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Metacognition for Every Clinician

BOOK SYNOPSIS

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Just prior to his retirement, the neurosurgeon Henry Marsh decided to look back on the forty years of his career, considering whether his mistakes had been negligent carelessness or acceptable 'errors of clinical judgement':

To my distress …. I could not deny that many of the mistakes I was remembering fell into the first category – I had been careless. They were also the mistakes I found most difficult to remember and I suspect that some of my worst mistakes remain buried in my subconscious or have been completely erased. It was also striking that the great majority of the mistakes had been mistakes in decision-making…... And yet, like most doctors, I like to think that I am a good doctor. [1]

Although his career is over, and he will no longer benefit professionally from his reflections at this point, he offers lesson for those of us that can. These few lines give many lessons. Despite his international acclaim as a neurosurgeon, Mr Marsh voluntarily admits to having committed serious errors in his career. And he is candid about having been in denial about these mistakes for a long time. There are lessons one can learn from his reflections.

- The tendency to deny limitations and problems in decision-making, thinking 'I am a good doctor'.
- That one doesn't need to wait until retirement to take remedial measures.
- To understand a type of thinking called metacognition; it is the ability to understand and reflect on both decisions and your underlying thinking processes. Using these skills, Mr Marsh dove deep into his memory, brought forgotten cases to his consciousness, and analysed his core thinking. This isn't the mere recollection of what happened; it is an important attribute of a good

decision maker: an exploration of thoughts. This is metacognition in action.

- That anyone desiring to be an expert should proactively develop such metacognitive skills, as these are seen almost universally among experts across a range of fields.

Unfortunately, the stereotypical image of a surgeon, compared to other medical specialities, is of an *actor* rather than *thinker*. There are two reasons this is unfortunate. It is a misperception and sadly, although some surgeons do tend to buy into it, this perception is inaccurate as surgeons don't think any less than other clinicians. In fact, it could be said that due to the gravity of many of their decisions, surgeons think more than most clinicians. They may appear to think less because their thoughts are not necessarily analytical or verbalised. Although a significant amount of surgical thinking is non-analytical and non-verbal, and is instead visual, tactile, or kinaesthetic; it is still 'thinking.' However, although it is not true that surgeons use less *cognition*, it may be the case that they tend to use less *metacognition*. Therefore, we come across surgeons who are unable to improve their decision-making. It is not because they cannot or do not want to improve, but rather because they are less able to appreciate the differences between their own thinking and that of those who perform better. Fortunately, it is now well established that metacognition can be taught and learned, allowing a great potential to improve our decision-making abilities. [2]

What is metacognition?

Metacognition is the process of 'thinking about thinking.' It involves understanding how you think and how you regulate the way that you think. The regulation of thinking is done by monitoring and evaluating the thought process and planning of thoughts (**figure 1**). [3] Thus, metacognition is a person's ability to manage their thinking. Although the word itself may be new to the reader, metacognitive actions are common. Consider the following two questions.

- When was the last time one failed to recall someone's name but were sure that you knew it? These frustrating 'tip-of-the-tongue' events are common and may increase as we age. They are metacognitive because you have a thought, "I am sure I know the person's name", about the cognitive action of memory; of remembering a name.

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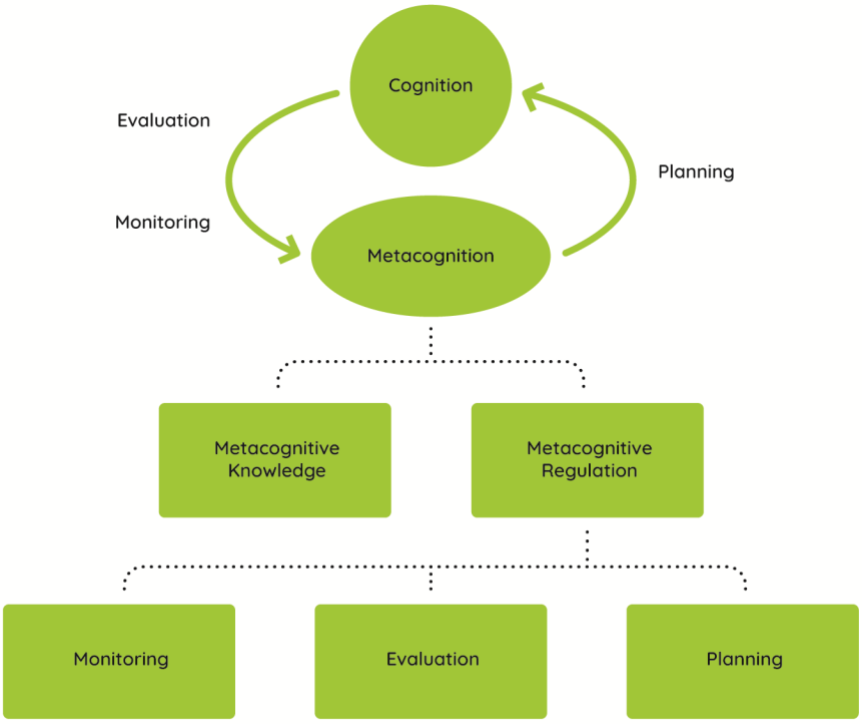

Figure 1 The roles of cognition and metacognition.

- How often does one use a shopping list or see others do so? Lists indicate an awareness that we are at risk of forgetting, and so we use an external aid.

Understanding the limits of one's own memory is a form of metacognition because it is based on your awareness of your memory and the limitations of your thinking. These examples also make it clear that metacognition is not a single concept but is multifaceted in nature. An analogy from management is that cognition is like a clerk whose role is to process and action the decisions taken by the manager, whose metacognitive role is to oversee and supervise the clerk's activities. Just as a manager is supposed to keep an eye on the clerk's performance and take managerial decisions, metacognition regulates thinking and the planning of decisions. Clinical metacognition includes checking clinical reasoning for possible errors and assessing what one needs to know about a treatment option. [4] Surgeons are expected to be self-directed learners throughout their careers, and metacognitive skills are critical to this in addressing what, when, and how to learn. Cognition and metacognition overlap (**figure 2**). Just as a manager may need to get involve in processing and actioning a decision, especially when the clerk is not around, on the other hand, a clerk may have to make managerial decisions.

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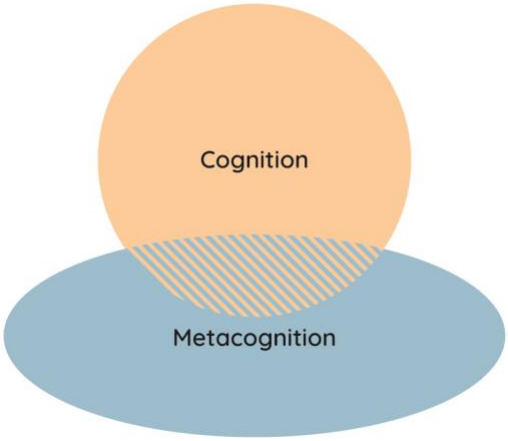

Figure 2 The overlap of cognition and metacognition.

A clinical example of the difference in their roles is shown when performing a diagnostic procedure or an investigation. Cognition is knowledge of the technique and test results. Metacognition is the capacity to review the result, determine if it is clinically consistent, and repeat the test if required or to plan the next step. An example of different facets of metacognition used in studying include recognising where one's weakness in a topic are, using mnemonics as memory aids and following up on your weak points by focusing study on them or reaching out to colleagues for help. These are all aspects of metacognition: metacognitive knowledge, metacognitive monitoring and metacognitive control, respectively.

Metacognitive abilities exist on a spectrum, from someone who is unaware of their thinking process, to disorganised awareness, organised thinking that can be verbalised, and finally, the reflective learner who can quickly adapt their thinking as the situation requires. Metacognition is necessary for lifelong learning and is essential in the development of professionalism. [5] An interesting difference between cognition and metacognition is that, while cognitive abilities decline at varying rates after a certain age, [6] metacognitive capabilities seem to remain. [7] Thus, senior surgeons with changing cognitive abilities would be expected to maintain and use metacognitive abilities to improve their performance in practice.

Lack of insight and metacognition

Some clinicians are poor at self-assessment and overconfident in their own levels of ability. Their ability may also be limited by distractions, fatigue or competing interests. Such a combination is often compounded by a lack of awareness (or acceptance) that there is a problem. In short, they lack insight. They don't know that they don't know; they are ignorant of their ignorance, making their decision-making error prone. Sometimes the inability of a clinician to learn how to make clinical decisions is not because they cannot learn, but because they are less able to appreciate the differences between their own performance and that of others. Fortunately, there is good evidence that increasing metacognitive capacity, their ability to understand and reflect on both the context of decision-making, and the underlying thinking processes they are

employing, can improve their overall performance. [8]

Improving metacognition

To achieve unconscious competence, you need to go to the next stage: knowing what you don't know. The fact is that most clinicians are not familiar with metacognition and may not be aware of how complex, overarching, and crucial surgical decision-making is. Even if they are aware of the complexity, most are unaware of how we process complex decisions. As a profession, we have not thoroughly tried to really understand how clinicians make or should make difficult decisions, why they sometimes go wrong and how experts sometimes make exceptionally smart decisions. Moreover, the efforts that the profession has so far taken to optimise decision-making have not yielded results. Despite this, some clinicians may still question the value of metacognition and improving decision-making. Clinicians make hundreds of decisions every day; it is a continual and deep-rooted aspect of the profession. Most are automatic and the vast majority do not result in problems. And even when there are problems, there are various factors other than the clinician's thinking that are usually held responsible. So, there are strong reasons why the decision-making process is not examined more closely, just as we don't pay much attention to other 'automatic' functions like breathing.

However, there is stark evidence that we do indeed need to improve both our individual and collective clinical decision-making:

- Clinical error is one of the **leading causes of death** in the developed world. [9]
- Clinical decision-making can be considered a **significant threat to the patient safety**. [10]
- More than 30% of healthcare **costs are wasted** on inappropriate care, and suboptimal care is increasingly connected to the quality of clinical decisions. Approximately 80% of healthcare expenditure results from clinicians' decisions. Therefore, improving healthcare necessitates improving clinical decisions. [11]
- Analysis of clinical decisions has revealed that a **significant number of errors** occur because of inappropriate thinking. [12]
- A**dverse events** are linked to failures in cognitive skills such as situational awareness and decision-making. [13]
- Following guidelines for interventions has been shown to improve patient outcomes and reduce costs, but **the degree of guideline implementation is variable**. For example, with hernia repair it has been found to be as low as 32% and an average of 65% of procedures. [14]

These studies make it clear that there is significant room for improvement when it comes to decision-making.

Medical training and professional development

Those who are responsible for training are often not aware of recent developments in

decision-making and how best to improve it. In the last few years training has moved away from immersion learning towards more formal, structured programs. Work schedules are regulated with a resulting reduction in clinical exposure. This loss of decision-making experience needs to be compensated by alternative methods. Also, reduced working hours means that trainees and trainers more frequently miss seeing the consequences of decisions they have taken. These factors make the need to actively teach decision-making even more important.

Despite their career-spanning importance, decision-making skills are also largely ignored in professional development, often only covered in an ad hoc and unstructured manner. Although clinicians are assumed to have learnt metacognitive skills through their career and how to learn via self-directed learning, there is ample evidence that this may not be the case. [15] Studies also show that metacognitive skills vary among clinicians, and unfortunately some find it very difficult to improve their skills. [16] Undoubtedly, there have been efforts to address the issue.

Articles and books have been written on this subject. In the epilogue of one of those books, *Surgical Decision-making: Beyond the Evidence Based Surgery* by Rifat Latifi, the author writes:

If you thought that by the end of the book, you would understand entirely how surgeons make decisions, I'm afraid that you may not be fully satisfied. While we have explained several aspects of this complex issue, much remains unknown, and further work is required. This work should be done by surgeons in collaboration with those trained to understand the mind, how the brain works and how the brain can be directed or trained. [17]

In a sense, what the author raises only at the end of his book – psychological factors – are the focus of this article: what can "those trained to understand the mind, how the brain works and how the brain can be directed or trained," tell us about clinician's decision-making? The lateness of our profession to acknowledge the importance of psychological factors has parallels with the history of aviation safety, where 'human factors' were only identified as key contributors to aviation accidents after decades of focusing predominantly on technological improvements. But once they were recognised as a key cause of accidents, aviation safety improved significantly with the implementation of training and protocols that addressed human factors, such as checklists. [19]

Although we are in serious need of a similar 'human factor' revolution in understanding and reducing clinical error, we also require solutions that address 'intra-human' factors, i.e., cognitive factors. As the author suggests, to optimise decisions, we need to understand what and how clinicians think while decisions are made. Other professions have made significantly more headway in this direction, including marketing and the financial sector, and a new discipline of 'decision science' has developed.

Decision Science

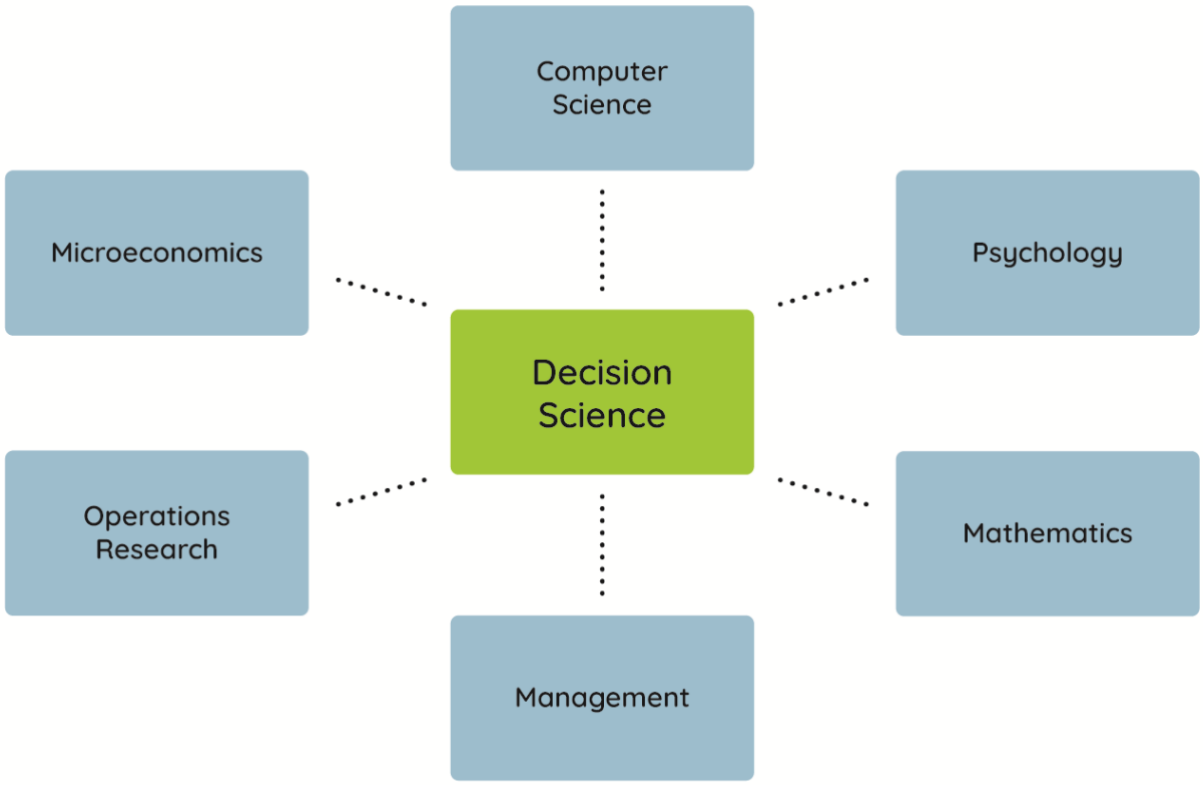

Fig 3-Contributing faculties of decision science.

Decision science has helped to unravel how decision-making works using a multidisciplinary approach incorporating information technology, mathematics, economics, and psychology (**figure 3**). It has provided new evidence for how decisions are made, how they can be improved, and it has demonstrated that decision-making is a skill that can and needs to be honed. Much of this new understanding is directly applicable to surgical decision-making, with exciting potentials for improving surgical performance.

Popular metacognition

If one is overconfident, or think we have more reliable information than we do, we run the risk of not changing our minds when we should to make the right decision. [19] On the other hand, if we are underconfident, we may remain indecisive even when the way forward is clear. More generally, poor metacognition can leave us stuck with decisions that we should have reversed or discarded long ago. Indeed, studies have demonstrated a direct link between metacognition and more careful, considered decision-making. [20]

Expert metacognition

It is not a chance observation that experts exhibit better metacognitive skills than nonexperts. What we don't know so far is if having metacognitive skills makes someone expert or if one gains such skills after becoming an expert; a 'chicken or egg' conundrum! Regardless, although some may have this ability naturally, most people need to nurture it to become an expert. By consciously understanding and improving our professional metacognitive skills, as all experts do, we are more able to identify our strengths and limitations precisely, find the most appropriate information and method needed to become an expert, thereby reducing the stress and time involved in achieving expertise. Moreover, metacognitive skills help to maintain the expertise. Indeed, some experts opine that maintaining expertise is more difficult than achieving it, as you are expected to handle more and more difficult cases as your reputation, and the stakes, increase.

Metacognition is also good for *you*, not just your patients!

So far, we have discussed the need for metacognition in decision-making in terms of patient outcomes. But there is another aspect that is even more important and underrecognized: the relationship between metacognition and a clinician's well-being. In over a decade working professionally with the mental well-being of surgeons and other specialist, I have seen serious consequences of poor metacognitive skills on doctor's health. Not only have patients lost their lives because of a suboptimal metacognition; doctors have also lost their own lives, too. No doubt these occurrences are rare but the stress around making decisions is certainly commonplace the stress of dealing with the consequences of decisions. The increased professional stress and burnout among doctors can be partly attributed to difficulties in decision-making and suboptimal metacognitive skills. It is not all a dark picture, of course. The satisfaction, relief, and pride one experiences after making a difficult but successful decision is a joy that is difficult to describe, and one can only understand by experiencing it. Again, metacognition plays a role in both negative and positive situations.

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Take-away points: *An introduction to surgical metacognition*

- There is concrete evidence that there are problems with clinical decision-making that contribute to poor outcomes.
- Experts are known to have superior metacognitive skills.
- Metacognition is a skill that needs to be developed like any other skill.
- Metacognition plays an important role in decision-making as well as mental well-being.

References

1 Marsh H. Better not look down…. The Psychologist. 2015; 28:466-469.
2 Medina MS, Castleberry AN, Persky AM. Strategies for Improving Learner Metacognition in Health Professional Education. Am J Pharm Educ. 2017;81(4):78. doi:10.5688/ajpe81478
3 Gonullu I, Artar M. Metacognition in medical education. Education for Health. 2014;27(2):225. doi:10.4103/1357-6283.143784
4 Chew KS, Durning SJ, van Merriënboer JJ. Teaching metacognition in clinical decision-making using a novel mnemonic checklist: an exploratory study. Singapore Med J. 2016;57(12):694-700. doi:10.11622/smedj.2016015
5 Mahajan R, Badyal DK, Gupta P, Singh T. Cultivating Lifelong Learning Skills During Graduate Medical Training. Indian Pediatr. 2016;53(9):797-804. doi:10.1007/s13312-016-0934-9; Gordon J. Fostering students' personal and professional development in medicine: a new framework for PPD. Med Educ. 2003;37:341–349.
6 Park HL, O'Connell JE, Thomson RG. A systematic review of cognitive decline in the general elderly population. Int J Geriatr Psychiatry. 2003;18(12):1121-1134. doi:10.1002/gps.1023
7 McGillivray S, Castel AD. Older and younger adults' strategic control of metacognitive monitoring: the role of consequences, task experience, and prior knowledge. Exp Aging Res. 2017;43(3):233-256. doi:10.1080/0361073X.2017.1298956
8 Crebbin W, Beasley SW, Watters DAK. Clinical decision-making: how surgeons do it. ANZ J Surg. 2013;83(6):422-428. doi:10.1111/ans.12180
9 Makary MA, Daniel M. Medical error: The third leading cause of death in the United States. BMJ. 2016; 353: i2139.
10 Tehrani ASS, Lee HW, Mathews SC, Shore A, Makary MA, Pronovost PJ, Newman-Toker DE. 25-Year summary of US malpractice claims for diagnostic errors 1986–2010: An analysis from the National Practitioner Data Bank. BMJ Qual Saf. 2013; 22(8): 672–680.)
11 Djulbegovic B.; Elqayam S. Many faces of rationality: Implications of the great rationality debate for clinical decision-making. Journal of Evaluation in Clinical Practice; Oct 2017; vol. 23 (no. 5); p. 915-922)

12 Graber ML, Franklin N, Gordon R. Diagnostic error in internal medicine. Arch Intern Med. 2005;165:1493 –1499.
13 Leape LL, Brennan TA, Laird N, *et al*. The nature of adverse events in hospitalized patients—results of the Harvard Medical Practice Study II. N Engl J Med. 1991;324(6):377-384.
14 Hargreaves J. Do Clinical Guidelines for Hernia Surgery Reduce Costs and Improve Patient Outcomes, and Do Surgeons Follow Them? Value in Health. 2015;18(7):A570-A571. doi:10.1016/j.jval.2015.09.1881
15 Burman NJ, Boscardin CK, Van Schaik SM. Career-long learning: relationship between cognitive and metacognitive skills. *Med Teach. 2014*; 36:715–723.
16 Mack HG, Spivey B, Filipe HP. How to Add Metacognition to Your Continuing Professional Development: Scoping Review and Recommendations. Asia Pac J Ophthalmol (Phila). 2019;8(3):256-263. doi:10.22608/APO.2018280
17 Latifi R. *Surgical Decision Making: Beyond the Evidence Based Surgery*. Springer International Publishing; 2016.
18 Gawande A. *The Checklist Manifesto How to Get Things Right.* Metropolitan Books; 2010.
19 Fleming SM. *Know Thyself: How the New Science of Self Awareness Gives Us the Edge.* John Murray; 2021: 138–139.
20 Rollwage M, Dolan RJ, Fleming SM. Metacognitive Failure as a Feature of Those Holding Radical Beliefs. Curr Biol. 2018;28(24):4014-4021.e8. doi:10.1016/j.cub.2018.10.05

Peer Reviewer Comments

1. *On metacognition – more detail?*

Metacognition is the capacity to reflect on and evaluate cognition and behaviour. It is self-awareness. It has a long research history in psychology and learning sciences and the message here is that it needs to be explicitly designed into training curricula and taught. Surprisingly though, little is reported in the text on *how* to do this. Sharing explicit insights from the book would be helpful. What evidence-based additions to current knowledge does the book submit?

On this last point we already know that:

- Techniques that may improve metacognition include awareness of and instruction in what it is, awareness and mitigation of cognitive errors, appropriate needs analysis, and choosing appropriate activities.
- Research has provided a growing body of behavioural and neuroimaging evidence that there is considerable overlap between the mind's eye and actual perception and that mental imagery are characteristic traits of expert surgeon rehearsal routines. [2]
- Mental imagery is a multimodal cognitive simulation process that enables us to represent perceptual information in our minds in the absence of actual sensory input.
- Cognitive and metacognitive skills do not correlate; and orientation toward Life-long learning does not predict metacognitive skills[3]
- Metacognition and learning of new surgical techniques has examined the role of portfolios, and the role of the educator supervisors. The evidence base for these is not strong however, and it is usually extrapolated to CPD activities from other fields.

More details about what works for whom and in what contexts would be enlightening for readers

1. *Points of contention*

The references to Human Factors. Erg in the synopsis may give a skewed idea of its scientific contribution to metacognition in healthcare settings. This is because it excises the 'human' from the 'system'. Key concepts such as 'situational awareness' are also 'social constructs' requiring team input. That is, contributions to metacognition can be facilitated socially and are not exclusively in the mind of the surgeon. Furthermore, a systems approach also frames metacognition within the context of effective workplace design, and the ergonomics of instruments, medical devices and organisational cultures. Put simply, 'human error' is *not* a cause of failure but a symptom of failure. This is a key human factor science message and deserves more clarity. Does the book address these issues and how? . Metacognition is never in a vacuum[4].

References

1.Gawande A. *The Checklist Manifesto: How to get things rights*. Profile; 2011.

2. Snelgrove H, Gabbott B. Critical analysis of evidence about the impacts on surgical teams of 'mental practice' in systematic reviews: a systematic rapid evidence assessment (SREA). *BMC medical education*. 2020;20(221)doi:https://doi.org/10.1186/s12909-020-02131-3

3. Burman NJ BC, Van Schaik SM. Career-long learning: relationship between cognitive and metacognitive skills. *Medical teacher*. 2014;36(8):715-23.

4. Carayon P WA, Hoonakker P, Schoofs Hundt A, . Kelly MM. SEIPS 3.0: Human-Centered Design of the Patient Journey for Patient Safety. *Applied Ergonomics*. 2020;84:1-23. doi:doi:10.1016/j.apergo.2019.103033.