Resilient health care: A scoping review and bibliometric analysis of an emerging research paradigm

CHRIS WORKING PAPER #108

FROM THE AUSTRALIAN INSTITUTE OF HEALTH INNOVATION

Resilient health care: A scoping review and bibliometric analysis of an emerging research paradigm

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Declaration of interest: None

Abstract

Following its emergence from the field of resilience engineering in 2012, resilient health care has grown to underpin a new paradigm of safety that leverages an understanding of what goes right to improve patient care. The aim of this paper was to review the resilient health care literature via multiple analyses, in order to examine growth and global longitudinal trends through bibliometric analysis and the influence of this body of work through citation analysis. We searched five academic databases (Scopus, CINAHL, EMBASE, Medline and Safety Science abstracts in ProQuest) using key resilience engineering terms, for literature published from inception to October 2018. The search was augmented with a by-hand examination of the four resilient healthcare books published to date. English-language literature in the context of health care, where system agents were humans, and where resilience was the core focus were included, resulting in a total of 197 publications. While the majority of outputs were found to be non-empirical (58.9%), there has been substantial growth in empirical papers in recent years. Journal articles (n=102) were spread widely across 63 journals. We conclude that that resilient health care is maturing, and formalising into a distinctive paradigm.

Highlights

- The resilient health care field is formalising as a paradigm
- Empirical work in resilient health care is limited, but growing
- Qualitative studies are important for understanding systems
- Having a primary journal dedicated to the topic of resilience could be of value to the field

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1. Introduction

Over the past three decades, health care has slowly moved from a focus on individual responsibility in safety, quality and performance [1] to a systems perspective when addressing problems with variation and adverse events [2-4]. However, the assumptions often made about these systems—that they are complicated but nevertheless tractable, are able to be understood and managed through the identification of root causes [5], are decomposable into parts, and that the "extraneous" variables can be controlled —is more and more being called into question [6]. Health care is now recognised as a complex adaptive system comprised of many agents who learn, adapt and interact at multiple scales with each other, their environment and its artefacts [7, 8]. Such intricate, manifold, and sometimes hidden connections challenge our ability to control, predict or even fully understand the system [9].

1.1 Tackling safety in a complex system

Increased awareness of complexity, coupled with stubbornly fixed rates of adverse events and preventable harm [10], have led some enlightened researchers, policymakers, managers and frontline staff to rethink their approaches to safety and quality in health care. Traditionally, safety has been understood in relation to its absence, i.e. when 'things go wrong' [11, 12]. Attempts to minimise the number of things that go wrong involve investigations such as root cause analyses, and subsequent implementation of barriers or other protective mechanisms to avoid the same event taking place in the future. Ironically, these mechanisms serve to increase system complexity, thereby raising the possibility of occurrence of further unexpected events [13, 14]. Organisational safety is conventionally determined by analysing and quantifying the number of such adverse events [15].

However, an increasingly influential idea for tackling safety and performance in complex systems is the principle of equivalence of successes and failures: an action is adjusted according to the prevailing conditions, and only in hindsight can that action be seen as correct or erroneous [16]. Much like failures and adverse events, successful outcomes within the complex, pressurised environment of clinical work are, therefore, due to the adaptive capacities of frontline staff. By virtue of their un-remarkableness, these events, circumstances and practices where 'things go right' have, until quite recently, been understudied and, therefore, poorly understood, despite having considerable potential implications for safety [17].

1.2 Resilience engineering in health care

The development of resilient health care (RHC) can be dated to around 2012 [18]; it emerged out of resilience engineering, an approach that views humans as a positive resource for coping with disturbances and variable conditions in complex organisations [19]. Resilience, in this context, is a system's capacity for flexibility, robustness, and adaptability in response to changing circumstances so that performance, including safety, is maintained [20]. In organisations, resilience involves the treatment of safety as a core value, proactively managing and preparing for it by anticipating, monitoring, learning and responding [21]. The distinction between a traditional, reactive focus on adverse events and the more recent emphasis on system resilience and understanding success in everyday clinical work corresponds with two ways of addressing safety in health care: Safety-I and Safety-II [22].

1.3 The present study

Theoretical and empirical contributions in the field of RHC, perhaps because of its interdisciplinary nature, have seemingly been scattered across an array of diverse journals and disciplines (e.g., in safety and human factors, psychology, medicine, social science and health services research), as well as in other academic outputs (e.g., books). While this suggests the potential wide-ranging appeal of this approach, it is difficult to coherently examine the literature in this field, and identify trends, patterns, gaps, and potential future directions. At the same time, the increasing interest in RHC is exemplified by this special issue, and the possible implications of the paradigm for improving safety and performance in health care organisations suggests a more rigorous examination of this burgeoning field is warranted. Accordingly, the present study involved a combined scoping review and bibliometric analysis of the literature on RHC, examining how the field has grown, developed and is changing over time, as well as its influence.

1.3.1 Aims

We aimed to scope the literature on RHC and analyse trends in the literature using bibliometric data. Our research questions were:

1. What areas has resilience theory been applied to in health care research, including topics and settings?
2. How has resilience theory been applied in health care research, both empirically and non-empirically?
3. How has RHC literature grown and changed over time?
4. Where is RHC work being published?
5. What are the citation patterns and the how have the influential ideas of RHC spread over time?
6. What are the future directions for research on RHC?

2. Method

2.1 Search strategy

A search strategy was developed by the research team in September 2018 and executed in October of that year. Five academic databases (Scopus, CINAHL, EMBASE, Medline and Safety Science abstracts in ProQuest) covering medicine, health care and the social sciences were searched from inception to 16 October 2018 using the keywords listed below. The research team complemented this search with a by-hand examination of several prominent RHC publications [e.g., 18], based on the authors' knowledge and experience of the field. Reference details (including abstracts) were downloaded into the reference management software Endnote X8 [23] and then exported to Rayyan QCRI [24] for title and abstract screening.

2.2 Keywords

Keywords were chosen to cover resilience and related concepts, like Safety-II, in the context of health care systems and organisations. It was deemed necessary to also add some exclusion (AND NOT) terms to the keywords to limit the otherwise large number of articles returned that focused on individual psychological resilience. Individual resilience does not fit under the system-focused paradigms of resilience engineering and RHC.

1. resili* OR safety*I OR safety*II OR safety*1 OR safety*2 OR "work*as*imagined" OR "work*as*done"

2. **AND** healthcare OR "health care" OR "health-care" OR hospital* OR "health facilit*" OR "acute care" OR "health organi*" OR "health system*" OR "primary care" OR "primary health*" OR "community health*" OR "general practice" OR "aged care"

3. **AND NOT** "emotional resili*" OR "personal resili*" OR "individual resili*" OR "carer resili*" OR "professional resili*" OR "psycho* resili*" OR "family resili*"

2.3 Inclusion and exclusion criteria

A contribution was included if it was an academic output in the context of health care, where resilience is a core focus (e.g., an article studying resilience, or applying or discussing resilience theory). Contributions that only mentioned "resilience" briefly; discussed it in a general, descriptive way; studied it as an individual phenomenon (i.e., psychological resilience); or were not in English, were excluded. Additionally, during the title/abstract screen stage, a decision was made to exclude literature on resilient systems in health care where the system agents were not humans (e.g., cybersecurity, physical infrastructure, and multi-organization disaster response).

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While bibliometric analysis is more straightforward for peer-reviewed journal articles, in this study we defined academic output broadly to also include book chapters, books and conference proceedings, because many contributions on RHC, especially until recently, have been published in edited books [e.g., 18, 25, 26, 27], rather than journals. Every chapter of an edited book that met inclusion criteria was reviewed individually, and counted as a unique contribution. Both empirical and non-empirical contributions, such as commentaries, conceptual papers and reviews, were included but treated differently during data extraction (see Table 1).

Table 1. Details of data extraction for scoping review.

Empirical contribution	Non-empirical contribution
Publication details: Publication type, year published, corresponding author country of residence, journal name.[1]	*Publication details:* Publication type, year published, corresponding author country of residence, journal name.[1]
Approach to resilience: How resilience is applied (e.g., conceptual framework, interpretation of results, practical intervention), any resilience tools/assessment techniques used, any other theory utilized.	*Approach to resilience:* How resilience is considered (e.g., conceptual discussion of application, structured review), any resilience tools or method discussed, any other theory drawn on.
Study details: Aim, design, setting and problem (e.g., safety in intensive care, teamwork), participants, any attempts to use resilience as a method.	*Topic area:* Context or problem in health care to which resilience theory is applied (e.g., safety in intensive care, teamwork).
Findings and implications: Results and future directions especially for resilience theory and its application to health care.	*Implications*: Any recommendations, ideas or future directions related to resilience theory and its application to health care.
Bibliometric data: Number of citations,[2] keywords,[1] definition and key authors referenced for resilience term (i.e., definition reference) and name of contribution co-authors.	*Bibliometric data:* Number of citations,[2] keywords,[1] definition and key authors referenced for resilience term (i.e., definition reference) and name of contribution co-authors.

[1] Where available.
[2] Data captured from Google Scholar.

2.4 Data extraction

The reference details of contributions meeting inclusion criteria were exported to Excel and divided amongst seven researchers (LE, KC, AG, RCW, JL, CP, EA) for full-text examination. A custom data extraction workbook was developed; each author trialed the workbook with a subset of papers (n=5) and then met to discuss the usability of the template. Following this, minor modifications were made, and the remaining references were distributed among the team for full-text review. A summary of the information extracted during the full-text review is shown in Table 1.

2.5 Data synthesis

Contributions were grouped together based on common attributes in the data (e.g., publication type) and categories devised by the research team to examine trends in the literature, particularly over time. In this regard, the context of the included articles, extracted by the research team in the form of summary terms, were reviewed and further classified by three authors (AG, KC, JL) into broader descriptive categories that allowed for the identification of common settings (where specified) and topic. Despite some overlap, contributions were only assigned to one category each for setting and topic. The future directions of contributions, particularly those published in the last three years (2016-2018), were reviewed in detail by two authors (KC, AG) to identify any recurrent themes.

3. Results

The database search returned 14,035 references, which was reduced substantially to 6,830 following the removal of duplicates. Through title and abstract screening, we excluded a further 6,624 references. The 206 references, plus an additional 62 contributions identified through the research team's knowledge and experience, were then examined in full, with reasons for exclusion (see Table 2) documented at this stage. The full search strategy is shown in Figure 1.
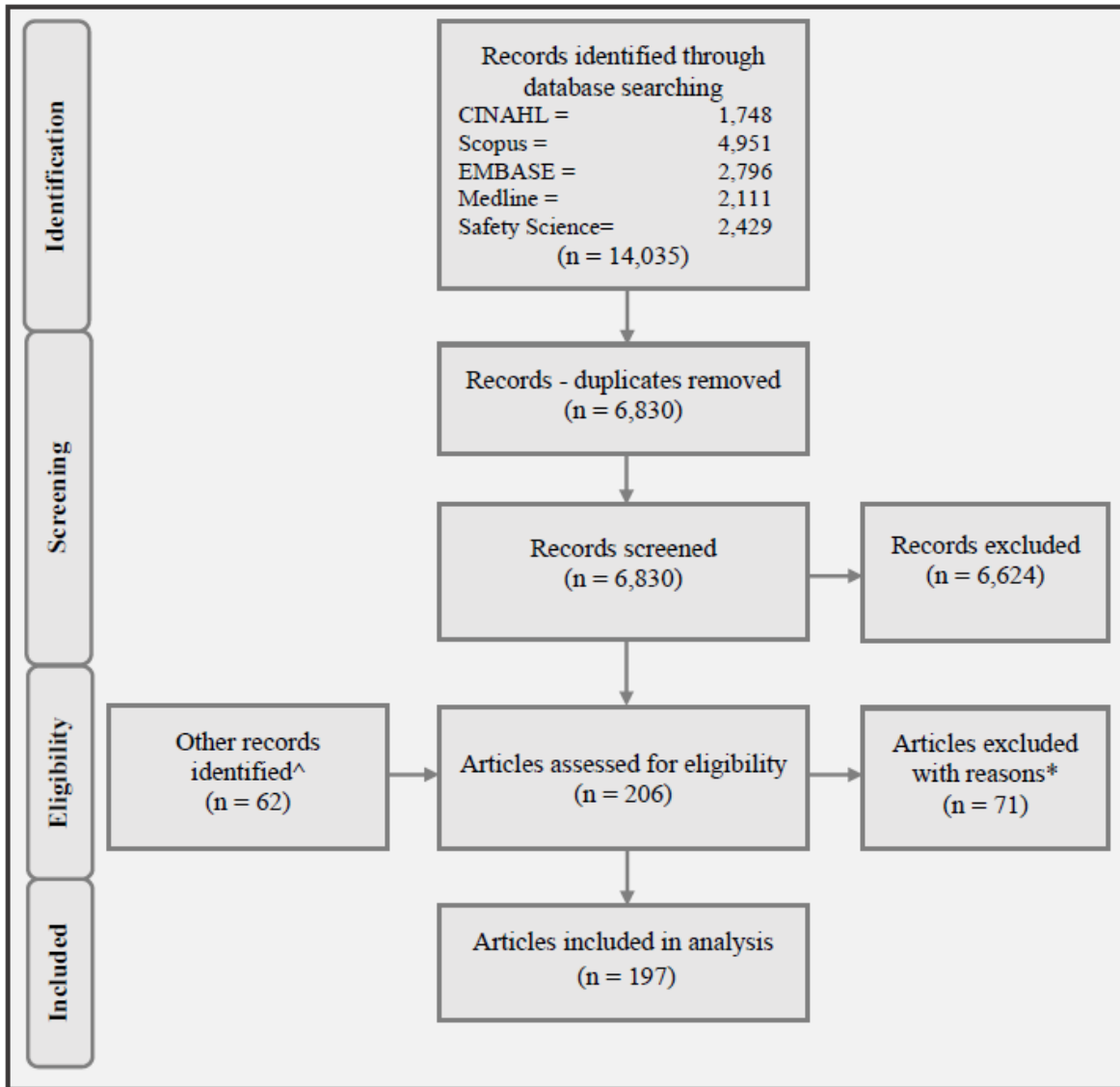
Figure 1. Flow diagram of search strategy.

* Reasons for exclusion in Table 2.
^ Based on the research team's knowledge and experience of RHC, particularly through their involvement in the Resilient Health Care Net.

Table 2. Reason for excluding a contribution at full-text review stage.

Reason for exclusion	Number of articles
Not an appropriate academic output	6
Not in the context of health care	4
Resilient health care is not a core focus	31
Full text unavailable*	30
Total	71

* Including n=5 outputs not available in English.

3.1 Publication details

A total of 197 academic outputs met inclusion criteria and were included in this scoping review and bibliometric analysis. These included 102 (51.8%) peer-reviewed journal articles, 73 (37.1%) book chapters of edited books, 20 (10.2%) conference proceedings and two (1.0%) books in which every chapter was written by the same author. Contributions came from 27 different countries, although there was considerable concentration among a few countries, with the United States of America (n=54, 27.4%), the United Kingdom (n=38, 19.3%), Australia (n=25, 12.7%) and Canada (n-14, 7.1%) together accounting for more than half of all included outputs; this was followed by Scandinavian countries of Denmark (n=13, 6.6%), Sweden (n=8, 4.1%) and Norway (n=6, 3.1%) (see Figure 2).

Published peer-reviewed journal articles (n=102) were widely spread across 63 different journals; the largest number of outputs were published in *Cognition, Technology & Work* (n=9, 8.8%), *Safety Science* (n=8, 7.8%), the *International Journal of Health Policy and Management* (n=7, 6.9%), and *BMJ Quality & Safety* (n=5, 4.9%), while 48 journals had published only one RHC paper. On the other hand, the 73 book chapters were largely concentrated among six edited books, particularly the four RHC compendiums which held 97.3% of the book chapters (n=71) [18, 25-29]. Overall, RHC contributions attracted an average of 5.2 cites a year, but these citation rates varied greatly by output type. The two books averaged 238.1 cites/year, while for journal articles the average was 3.9 cites/year, 1.7 for individual book chapters, and 1.0 for conference proceedings.
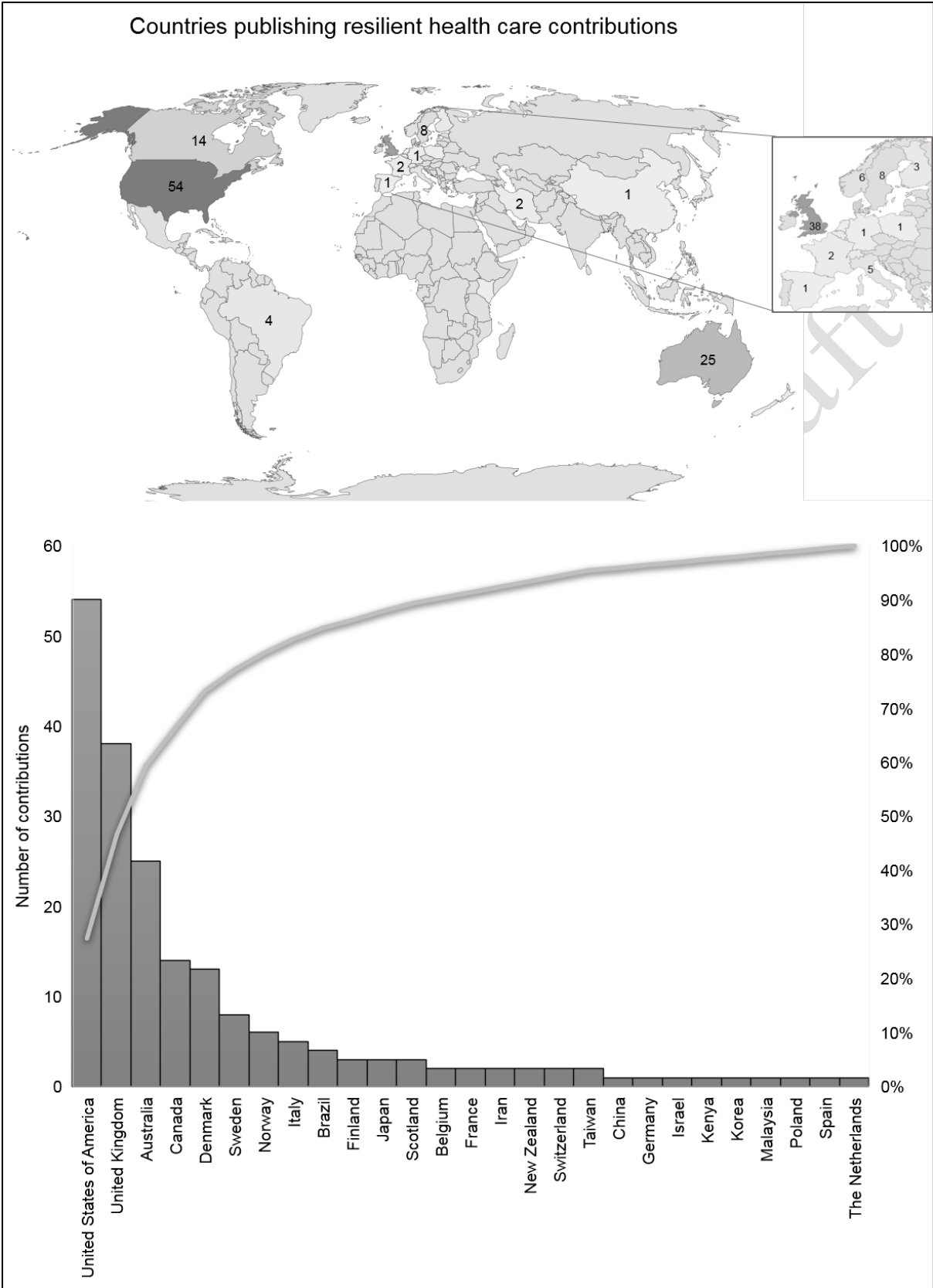
Figure 2. Contributions on resilient health care by country.

3.2 Empirical literature

Eighty-one (41.1%) of the included outputs were classified as empirical (Appendix 1), with the vast majority of studies being observational (n=74, 91.4%). Experimental (n=7)[1] contributions were few; making up only 8.6% of the empirical literature. The experimental studies focused on implementing concepts from resilience theory, and hence aimed at strengthening resilient performance, thereby to enhance patient safety and patient outcomes. Three of these experimental studies focused on development and implementation of technology that can support resilient behaviour. When considering all the empirical literature, qualitative methods were most commonly used (n=51, 63.0%), followed by quantitative studies (n=21, 25.9%); only 11.1% of studies used a mixed methods approach (n=9).

Within the empirical literature, resilience was most commonly used for interpretation of findings (n=48, 59.3%), followed by use as a conceptual framework (n=41, 50.6%).[2] Almost half of all empirical outputs (n=36, 44.4%) had also used tools or assessment techniques based on resilience principles, with the most common being some operationalisation of the Resilience Assessment Grid (RAG) [30-32] or the Functional Resonance Analysis Method (FRAM) [33-35].

The majority of empirical studies took place in a hospital setting (n=62, 76.5%); within this subset common departments or clinical areas included anaesthesia, emergency departments, intensive care, and surgical settings. Although studies outside of the hospital were less common (n=19, 23.5%), settings ranged from a general health care setting, to health care given in the home, to nuclear health, pharmacology and rural health care. The main topic, problem or issue examined by each of these outputs was classified and quantified. As can be seen in Table 3, the most common topics for empirical contributions were a general focus on safety in the light of resilience theory, and the study of how everyday clinical work is actually performed (i.e., work-as-done). Information technology, teamwork and handovers (including patient flow and patient discharge), and the development of tools for assessing resilience in health care were other topics of focus in the empirical literature.

3.3 Non-empirical literature

There were 116 (58.9%) non-empirical contributions (Appendix 2);[3] more than half of these were conceptual discussions (n=61, 52.6%), followed by commentaries (n=26, 22.4%),

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[1] These contributions were a paper in a conferencing proceeding and a journal article both reporting on the one study.

[2] Categories are not mutually exclusive, some empirical contributions used resilience theory in multiple parts.

[3] Including protocols and both unstructured and structured (e.g., systematic, scoping) reviews.

conceptual case studies (n=13, 11.2%) and methods or practical papers (n=5, 4.3%). There were also five (7.76%) structured reviews and four protocols (3.4%). The reviews focused on resilience in health care [30, 36, 37], methodological strategies in RHC studies [38], medication administration [39], while protocols were for planned studies on quality improvement using resilience principles [40-43]. Many of these non-empirical contributions, despite not collecting primary data, discussed approaches to studying or assessing resilience, with FRAM and RAG again common, as well as social network analysis [44-49].

The majority of the non-empirical contributions discussed RHC generally, i.e. without a defined setting (n=86, 74.1%). A large number of outputs where a setting was defined (n=26) focused on the hospital setting, primarily the Emergency Department. Other settings included general practice [50], pharmacology [51, 52] and the coronial system [53]. The most common topic area (as per the empirical outputs) had a general focus on patient safety (see Table 3). This was also the case for the protocols and reviews. Information technology, work-as-done, governance, simulation, as well as teamwork and handover were other popular areas of focus.

Table 3. The topic area (i.e., context or problem) to which resilience theory is applied.

Topic	Non-empirical	Empirical
Blood handling	1	1
Disruptions	3	0
Governance	7	0
Information technology	8	8
Leadership	1	1
Lean	1	2
Measuring resilience	2	2
Medical devices	1	1
Medication management	3	2
Patient flow	1	1
Patients and families as a source of resilience	4	0
Resilience strategies	2	2
Robotic surgery	0	2
Safety (general)	57	19
Simulation	6	3
Suicide prevention	1	0
Meeting targets	2	3
Teamwork and handovers	5	8
Tool development	1	8
Work-as-done	9	13
Workforce well-being	1	2

3.4 Trends and future directions

The number of contributions on RHC was examined over time, with findings suggesting growth in the literature particularly from 2013 onwards (see Figure 3). This pattern of growth varied between empirical and non-empirical contributions, with non-empirical proliferating from the early 2000s, whilst empirical contributions began to be published from the mid-2000s, except for one journal article published much earlier in 1998 [54]. Growth in the non-empirical literature appeared to plateau at the same time as there was more substantial growth in empirical contributions. Review articles also started emerging in more recent years, reflective of the maturing nature of the field.
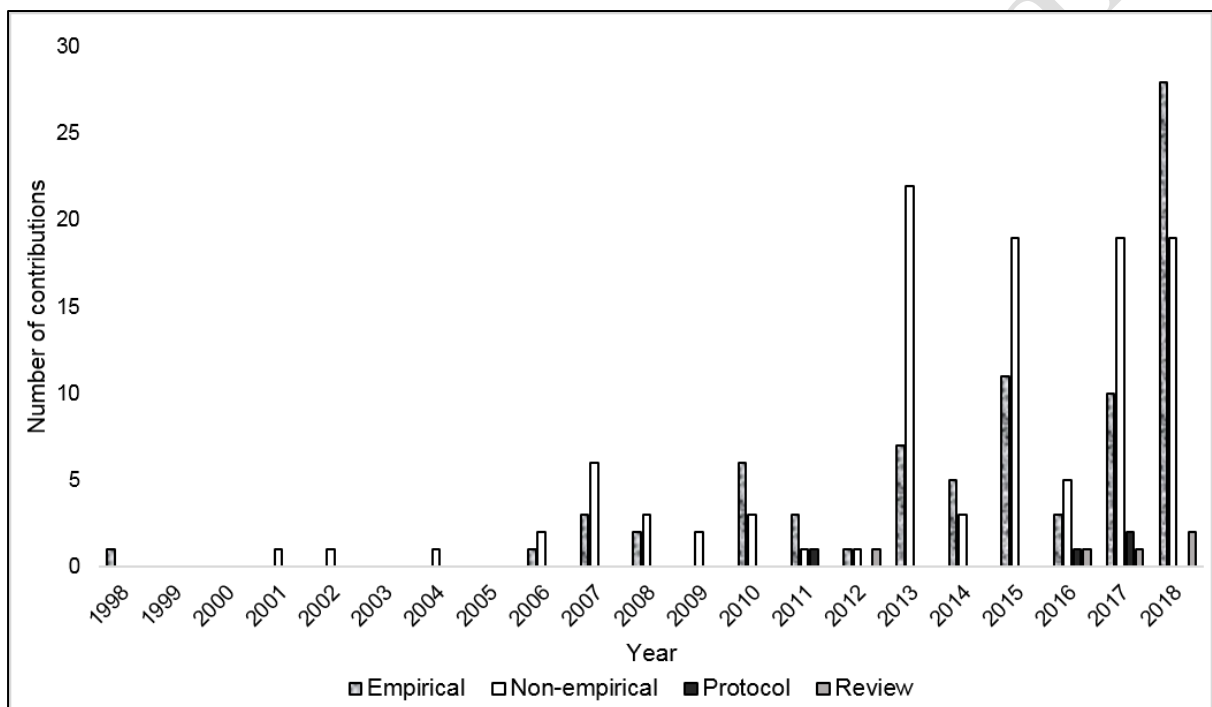
Figure 3. Number of different types of resilient health care contributions over time.

3.4.1 Future directions

In our final analysis, as a counterpoint to the preceding analyses which examined how the field of RHC has developed and changed over time, we identified, extracted and classified from the literature what is being said about potential future directions of the field. These were broadly categorized into four themes. The first focused on the need to better understand the human aspects of resilient systems [e.g., 55, 56], including how maintaining system resilience impacts on those in the system [e.g., 57], the role of patients and families in RHC [e.g., 58], informal networks and communication [e.g., 28], and the importance of people feeling involved in, and empowered to maintain, system safety [e.g., 59].

A second direction for further RHC work involves the need to improve understanding of workarounds and everyday clinical work [e.g., 60, 61]. In particular, multiple contributions suggested the need to investigate and expand the knowledge-base of work-as-done across different settings, including different cultures, countries and hierarchical levels, to establish the generalizability or contextual-nature of findings accumulated so far [e.g., 30, 62, 63].

Third, numerous contributions reported a need to develop methods for studying resilience [e.g., 64, 65, 66], and give them a strong theoretical basis [38]. In this regard, simulation was viewed as one particularly prominent research tool for understanding resilience [e.g., 67, 68]. In general, Sujan and Spurgeon [69] called for more empirical studies of RHC, while Anderson, Ross [70] and others [38, 45, 71-74] suggested the need to focus on outcomes of resilience interventions, particularly those related to patient safety and quality.

Finally, there were calls in the literature for research that might shed light on factors that influence the successful implementation of resilience or resilience-oriented initiatives in health care [e.g., 75]. This included identifying how to scale-up and spread such ideas [e.g., 76, 77].

4. Discussion

The theoretical, conceptual and empirical applications of resilience engineering to health care, including ideas such as Safety-II, focusing on things going right, the complexity science approach, and the misalignment of work-as-imagined and work-as-done [27] have come at time when health care systems have been grappling with the dissatisfaction with progress in patient safety to date [3, 4, 78]. RHC appears on the basis of this review to constitute a paradigm shift in tackling patient safety and other performance issues. Indeed, the present scoping review and bibliometric analysis of the literature on RHC identified a substantial number of relevant outputs and highlighted the growth of the field since 2012.

The recent increase in empirical papers and structured reviews is a sign that RHC is maturing and formalising as a research paradigm, and suggests there are aspirations to continue developing theory and to capture more field demonstrations and strengthen the empirical evidence-base. At the same time, one recent review of resilience methodologies in health care [i.e., 38] suggested that the application and operationalisation of resilience principles to empirical work is still limited. In this regard, our own investigation in this multi-faceted review identified a relative lack of experimental studies in comparison to observational research. This does align with recognition of the difficulty in determining causality in a complex adaptive system [9], as well as some perspectives within the field that resilience is not open to direct measurement or intervention [e.g., 79]. On the other hand, this

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dearth of literature challenges our ability to determine the outcomes of resilience, reflected in the fact that multiple contributions discussed the need for future research to examine outcomes.

Having said that, qualitative approaches have predominated in the empirical literature, reflecting that priorities have been placed on gaining in-depth understanding of everyday clinical work, rather than just measuring systems and system behaviour. While many of the qualitative studies used interviews for their data collection method, we also identified two semi-qualitative methods, namely FRAM and RAG, have become prominent. If used more widely, these approaches have the potential to increase our understanding of how to deal with the multi-dimensional nature of safety, and to safely manage variability in everyday clinical work. They may therefore be increasingly applied in the future to understand work-as-done across settings.

Analyses topics and settings of contributions identified applied trends in the literature. Common themes were work-as-done and safety in general, as well as specific safety and performance issues related to information technology, and teamwork and handovers, particularly in hospital settings. The focus on hospitals and safety in general neatly sets up other future directions identified, namely understanding of everyday clinical work in multiple and diverse settings, organisational structures, cultures, and countries. This need for plurality was also emphasised by the strong bias toward high-income, English speaking countries in existing RHC literature.

Findings from our review confirmed that a significant proportion of the RHC literature has been concentrated among a handful of edited books, while the bulk of peer-reviewed articles are spread widely across a diverse range of journals. This suggests that while there is a large body of research on RHC, much of the work is difficult to access, even invisible, due to the impediments of not having a primary journal dedicated to the topic, and relying heavily on book chapters for the dissemination of ideas. Indeed, while RHC journal articles have had moderate influence, of a level comparable to papers published in this very journal [Cite Score of 3.22 in 2017, 80], cites were much lower for book chapters. It is worth considering that there may be advantages for the field, in terms of growth of ideas and future research collaborations, if more RHC journal articles were concentrated in a handful of relevant journals.

4.1 Strengths and limitations

To date, there has been no multi-faceted review of the field of RHC. The strengths of this review include the thorough search strategy, with a large number of databases searches, as

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well as by-hand search of a number of key reference texts, which allowed the existing literature to be mapped. The limitations of the review are primarily methodological. As the review identified, much of the foundational literature has been published as chapters in edited books. However, as is sometimes the case, authors may have cited a whole edited book, such as Resilient Health Care [18], receiving to date 181 cites, rather than a specific chapter (averaging less than 2 cites/year). It is possible, therefore, that the citations for individual book chapters are an underestimate of their true value, and the nuances of idea spread have been lost. This review highlights the need for future research to clarify the human aspects of resilient systems, workarounds, and everyday clinical work. Finally, this review highlights the need for future efforts to establish methods for examining RHC systems and the factors that influence successful implementation of resilience-based initiatives.

5. Conclusion

The evidence presented in this review makes a contribution to discussions about how the RHC field has grown, developed and is changing over time, as well as its influence. It is evident that the field is formalising as a paradigm. While the application and operationalisation of resilience principles to empirical work is still limited, recent focus appears to have shifted from attempting to understand resilient systems to how we might engender or foster resilience in health care organisations. To facilitate growth of ideas, consideration of fostering research collaboration outside of the core group and concentration of work in a handful of relevant journals might be of value. n

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