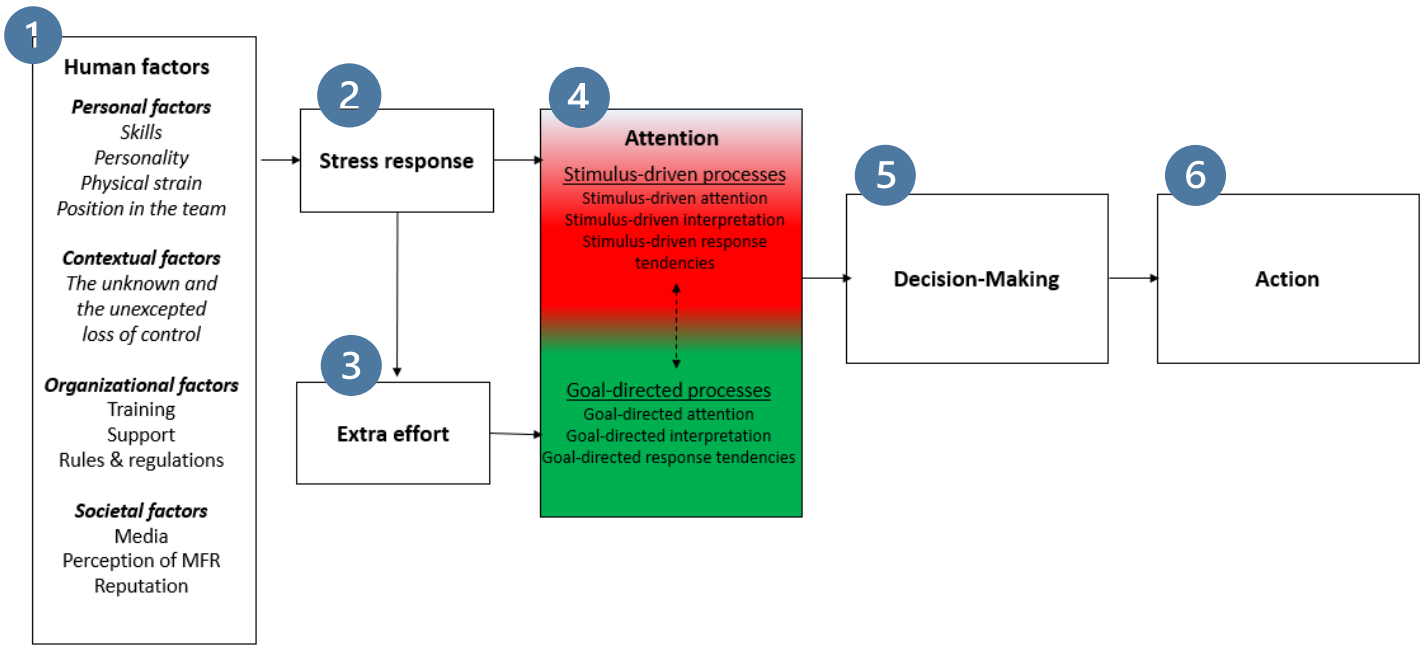
FACTSHEET – Scientific Model

Med1stMR is an end-user-oriented research project. The combination of technology, end users and research need a profound backbone on different levels. One is delivered by the scientific model of MED1stMR. It serves as the foundation for understanding how **medical first responders (MFRs) act under stressful circumstances**. This model includes not only general physiological stress-response models but combines them with psychological mechanisms to fully account for differences in **effective performance in medical emergencies** (EPME). The validation of the model will directly influence the adaptions made in the MED1stMR technology solution – the mixed reality training tool.

The EPME model represents a causal chain model that explains how the stress experienced during medical emergencies can lead to changes in the **attention**, **decision-making**, and **action** of an MFRs Specifically, the model consists of three main elements that directly interact with each other following the exposure to the stressor. In short, **human factors interact with the potential stressor** to evoke or buffer against a stress response. This stress response, in turn, may elicit extra mental effort. Together, the stress response and the increased effort cause alterations in the attentional processes, which influence the decisions that the MFR makes, and what actions are taken.

Stress can consequently lead to less effective actions, which are also executed less optimally and a mental overload of the executing medical first responders. Therefore, training needs to increase perceived coping resources or the effective implementation of extra effort. Additionally, psychological skills, such as mindfulness may also help a MFR to redirect their attention, while breathing exercises can help to buffer the immediate physiological responses.



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1 Human Factors

When the demands of a situation (e.g. the incident) exceed the available coping resources, a person experiences stress, which leads to various physiological responses. Human factors influence this. **The different and individual composition of human factors cause an individual perception of stress for each human being**.

- Personal – e.g. characteristics, skills etc.
- Contextual – situation dependent e.g. patient demographics, available resources on site etc.
- Organizational – administration body where the MFR works (rules, guidelines etc.)
- Societal – media, reputation etc.

2 Stress Response

Stress is conceptualised as a dynamic process that unfolds over time. First, a person is exposed to a potentially **threatening stimulus** and then the person **reacts** (physiological changes like elevated breath rate and emotional response) and finally **recovers** to the previous stage.

3 Extra Effort

The potential negative effects of stress, such as heightened anxiety can be combated with **intentional behavioural changes**. A central feature of the EPME model for this is extra effort. Specifically, extra effort **may help** to either **reduce stress** directly or to **maintain goal-directed** behaviours and suppress impulsive actions. However, it should be noted that spending this extra mental effort to maintain control is not sufficient to combat the negative impacts of stress. Therefore, specific training is required to properly react under stress.

4 Attention

Broadly speaking, attention reflects the process of **selecting the stimuli in the environment** that are chosen to engage with and the stimuli which are to be ignored (to reach a desired end state). We distinguish between stimulus-driven processes (reaction to environment) or goal-directed processes. The aim is to **get the trainee in the goal-driven mode** and being focused but relaxed instead of stimulus-driven and distracted. A certain level of focus caused by relevant stimuli is desired, but balance is the key and focusing on task-irrelevant stimuli can lead to a higher stress perception.

5 Decision-Making

Depending on the information that is attended to (goal-directed or stimulus-driven), MFRs engage in the decision-making process. Translated to the context of MFRs, a prime example for decision-making is the triage process. Ideally, an MFR is trained to accurately assess the relevant categorisation information and adequately evaluate the patient's condition. However, **if an MFR experiences high levels of stress, they may become distracted by irrelevant stimuli** (e.g., non-fatally bleeding wounds) and thereby delaying the decision-making process and increasing the chance of making the wrong decision due to the distractions.

6 Action

Once a decision for a particular action is made, the according **movement pattern** is executed. Because high levels of stress change the blood flow and muscle activity, the resulting movement execution **diverts from the usual pattern**. Specifically, movements become **less precise** (for fine motor skills), **more explosive**, delayed, less fluent, and more rigid. This means that stress first drives the attention away from relevant cues. This in turn influences what decisions can be made based on the available information. And finally, the execution of the decisions also becomes disrupted due to decreases in motor patterns.

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