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# The application of the Resilience Assessment Grid in outpatient clinics: A validation study

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## ABSTRACT

The Resilience Assessment Grid (RAG) has gained increasing traction in healthcare discourse for its effectiveness in understanding and assessing the potential resilient performance of healthcare organisations. RAG is intended to be tailored for the specific organisation. However, developing a context specific RAG questionnaire can be time-consuming, limiting its widespread implementation. The current study aimed to investigate whether an existing Danish RAG questionnaire for outpatient clinics could be successfully content validated and applied in another outpatient clinic context.

A modified Delphi method was used to content validate the Danish RAG questionnaire in the Australian outpatient clinic setting, using interviews and expert panel reviews. The 29-item English version of the RAG questionnaire was administered in 2023 to nine managers and five healthcare professionals responding on a five-point Likert scale, who work across 34 hospital outpatient clinics at Macquarie University (MQ) Health Clinics. The questionnaire was also employed during managerial and departmental meetings in a collaborative learning format. Descriptive statistics were used to analyse the data, which was then presented using radar charts to facilitate the interpretation of the resilient profiles of MQ Health Clinics.

The translation and validation of the Danish RAG questionnaire was successful. The English language RAG questionnaire was perceived as useful by managers to assess their clinics' resilient strengths and weaknesses and identify areas for improvement within their clinic.

While the RAG methodology highlights the importance of context-specificity, this study's findings suggest that the content validated RAG questionnaire has the potential for application in other outpatient settings with minimal adaptation.

## 1. Introduction

Healthcare systems are complex systems (Braithwaite et al., 2013) that are experiencing increasing patient demands (United Nations, 2019) and greater workload (McHill et al., 2018), yet must operate within constrained resources (The Danish Health Data Authority. Big expenses associated with multimorbidity [Store udgifter forbundet med multisygdom], 2015). Healthcare systems are often subjected to both predictable and unpredictable events, such as the recent example of COVID-19 (Haldane et al., 2021). To address these multifaceted challenges, healthcare organisations have fostered the adaptation of non-

linear approaches, particularly Resilience Engineering (RE) (Nemeth et al., 2008; Woods et al., 2006). RE, an emerging paradigm, focuses on the system's potential to cope with complexity to achieve acceptable outcomes and to manage conflicting goals (Woods et al., 2006). It provides concepts and methods for improving the potential for resilient system performance (Hollnagel, 2018). RE holds relevance in healthcare because modern healthcare systems require the resilient potential to effectively cope with complex challenges and to adapt varying situations to deliver high quality care (Nemeth et al., 2008; Hollnagel et al., 2013).

RE defines resilience as “the ability to perform as required under a variety of conditions – which includes being able to respond appropriately to

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both disturbances and opportunities” (Hollnagel et al., 2021). Using this definition, we assume that systems work because “Resilience is an expression of how people, alone or together, cope with everyday situations—large and small—by adjusting their performance to the conditions” (Hollnagel, 2018). RE proposes four resilient potentials that organisations require to understand and enhance their resilient performance. These are the potential to respond, the potential to monitor, the potential to learn and the potential to anticipate (Hollnagel, 2018). The potential to respond refers to an organisation’s ability to respond in a timely manner to cope with changing conditions (Hollnagel, 2018). The potential to monitor refers to the organisation’s ability to monitor its operations and detect changes that may affect the organisation’s day-to-day performance (Hollnagel, 2018). The potential to learn looks at how well the organisation learns from past experiences and how it acquires new knowledge and skills (Hollnagel, 2018). Lastly, the potential to anticipate addresses the organisation’s ability to predict the trajectory of developments (both positive and negative) further into the future and their effect on the organisation (Hollnagel, 2018). Organisations can use the resilient potentials as proxy measure to understand and assess their organisation’s resilient performance (Hollnagel, 2018). Together, these four resilient potentials form the Resilience Assessment Grid (RAG) developed by Hollnagel (Hollnagel, 2018). By using the RAG as a way of framing resilience, we can assess the extent to which these resilient potentials are present or absent in an organisation.

RAG has been applied in high risk industries such as aviation (Ljungberg and Lundh, 2013), traffic management (Patriarca et al., 2016), nuclear plant (Sakuda and Kitamura, 2019) and the water sector (Rodríguez et al., 2020) to analyse and support resilient performance. In healthcare, the RAG has been primarily applied in emergency care (Alders, 2019; Chuang et al., 2020; Chuang et al., 2020; Hunte et al., 2018), anesthesia departments (Falegnami et al., 2018; Patriarca et al., 2018). More recently the RAG has been applied in outpatient clinics by Safi et al. (Safi et al., 2022) to enhance the resilient performance of outpatient clinics. The Safi et al. study (Safi et al., 2022) developed a Danish RAG questionnaire for hospital outpatient clinic setting. The study included frontline clinicians, clinical middle managers, and leaders with administrative responsibilities. The RAG was applied longitudinally via survey format twice over 12 months. The longitudinal approach enabled the outpatient clinics to assess any changes in their resilient potentials over time. The RAG assessment findings were used to create a resilient profile of the outpatient clinics and guide a quality improvement project (Safi et al., 2022).

RAG is a common method for identifying and leveraging resilient strengths of the healthcare organisation (Safi et al., 2022). However, its implementation faces challenges due the need for the analysts to customise and tailor the RAG questions to the specific organisation or system under study (Hollnagel, 2018; Hollnagel et al., 2021; Safi et al., 2022). Additionally, there is no standardised guide available for adapting and applying the RAG (Safi et al., 2022). Developing a tailored RAG questionnaire can be time-consuming (Falegnami et al., 2018) resulting in underutilisation and implementation gaps (Safi et al., 2022).

Hollnagel (Hollnagel et al., 2021) also highlights that the RAG questionnaire serves as a managerial tool for gaining a better understanding of an organisation’s strengths and weaknesses in terms of the resilient potentials. Recent research within the RE (Thude et al., 2019; Klockner and Meredith, 2020; Fagerdal et al., 2022; Lyng et al., 2022; Zhuravsky et al., 2019) shows that engagement with managers and leaders is vital for enabling resilience in organisations, as they have to manage conflicting goals and demands (Flin et al., 2006). Vogus and Sutcliffe (Vogus and Sutcliffe, 2012) explain that managers act as a conduit between top administrators and frontline workers. Studies using the RAG to date have demonstrated limited involvement of the managers and leaders (Safi et al., 2022; Ellis et al., 2019), suggesting that the full potential of the RAG in improving resilient performance is not being realised. To do so, it is necessary to consider the implementation challenges faced by managers and leaders, in addition to the context

specificity of the RAG itself. To address these gaps, we sought to investigate whether the existing Danish RAG questionnaire developed for outpatient clinics can be successfully adapted and applied in other outpatient clinic settings. Expanding on the work of Safi et al. (Safi et al., 2022), we aimed to content validate the Danish RAG questionnaire in an Australian hospital outpatient clinic setting and explore its practical utility in collaboration with clinic leaders and managers.

## 2. Methodology: Contextualising and content validating the RAG

The RAG questionnaire differs from traditional questionnaires as it needs to consider the context of where it will be applied. Given the context-specific nature of the RAG questionnaire and its intended use by industry practitioners with varying levels of analytical expertise, we explored analysis options in consultation with our statistician and resilience experts. We found that quantitative scale validation was not the most suitable method for validation. To ensure the questionnaire’s reliability, we relied on the qualitative Delphi rounds. This iterative expert feedback process helped with the English language RAG content validation and also ensured that the translated English RAG questionnaire was in concordance with the underlying RAG constructs. This study was conducted in two phases using qualitative and quantitative methods:

- i. Using a modified Delphi method (Clay-Williams and Braithwaite, 2009), we translated and content validated the Danish RAG questionnaire for the Australian setting. Content validation was achieved by gathering feedback from a panel comprised of experts in RE concepts and experts working in the outpatient clinic setting with experience in the operation of the clinics.
- ii. We applied the English language version of the RAG questionnaire at MQ Health Clinics in Australia. The questionnaire was designed to gather both qualitative and quantitative data.

### 2.1. Setting: MQ Health Clinics

MQ Health is a Macquarie University owned entity that operates 34 outpatient clinics. MQ Health Clinics are also associated with the Macquarie University Hospital (MUH), a medium-sized not-for-profit private hospital in Sydney. It has 144 bed facility and employ over 1500 staff, both clinical and non-clinical, providing general practice, allied health, and specialty outpatient care. The current study is conducted at MQ Health Clinics. MQ Health Clinics are managed by clinical and non-clinical managers responsible for more than one clinic.

### 2.2. Validating the RAG questionnaire using modified Delphi method

The study used a modified Delphi method consisting of two rounds to translate and content validate the RAG questionnaire. In the first round, a group of four resilience experts, including two native English speakers and two native Danish speakers with English as a second language, translated and reviewed the RAG questions. They ensured the fidelity of the questionnaire’s language and content to the original Danish version during the review process.

In the second round of expert review, conducted via an interview with each individual, a group of six experts consisting of middle managers (n = 2), a quality consultant, and Directors of clinics (n = 3), were asked to rate each item of the RAG questionnaire (Appendix A: Structured RAG questionnaire) on a three-point Likert scale for clarity, with the options being “clear”, “not clear needs revision”, and “not clear” (Polit et al., 2007; Collins, 2003). The experts were provided with a paper format of the items and were asked in-person to review each item and rate it. This was used to improve the language of the items including the use of proper terms to make them clear and avoid

misunderstandings. The expert feedback via the interviews was used to understand if the participants found the items or questions relevant (Collins, 2003; De Vet et al., 2011). They were also asked about the relevance of the questionnaire to their context and whether they would consider applying it. The interview process was audio recorded, and notes were taken for later analysis. Given that the experts found the items relevant and the content remained substantially the same, and we did not intend to reduce the number of items, a new content validity index (CVI) was not needed to be computed for the Australian context, similar to the Danish RAG study (Safi et al., 2022). The finalised RAG was then checked by a resilience expert to ensure accuracy with the four resilient potentials.

The English version of the RAG questionnaire (Appendix B: The RAG questionnaire English Final) was a valid replication of the Danish version, differing solely in the language used, and in addition of a third question in the demographic section. This additional question was about work experience that did not impact the four resilient potentials but was considered relevant by the MQ clinical experts. The final RAG questionnaire comprised 29 questions, consisting of three demographic questions, eight items pertaining to responding, six items on monitoring, six items on learning, and five items on anticipating and ended with an open-ended comment section. The participants rated each question on a 5-point Likert scale (0–4) (e.g., “In the department, I know when my colleagues are under pressure and need help” with response options of never, rarely, sometimes, often or always).

### 3. Application of the RAG

The RAG was applied in two MQ Health Clinic settings: (1) the MQ Health Clinics managerial meeting on December 2022, which was attended by 12 people, and all completed the RAG survey; and (2) the Physiotherapy Clinic on March 2023, which was attended by 7 people, and all completed the RAG survey. The table below outlines the meeting structure where the RAG was utilised.

All participants were consented prior to completing the survey and participating in the discussion.

#### 3.1. Application of RAG in MQ Health Clinics managers’ meeting

The RAG was applied at a monthly manager’s meeting with the object of obtaining a baseline resilient profile of the MQ Health Clinics from the manager’s perspectives and gain feedback on the RAG questionnaire. The meeting included 12 participants, including the Head Operation Manager. The meeting was structured as follows: a brief presentation about the RAG was given, followed by the managers completing the RAG survey. Additionally, an interactive poll using Polleverywhere was conducted to engage with the managers regarding the RAG questionnaire.

To build rapport with the managers, a 15-minute brief presentation about RAG was given, using previous work in Denmark as an example. After the presentation, the managers were provided with information about the study, the opportunity to ask questions, and a consent form. Once consent was obtained, participants were asked to fill out the RAG survey, which took approximately 10 min to complete. The interactive part of the meeting used a live online poll to engage the managers and encourage reflection on the RAG questionnaire. Managers used their smartphone or computer to participate in the poll, with the live results being displayed on a big screen for all to see. The use of an interactive live poll helped to engage the managers and elicit collaborative learning discussion about the different demands of their work after each poll question. The poll included six questions or items from the RAG survey, one from each potential. The questions were selected based on the responses that we received from the Delphi rounds where the experts had shown strong interest. Due to time constraints, we were only able to include six questions and these were; *R5\_ressources*, *R7\_interruptions*, *M1\_role and responsibility*, *M3\_situation awareness*, *L2\_safety culture* and

*A2\_valnerability* (see Table 3). The meeting ended with a discussion about the relevance of the RAG questionnaire and whether it would be useful to use it in the future, as well as feedback on how the application could be improved. It is important to note that the live online poll was anonymous, and the discussions were recorded for later note-taking. The meeting was facilitated by a researcher, and a second researcher took notes. This helped with analysing the data and gaining insights into the resilient profile of the MQ Health Clinics from the managers’ perspectives.

#### 3.2. Application of RAG at Physiotherapy clinic

The head of the clinic arranged a meeting with his team of six staff including five clinicians and a middle manager, where we applied the RAG. Similar to the managers meeting, the structure of the meeting was to deliver a 15 min presentation about the RAG, provide participant information and obtain consent, then complete the RAG survey and a discussion about the application of the RAG and how it can be improved. The 20 min discussion was audio recorded and hand written notes were taken during the discussion.

#### 3.3. Data management

The data from the RAG survey was transferred to Microsoft Excel Version 2016, and separate analyses were conducted for each setting. Descriptive statistics were used to calculate the mean score of each item and the overall mean score of the four resilient potentials. The meeting notes were documented in Microsoft Word Version 2016. The notes were reviewed and cross-referenced with the audio recordings. This was followed by documenting and highlighting the overarching themes. To ensure credibility of the findings, a second researcher also cross-checked the notes and the themes during this process.

## 4. Results

The results were summarised and presented in tables and radar charts. Table 1 provides an overview of the study participants.

The response rate for both meetings was 100 %. In Table 1, the respondents are evenly distributed in terms of their functions. Managers represented nearly half (46.7 %) of the respondents, while coordinators and others accounted equally for the remainder (26.3 % each). ‘Coordinators’ were those who performed an assistant role to the managers and ‘others’ consisted of participants with a clinical background, such as physiotherapists. Around 50 % of the respondents had over three years work experience at MQ Health Clinics and more than 50 % had over five years of experience within their profession (Table 2).

Table 3 presents the calculated mean scores, and Figures 3 and 4 illustrate, through radar charts, the resilient profile of the MQ Health Clinics and the Physiotherapy Clinic respectively.

#### 4.1. Resilient profile of MQ Health Clinics

**Respond.** The MQ Health Clinic’s potential to respond was assessed using eight sub-indicators. The MQ Health Clinics scored high in

**Table 1**  
Outline of the RAG application at MQ Health Clinics.

|                                     | MQ Health Clinics                 | Physiotherapy Clinic |
|-------------------------------------|-----------------------------------|----------------------|
|                                     | N = 12                            | N = 7                |
| Meeting / data collection structure |                                   |                      |
| RAG presentation                    | 15 min                            | 15 min               |
| RAG survey                          | 10 min                            | 10 min               |
| Discussion                          | 30 min discussion RAG online poll | 20 min               |

**Table 2**  
Demographics of study participants.

| Total   | N = 19 (100 %) |            |
|---|----------------|------------|
| Function  | Manager        | 9 (47.4 %) |
|   | Coordinator    | 5 (26.3 %) |
|   | Other          | 5 (26.3 %) |
|   | Physician      | –          |
|   | Nurse          | –          |
| Work experience MQ Health Clinics (years)       | 0–1            | 5 (26.3 %) |
|   | 1–3            | 5 (26.3 %) |
|   | 3–5            | 3 (15.8 %) |
|   | 5+             | 6 (31.6 %) |
| Work experience within their profession (years) | 0–1            | 1 (5.3 %)  |
|   | 1–3            | 2 (10.5 %) |
|   | 3–5            | 4 (21.1 %) |
|   | 5+             | 12 (63.2)  |

R2\_teamwork (3.5), R4\_shared priorities (3.1) and staff-engagement (2.8), meaning that at the MQ health Clinics staff often support each other in challenging situations and have a clear understanding of their clinics’ priorities (see Fig. 1). This is associated with the high score in staff-engagement, where the staff is highly motivated in solving task across specialties. However, the MQ Health Clinics recorded a low score in R5\_resources (2.1), implying that the clinic struggle to have adequate staffing levels to be able to perform their work. Additionally, they experience a lot of interruptions (R7).

**Monitor.** The MQ Health Clinic’s potential to monitor was assessed using six sub-indicators. The MQ Health Clinics high score in M3\_situation awareness (3.7) indicates that the managers always have an awareness of their colleagues pressures leading to high scores in R2\_teamwork (3.5). Situation awareness is also linked with that the managers have often an overview of the work (M5\_organisational support, 3.1). Another important aspect is that there is an easy access to the M6\_leadership (3.6) when necessary.

**Learn.** The MQ Health Clinic’s potential to learn was assessed using six sub-indicators. The radar chart for the potential to learn is skewed to the right, indicating that the MQ Health Clinic has a strong L2\_learning culture (3.9), where employees feel safe asking questions about things they do not know. While the MQ Health Clinics rates a little above average in L5\_learning from things that goes well (2.8), it is reported that there is lack of sufficient time on following up on quality initiative and learn from them (L6\_feedback process, score 2).

**Anticipate.** The MQ Health Clinic’s potential to anticipate was assessed using five sub-indicators. The radar chart illustrates that the MQ Health Clinics emphasises A1\_expertise (3.2), A2\_vulnerability (3) and A4\_proactive (3). This suggests that the MQ Health Clinics have the required skills and knowledge more than often to perform their required tasks and are aware of the challenges they face and working to improve their work.

#### 4.2. Physiotherapy clinic

**Respond.** The radar chart for respond reveals that the physiotherapy clinic scored relatively low in flexibility (R1) in their work schedule. The clinic sored over the average in R5\_resources (2.5), indicating that the clinic most of the time had right level of staffing (see Fig. 2). The clinic performed well in R8\_self-management (3.3), R2\_teamwork (2.7) and R4\_shared priorities (2.7), meaning that they have a good understanding of the clinic’s priorities and work together as a team to perform them.

**Monitor.** The radar chart for monitor shows that the clinic performed well across the sub-indicators except M3\_situaton awareness (2.2). The highest score being in M1\_role & responsibility (3.2), indicating that the staff members have a good understanding of their roles and responsibilities.

**Learn.** The radar chart for the learn sub-indicators suggests that the clinic has a high L2\_learning culture (3.1), and staff feel safe asking questions and expressing their opinions. However, the results suggest

**Table 3**  
Mean scores for each RAG survey item.

| Respondent organisation  | MQ Health Clinics | Physiotherapy Clinic |
|--|-------------------|----------------------|
| Total respondents (N)  | N = 12            | N = 7                |
| Respond  |                   |                      |
| R1_Flexibility: There is flexibility in my schedule/work.  | 2.7               | 1.8                  |
| R2_Teamwork: In the department/clinic, we help each other in stressful situations.   | 3.5               | 2.7                  |
| R3_Leveraging Knowledge: In the department/clinic, we can perform each other’s functions within the same professional group/and or team.   | 2.6               | 2.2                  |
| R4_Shared priorities: In the department/clinic, we have a common understanding of what we should prioritise.   | 3.1               | 2.7                  |
| R5_Ressources: In the department/clinic, we have the right level of staffing to be able to perform everyday tasks.   | 2.1               | 2.5                  |
| R6_Self-management: In the department/clinic, we can handle normal day-to-day operations without a manager being directly available.   | 2.8               | 3.3                  |
| R7_Interruptions: In the department/clinic, I don’t experience many interruptions to my everyday work that prevent me from being able to perform my work/role.                   | 1.4               | 2.2                  |
| R8_staff engagement: In the department/clinic, we are motivated to solve tasks across departments /clinics/specialties.  | 2.8               | 2.4                  |
| Respond total mean   | 2.6               | 2.4                  |
| M1_role and responsibility: In the department/clinic, I know my colleagues’ role and where their skills can be used.   | 3.4               | 3.2                  |
| M2_Communications: In the department/clinic, we communicate with each other to ensure that we complete the tasks.  | 3.4               | 2.8                  |
| M3_Situation awareness: In the department/clinic, I know when my colleagues are under pressure and need help.  | 3.7               | 2.2                  |
| M4_Evaluation: In the department/clinic, we consider ways to continuously improve our work.  | 3.5               | 3                    |
| M5_Organisational support: In the department/clinic, we have access to an overview of the day’s work tasks.  | 3.4               | 3.1                  |
| M6_Leadership: In the department/clinic, I can easily get in touch with my immediate (line) manager.   | 3.6               | 3                    |
| Monitor total mean   | 3.5               | 2.8                  |
| L1_Knowledge dissemination: In the department/clinic, we share relevant professional knowledge.  | 3.3               | 3                    |
| L2_Safety culture: In the department/clinic, I feel safe asking about something I do not know.   | 3.9               | 3.1                  |
| L3_Relevance: I get useful answers to my questions.  | 3.3               | 3.1                  |
| L4_Development: In the department/clinic, I have enough support to develop or improve myself (through new work assignments, training, education, increased responsibility, etc.) | 2.8               | 2.1                  |
| L5_Learning from what goes well: In the department/clinic, we use our experiences from successful patient cases to learn.  | 2.8               | 2.1                  |
| L6_Feedback process: In the department/clinic, we have sufficient time to follow up on quality initiatives and learn from them.  | 1.9               | 2                    |
| Learn total mean   | 3                 | 2.2                  |
| Anticipate   |                   |                      |
| A1_Expertise: In the department/clinic, we have the skills and knowledge needed to carry out our work.   | 3.3               | 3.2                  |
| A2_Valnerability: In the department/clinic, we are aware of where we have challenges.  | 3.3               | 3                    |
| A3_Opportunistic mindset: In the department/clinic, we focus on identifying future opportunities.  | 2.6               | 2.4                  |

(continued on next page)

**Table 3** (continued)

| Respondent organisation  | MQ Health Clinics | Physiotherapy Clinic |
|--|-------------------|----------------------|
| <i>A4_Proactive:</i> In the department, we work actively to improve our work to meet future challenges and requirements. | 3.0               | 2.4                  |
| <i>A5_Communication:</i> In the department/clinic, plans are clearly communicated to staff.                              | 2.8               | 1.7                  |
| Anticipate total mean  | 3                 | 2.5                  |

Note: The RAG scores range from 0 to 4 and is reported as mean. 4 indicates the highest.

score and 0 represents the lowest score. The scale reflects responses ranging from.

0 = never, 1 = rarely, 2 = sometimes, 3 = often or 4 = always.

that there is room for improvement in L5\_learning from what goes well (2.1) and L4\_development (2.1), indicating that there is sometimes sufficient support for skills and knowledge development.

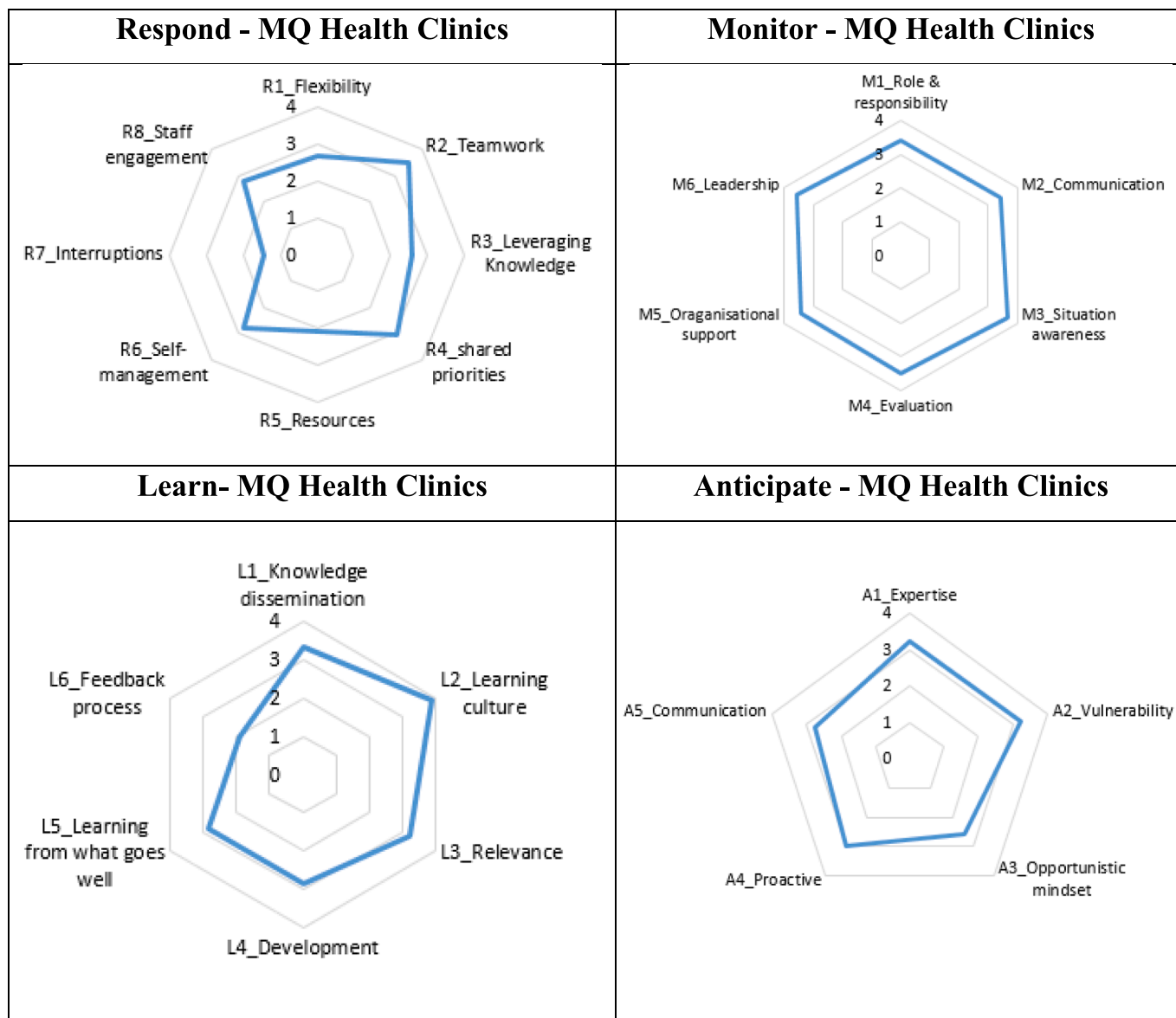
**Anticipate.** The results for the anticipate sub-indicator suggests that the clinic performs well in A1\_expertise (3.2) and A2\_vulnerability (3),

indicating that they are aware of their strengths and weaknesses and have the skills and knowledge required to deliver quality services. The clinic also scored relatively well in being proactive (A4, 2.4), suggesting that they have a culture of continuous improvement. However, the score for A5\_communication (1.7) is relatively low, indicating room for improvement in the communication channel to clearly communicate future plans to staff.

**4.3. Feedback on RAG questionnaire and application**

After the presentation and the RAG survey, a joint discussion was held to discuss its application in both settings. During the managerial meeting, the discussion lasted 30 min, the managers gained an in-depth understanding of the RAG’s application and its potential for future use. The use of a live online poll during the meeting helped to engage the managers to reflect on the RAG’s application. The main themes from the discussion are presented in Table 4, along with a selection of supporting quotes.

According to the managers, the RAG questionnaire is useful to prompt discussion and allows staff to discuss the challenges they are



**Fig. 1.** Resilient profile of the MQ Health Clinics. The results are presented as on a 5-point Likert scale from 0 to 4, with 4 indicating the highest score and 0 representing the lowest score. The scale reflects responses ranging from 0 = never, 1 = rarely, 2 = sometimes, 3 = often or 4 = always.

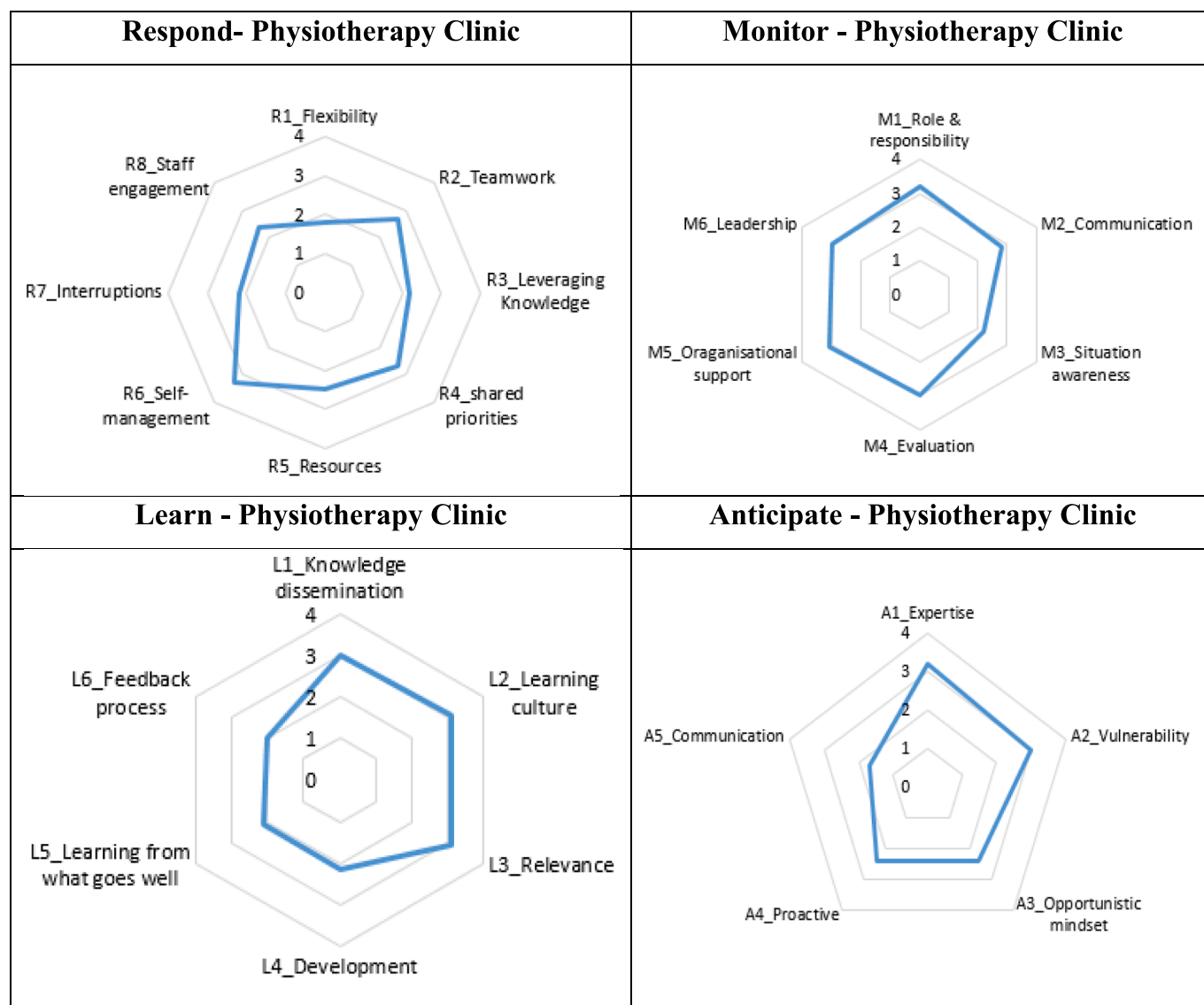


Fig. 2. Resilient profile of the MQ Health Clinics. The results are presented as on a 5-point Likert scale from 0 to 4, with 4 indicating the highest score and 0 representing the lowest score. The scale reflects responses ranging from 0 = never, 1 = rarely, 2 = sometimes, 3 = often or 4 = always.

facing and how to collectively tackle them. Additionally, the use of the RAG in managerial meetings allowed managers to build rapport with other managers from the MQ Health Clinics. The managers expressed an interest in using the RAG in their own clinics and future managerial meetings, to continuously apply it and compare the results.

Regarding the practical application of the RAG, respondents appreciated that the survey was anonymous and completed individually, followed by group discussions. It provided confidentiality which ensured that the respondent feel secure about discussing any sensitive aspects of their work.

During both meetings, respondents noted that the phrasing of item R7, which pertains to experiencing interruptions, was confusing due to its double negative construction. R7, *In the department/clinic, I don't experience many interruptions to my everyday work that prevent me from being able to perform my work/role.*

Participants also suggested adding an option to select a specific clinic at the start of the RAG survey, which would provide more data points for analysis.

### 5. Discussion

The current study aimed to investigate whether a Danish RAG questionnaire for outpatient clinics can be successfully validated and applied in other outpatient clinic settings. Using the modified Delphi method, the Danish RAG questionnaire was effectively translated into English, content validated, and practically applied in an Australian outpatient clinic setting. A resilient profile of MQ Health Clinics (n = 12) and the Physiotherapy clinic (n = 7) was created with respect to the four resilient potentials. The managers viewed the RAG questionnaire as a good analytical tool. At MQ Health Clinics, the executive manager utilised the RAG to build rapport with the managers across the MQ Health Clinics and to identify challenges faced by the clinics.

Furthermore, the managers and coordinators responded positively to the potential to anticipate and monitor. These two potentials are relevant for the managers to perform their work. As managers and coordinators, it is necessary to stay informed about the happenings within one's organisation (monitor), as well as anticipate what may happen in the future (Sakiru et al., 2013). Furthermore the potential to monitor enhance the potential to respond effectively, preventing delayed responses that can lead organisations to lag behind (Hollnagel, 2018). In

**Table 4**  
Feedback from participants.

|                        | Areas  | Supporting quotes  |
|------------------------|--|--|
| Benefits of RAG        | Analysis tool                                  | <i>“Allows for an open, honest and frank discussion...people are more forthcoming with their problems”</i>   |
|                        | Shared understanding between manager and staff | <i>“Allows the managers and staff to be on the same page. I might think that we have the right level of staffing but it may not be the case”</i>   |
| Practical application  | Anonymous/individual survey                    | <i>“It is good that it is anonymous, people would be honest with their answers. For instance, if the staff don't feel like they are getting enough development opportunities, they can express it without feeling the need to directly speak to the manager”</i> |
|                        | Team /group discussion                         | <i>“Applying the RAG as a team or in the group would bring up more discussion, but it relies on people feeling comfortable talking in a team”</i>  |
| RAG survey improvement | R7_interruptions                               | <i>“The item is double negative and needs to be rephrased.”</i>  |
|                        | Demographic data point                         | <i>“you can add the clinic option in the demographic question if you want another data point”</i>  |

Vogus and Sutcliffe (Vogus and Sutcliffe, 2012) model managers are in the center, meaning that they possess insight into the organisational strategy and are responsible for conveying this information to frontline workers, while also ensuring that feedback from frontline workers is communicated back to higher level management. This gives them valuable information for handling conflicting demands and priorities tasks and allocate resources effectively. A study by Fagerdal et al. (Fagerdal et al., 2022) found that team leaders play an important role in enabling adaptive capacity or resilience in their team. The study observed that the hospital team leaders were vigilant of changes in the team and its external environment as well as having a broad network with other organisational units (Fagerdal et al., 2022).

In contrast to our study, previous studies (Patriarca et al., 2018; Safi et al., 2022; Darrow, 2017) using RAG have typically focused on the frontline worker's understanding of the four resilient potentials, while staff with managerial or leadership responsibilities has had limited involvement. Furthermore, the transferability of the RAG questions in these studies was limited because they were often focused on a specific unit or issue (Safi et al., 2022). However, our study included managers with non-clinical backgrounds and was not limited to a specific clinic, presenting a difference. Similarly, a study by Klockner & Meredith (Klockner and Meredith, 2020) used the RAG to survey middle managers to assess the operation safety system resilient potential in a large road transport organisation in Australia. Their study reported that the RAG application highlighted areas for improvement and that the middle managers would be able to use the results to bridge the communication between top administrators and frontline workers (Klockner and Meredith, 2020). The application of the RAG may also bridge the gap between work as imagined (WAI) by those who create the organisational structures (Hollnagel et al., 2015) and work as done (WAD) by those who actually carry out the work (Hollnagel et al., 2015). The interpretation of this gap between WAI and WAD depends on the perceiver's position within the organisation (Zhuravsky et al., 2019; Lofquist et al., 2017). In both the Danish (Safi et al., 2022) and the current Australian outpatient clinic, using the RAG as a framework brought leaders and managers from different clinics together to discuss their organisations' resilient potential. This enhanced their capacity to work together as a team to understand and improve their organisation's performance.

### 5.1. Translation of the RAG questionnaire into practice

While the RAG is intended to be context-specific (Hollnagel, 2018), it is important to note that the process of developing the RAG questionnaire can be complex and time-consuming process in practice (Falegname et al., 2018; Safi et al., 2022). Furthermore, the RAG is an expert-friendly method, which present challenges for practitioners and non-experts with limited resources to effectively apply it, thus impeding its implementation. The current study has shown that the RAG questionnaire for the outpatient clinics in Denmark has the potential to be transferred and applied in a different outpatient clinic setting. Table 5 details a guide on how to proceed with the application of the content validated English language RAG questionnaire in practice:

### 5.2. Limitations and strengths

A limitation of the study is that we did not include other hospital outpatient clinic settings which may limit the generalisability of the findings. Secondly, we do not know if a RAG provided specifically for the MQ Health Clinics context would have encompassed additional focal points and provided a more precise assessment of their resilient potential. However, we verified through the Delphi rounds and feedback that the pre-existing RAG questionnaire was relevant and applicable in MQ Health Clinics.

In the Danish RAG study (Safi et al., 2022), the authors had computed the content validity index (CVI) to facilitate the reduction of items. However, in the Australian case, computation of a new CVI was not needed, as the experts found the items relevant during the Delphi rounds. Furthermore, there was no need for item reduction, as we intended to maintain the original format of the RAG questionnaire.

The strength of the study is that we captured managers from 34 outpatient clinics. Another strength is that we demonstrated both qualitatively and quantitatively how the RAG can be applied in practice. Future research should look to validate the RAG on a bigger sample size and across other outpatient clinics and healthcare contexts. The findings of this study is also relevant for other industries as it provides a guide for how they can validate and apply the RAG in their organisation. Future research should look to explore the application of RAG in collaboration with managers and leaders in other industries.

## 6. Conclusion

In conclusion, this study aimed to expand upon the application of a pre-developed RAG questionnaire for assessing resilient potential in healthcare, specifically in the context of a hospital outpatient clinic setting. Through content validation in Australian hospital outpatient clinic settings, the study demonstrated the valuable utility of the RAG questionnaire for managers and leaders in assessing and understanding their organisation's resilient potential. The use of the RAG questionnaire in a survey format, group setting, and interview format provided meaningful information for identifying areas for improvement and set future directive actions. While the RAG needs to be context-specific, the findings suggest that our content validated RAG questionnaire for outpatient clinic settings has the potential to be applied across other outpatient clinics or healthcare contexts.

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### Ethics.

This research was approved by the Faculty of Medicine, Health, and Human Sciences Low-risk Human Research Ethics Committee (HREC) at Macquarie University (project reference no. 520221226442571).



Table 5

A guide to applying the Resilience Assessment Grid (RAG) in practice.

|   |  |
|---|--|
| <b><u>Contextualising the RAG questionnaire</u></b> | In some cases, the RAG questionnaire can be applied to the organisation without any adaptation. Depending on the organisation, however, it might require some adjustments in the wording of the questions and the response-choices for the questions, while still retaining the RAG questionnaire its original format. In this study, minor language changes were undertaken. Hollnagel (10) suggests that some questions of respond potential should be based on the organisation's practices, as these can vary. Hence, some items for the potential to respond may need to be contextualised to the organisation. Questions for the other potentials are largely based on RE theory and is relevant in terms of addressing resilience in the organisation (10).   |
| <b><u>Resilience expert.</u></b>                    | While the RAG questionnaire is simple to use in survey format and group setting, it may still require some general understanding of the RE field in order to interpret the results. Hence, it may be helpful to involve a resilient expert to advise.  |
| <b><u>Application.</u></b>                          | The RAG questionnaire can be applied in different ways depending on the preferences of the organisation. <b>Survey format.</b> Administer the RAG questionnaire to the relevant people involved in the functions who have a good understanding of the organisation's operations. Compare the responses of the RAG survey from the managers, leaders, top administrators against the responses from the frontline staff. It is advisable to complete the survey anonymously. Once the survey has been completed the results for each potential can be discussed jointly. The results can be depicted in radar charts as a way to visualise potentially complicated relations and can be used to represent what the goal or target should be. <b>Group setting / meeting.</b> The RAG questionnaire can also be applied in group format where the respondents joint rate their organisations performance across each resilient potential. Use interactive tools or visual aid to display the RAG categories. This will facilitate a discussion about the organisation's strengths and weakness in each category. <b>Interview format.</b> The RAG questions can be used as a framework to conduct individual interviews with key stakeholders (e.g. managers, team leaders and employees). |
| <b><u>Interpretation of the results.</u></b>        | The results obtained from the RAG should not be used for comparative purposes with external organisations; rather, its intended application is for longitudinal analysis in an organisation, enabling an insight into how the resilient potentials change over time (8). The interpretation of the results depends on how the organisation has defined how each item needs to be answered. If the answers are given on a Likert scale, they can be visualised on a radar chart. The radar chart offers a snapshot of the organisation's profile for each potential, making visible any shifts in performance over time (8). In this way, the organisation can see whether they have maintained their position or improved it. While the radar chart captures the overall picture, it is important to also consider each potential by itself, to determine whether the status of the sub-facets is as expected and as intended (8), and to decide what the organisation should do to support and improve it.  |
| <b><u>Prioritisation of the potentials.</u></b>     | While Hollnagel suggests that each potential should be prioritised equally (8), he recognises that the balance depends on what the organisation does and need to do in order to maintain functioning (39). However, for an organisation to act resiliently it needs to address somehow all the potentials. If addressing each potential is time consuming and overwhelming, a solution may be to circulate each potential in regular interval. Typically, all four resilient potentials are assessed, enabling the   |

Table 5 (continued)

|                                |   |
|--------------------------------|---|
| <b><u>Monitor progress</u></b> | identification of critical areas for the organisation and pinpointing where interventions may be relevant or have large effects. The RAG questionnaire should be applied at regular intervals to keep track of the organisation's progress. The frequency of applying the RAG application depends on the goals of the organisation and should align with the rate of organisational changes being considered, whether they are deliberate or due to external conditions (10, 21). One possible solution is to apply the RAG pre-and post-organisational changes to assess their impact. |
|--------------------------------|---|

### CRediT authorship contribution statement

**Mariam Safi:** Conceptualization, Data curation, Writing – original draft, Writing – review & editing, Visualization, Investigation, Validation, Formal analysis, Methodology, Project administration. **Bettina Ravnborg Thude:** Writing – review & editing, Validation, Supervision, Methodology. **Frans Brandt:** Writing – review & editing, Validation, Resources. **Elizabeth Austin:** Writing - review & editing, Validation. **Robyn-Clay Williams:** Conceptualization, Data curation, Writing - review & editing, Validation, Methodology, Supervision, Resources.

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ssci.2023.106396>.

### References

- MDL. Alders A reflective process for analysing organisational resilience to improve the quality of care: King's College London 2019.
- Braithwaite, J., Clay-Williams, R., Nugus, P., Plumb, J., 2013. Health care as a complex adaptive system. In: Hollnagel, E., Braithwaite, J., Wears, R.L. (Eds.), *Resilient Health Care*. Ashgate, Farnham, UK, pp. 57–73.
- Chuang, S., Ou, J.-C., Hollnagel, E., Hou, S.-K., Ganguly, A.R., 2020. Measurement of resilience potential-development of a resilience assessment grid for emergency departments. *PLoS One* 15 (9), e0239472.
- Chuang, S., Ou, J.-C., Ma, H.-P., 2020. Measurement of resilience potentials in emergency departments: Applications of a tailored resilience assessment grid. *Saf. Sci.* 121, 385–393.
- Clay-Williams, R., Braithwaite, J., 2009. Determination of health-care teamwork training competencies: A Delphi study. *Int. J. Qual. Health Care* 21 (6), 433–440.
- Collins, D., 2003. Pretesting survey instruments: An overview of cognitive methods. *Qual. Life Res.* 12, 229–238.
- Darrow, L., 2017. Exploring the factors that drive organizational resilience. *Lessons from Healthcare*.
- De Vet, H.C., Terwee, C.B., Mokkink, L.B., Knol, D.L., 2011. *Measurement in medicine: A practical guide*. Cambridge University Press.
- Ellis, L.A., Churrua, K., Clay-Williams, R., Pomare, C., Austin, E.E., Long, J.C., Grødahl, A., Braithwaite, J., 2019. Patterns of resilience: A scoping review and bibliometric analysis of resilient health care. *Saf. Sci.* 118, 241–257.
- Fagerdal, B., Lyng, H.B., Guise, V., Anderson, J.E., Thornam, P.L., Wiig, S., 2022. Exploring the role of leaders in enabling adaptive capacity in hospital teams – A multiple case study. *BMC Health Serv. Res.* 22 (1), 908.
- Falegnami, A., Bilotta, F., Pugliese, F., Costantino, F., Di Gravio, G., Tronci, M., Patriarca, R., 2018. A multicountry comparative survey about organizational resilience in anaesthesia. *J. Eval. Clin. Pract.* 24 (6), 1347–1357.
- Flin, R., 2006. Erosion of managerial resilience: From Vasa to NASA. In: Hollnagel, E., Woods, D.D., Leveson, N. (Eds.), *Resilience Engineering: Concepts and Percepts*. Ashgate, Aldershot, UK, pp. 223–233.
- Haldane, V., De Foo, C., Abdalla, S.M., Jung, A.-S., Tan, M., Wu, S., Chua, A., Verma, M., Shrestha, P., Singh, S., Perez, T., Tan, S.M., Bartos, M., Mabuchi, S., Bonk, M., McNab, C., Werner, G.K., Panjabi, R., Nordström, A., Legido-Quigley, H., 2021. Health systems resilience in managing the COVID-19 pandemic: Lessons from 28 countries. *Nat. Med.* 27 (6), 964–980.

- Hollnagel, E., 2015. Why is work-as-imagined different from work-as-done?. In: Wears, R., Hollnagel, E., Braithwaite, J. (Eds.), *Resilient Health Care: The Resilience of Everyday Clinical Work*. Volume 2. Ashgate, Farnham, UK, pp. 249–264.
- Hollnagel, E., 2018. *Safety-II in practice: Developing the resilience potentials*. Routledge, New York, US.
- Hollnagel, E., Braithwaite, J., Preface, W.R.L., 2013. on the need for resilience in health care. In: Hollnagel, E., Braithwaite, J., Wears, R. (Eds.), *Resilient Health Care*. Ashgate, Farnham, UK, p. ...
- Hollnagel, E., Leonhardt, J., Licu, T., 2021. The systemic potentials management: Building a basis for resilient performance. A White Paper. Brussels, Belgium.
- Hunte, G., Marsden, J., 2018. Engineering resilience in an urban emergency department. In: Hollnagel, E., Braithwaite, J., Wears, R.L. (Eds.), *Delivering Resilient Health Care*, Volume 4. Routledge, Abingdon, UK, pp. 131–149.
- Klockner, K., Meredith, P., 2020. Measuring resilience potentials: A pilot program using the resilience assessment grid. *Safety*. 6 (4), 51.
- D. Ljungberg V. Lundh *Resilience Engineering within ATM-Development, adaption, and application of the Resilience Analysis Grid (RAG)*. 2013.
- Lofquist, E.A., Dyson, P.K., Trønnes, S.N., 2017. Mind the gap: A qualitative approach to assessing why different sub-cultures within high-risk industries interpret safety rule gaps in different ways. *Saf. Sci.* 92, 241–256.
- Lyng, H.B., Macrae, C., Guise, V., Haraldseid-Driftland, C., Fagerdal, B., Schibeveag, L., et al., 2022. Capacities for resilience in healthcare; a qualitative study across different healthcare contexts. *BMC Health Serv. Res.* 22 (1), 474.
- McHill, A.W., Czeisler, C.A., Shea, S.A., 2018. Resident physician extended work hours and burnout. Oxford University Press US, p. p. zsy112..
- Nemeth, C., Wears, R.L., Woods, D., Hollnagel, E., Cook, R., 2008. Minding the gaps: Creating resilience in health care. In: Henriksen, K., Battles, J., Keyes, M., Grady, M. (Eds.), *Advances in Patient Safety: New Directions and Alternative Approaches* (vol 3: Performance and Tools). Agency for Healthcare Research and Quality, US.
- Patriarca, R., Gravio, G.D., Costantino, F., 2016. Resilience engineering to assess risks for the air traffic management system: A new systemic method. *Int. J. Reliab. Saf.* 10 (4), 323–345.
- Patriarca, R., Di Gravio, G., Costantino, F., Falegnami, A., Bilotta, F., 2018. An analytic framework to assess organizational resilience. *Saf. Health Work* 9 (3), 265–276.
- Polit, D.F., Beck, C.T., Owen, S.V., 2007. Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. *Res. Nurs. Health* 30 (4), 459–467.
- Rodríguez, M., Lawson, E., Butler, D., 2020. A study of the Resilience Analysis Grid method and its applicability to the water sector in England and Wales. *Water and Environment Journal*. 34 (4), 623–633.
- Safi, M., Thude, B.R., Brandt, F., Clay-Williams, R., Mohammed, J., 2022. The resilient potential behaviours in an internal medicine department: Application of resilience assessment grid. *PLoS One* 17 (10), e0276178.
- Safi, M., Thude, B.R., Brandt, F., Clay-Williams, R., Tsutsumi, Y., 2022. The application of resilience assessment grid in healthcare: A scoping review. *PLoS One* 17 (11), e0277289.
- Sakiru, O.K., D’Silva, J.L., Othman, J., DaudSilong, A., Busayo, A.T., 2013. Leadership styles and job satisfaction among employees in small and medium enterprises. *International Journal of Business and Management*. 8 (13), 34.
- H. Sakuda M. Kitamura editors. *Resilience Assessment Grid (RAG) for facilitating safety consciousness of nuclear power plant personnel*. REA Symposium on Resilience Engineering Embracing Resilience 2019.
- The Danish Health Data Authority. *Big expenses associated with multimorbidity [Store udgifter forbundet med multisygdom] 2015* [Available from: <https://sundhedsdatastyrelsen.dk/-/media/sds/filer/find-tal-og-analyser/sygdomme-og-behandling/kronisk-sygdom/store-udgifter-multisygdom-2015.pdf> ] Accessed 21 August 2023.
- Thude, B.R., Juhl, A.G., Stenager, E., von Plessen, C., Hollnagel, E., 2019. Staff acting resiliently at two hospital wards. *Leadersh. Health Serv.* 32 (3), 445–457.
- United Nations Department of Economics and Social Affairs; Population Division. *World Population Ageing 2019: Highlights (ST/ESA/SER.A/430)*. New York 2019.
- Vogus, T.J., Sutcliffe, K.M., 2012. Organizational mindfulness and mindful organizing: A reconciliation and path forward. *Acad. Manag. Learn. Edu.* 11 (4), 722–735.
- Woods, D.D., Hollnagel, E., 2006. Prologue: Resilience engineering concepts. In: Hollnagel, E., Woods, D.D., Leveson, N. (Eds.), *Resilience Engineering: Concepts and Precepts*. Ashgate, Aldershot, UK, pp. 1–6.
- Zhuravsky, L., Lofquist, E.A., Braithwaite, J., 2019. Creating resilience in health care organisations through various forms of shared leadership. In: Braithwaite, J., Hollnagel, E., Hunte, G. (Eds.), *Resilient Health Care: Working across Boundaries*, Volume 5. CRC Press, Taylor & Francis Group, Boca Raton, FL, pp. 53–66.