context. Without multi-level data, RHC will become a discipline centred on individuals' resilient abilities rather than resilient systems. The methodological focus should more firmly embrace the complexity and adaptive capacity of the system as a whole and integrate data sources at all levels, which would stress that context matters and ensure stronger explanatory power.

Acknowledgement

We would like to thank Siri Wiig who helped guide the early development of this study, and the members of Resilient Health Care Network who contributed with feedback during the network meeting in Sydney, August, 11-13, 2015. The Western Norway Regional Health Authority funded this project under grant agreement no. 911846.

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