Intensive Care Med (2017) 43:1392–1394
DOI 10.1007/s00134-017-4724-1

WHAT'S NEW IN INTENSIVE CARE

Evidence or belief-based medicine? Ten doubts

Luciano Gattinoni[1*], John J. Marini[2] and Michael Quintel[1]

Our practice of medicine is based on beliefs, which are the positive mental attitudes towards the likelihood of something being true or, better yet, of advantage for patients, with or without evidence that this is the case. Beliefs that have been substantiated by convincingly supportive clinical data form the core of 'evidence-based medicine'. Unfortunately, such evidence contributes to only a fraction of our beliefs. Among the hundreds of factors which condition those beliefs, we briefly discuss the ones we consider more relevant in intensive care.

As shown in Table 1, our beliefs originate from different sources. It is easier to believe concepts published in high-impact factor journals, presented by fascinating speakers and continually repeated during meetings and congresses. These factors obviously increase the credibility of these beliefs up to the point where they are weighed as 'proven'. Direct experience further contributes to the evolution our beliefs, corroborating or dampening them, as do the characteristics of the individual's personality, more or less compliant in accepting or rejecting 'prepackaged' truths. Finally, such extra-medical factors as workload and cost may deeply influence our beliefs and practices. Therefore, it is interesting to consider how several beliefs in intensive care expand well beyond their scientific 'evidence'. Within this framework, we would like to question some general accepted beliefs, which belong to three categories:

- Common beliefs generated by stereotypical repetition of the same concept, despite the absence of solid supporting proofs.
- Common beliefs (positive or negative) supported by randomized clinical trials.
- Common beliefs immediately accepted because of 'extra-medical' factors.

Common beliefs without support

1. The most spectacular example in this category is that sepsis is a disproportionate host response to an infection. This fascinating theory was expressed by Sir William Osler in 1904 and has been continuously repeated until it has become a 'dogmatic' statement. Hundreds of trials have been performed to block/dampen the host response through different pathways. Yet, not one of these consistently improved the outcome. The common reaction to these negative trials is that the population was wrongly selected or that the timing of intervention was inappropriate. This may be true, but after hundreds of experiments that contradict the hypothesis, it may be time to consider that the common belief is wrong, and that new theories and hypotheses should be proposed.

2. Another common belief is that atelectrauma is a major cause of ventilator-induced lung injury. Actually, all clinical trials testing PEEP levels around 5 cmH_2O (expected high atelectrauma) versus PEEP levels around 15 cmH_2O (expected lower atelectrauma) have been negative, counter to the hypothesis. The common reaction to these trials (including a personal one [1]) has been that the enrolled populations were inadequate in number or inappropriately selected. This may be true, but we have increasing doubts. In daily practice, PEEP around 10 cmH_2O is used even in severe ARDS [2]. Does this practice reflect experience challenging the common belief?

Common beliefs supported by clinical trials

The 'high-quality multicenter randomized clinical trials' (often described as such by the authors of the trial itself)

*Correspondence: gattinoniluciano@gmail.com
[1] Department of Anesthesiology, Emergency and Intensive Care Medicine, University of Göttingen, Robert-Koch-Straße 40, 37075 Göttingen, Germany
Full author information is available at the end of the article

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Table 1 Factors conditioning our beliefs in intensive care

Individual	Community
School/university education/mentors	Guidelines (from expert opinions, clinical trials, meta-analyses,…)
Continuous medical education: Literature (quality of journals) Congresses (quality of speakers) Clinical rounds (quality of the team)	Opinion leaders Number of 'believers'
Direct experience	Clinical practice surveys
Personality (more or less interested/compliant/rebel)	Economic pressure (convenience): Amount of work (intellectual/practical) Costs

are the foundation of evidence-based medicine. If they are positive, it is difficult to deny the truth of the tested common belief. In contrast, if they are negative or inconclusive, the results may be questioned, as they may reflect either a wrong starting hypothesis or misconduct of the trial [3, 4]. Unfortunately, negative and positive trials are often considered of equal value in the corpus of the evidence-based medicine.

3. The results of positive trials, such as that comparing 12 versus 6 ml/kg tidal volume ventilation in ARDS, should be considered within the experimental limits they tested, avoiding their extension beyond them. The advantage of 6 ml/kg has been translated into the common belief that the lower the tidal volume, the better the outcome; therefore, 4 ml/kg (or even lower with extracorporeal CO_2 removal) should be better than 6 ml/kg. Possibly true. Yet, such an 'ultraprotective ventilation' strategy [5] may lead to worsening hypoxemia due to reabsorption atelectasis that encourages a boost of inspired oxygen into a potentially toxic range or, more appropriately, a compensatory reset of mean airway pressure.

Negative trials leave room for doubts stemming from the lack of biological plausibility, problems with enrolment or ineffective study design.

4. The three randomized studies of early goal-directed therapy (EGDT) [6–8] are excellent examples, in our opinion, of inadequate design failing either to support or disprove the hypothesis. The 'Rivers trial' in patients with severe sepsis used a ScvO2 value of 70% as a target for hemodynamic interventions, and found an impressive improvement of outcome [9]. The 70% target value was chosen as the indicator of adequate balance between oxygen supply and consumption. The average ScvO2 baseline value of the 'Rivers' patients was below 50%, clearly indicating a severe imbalance between oxygen supply and consumption. The more recent three trials used the same ScvO2 target as in the 'Rivers trial'. However, the baseline ScvO2 of the patients enrolled in these studies was around 70%, clearly indicating that an imbalance between oxygen supply and consumption was not present at the outset. Not surprisingly, the results of these trials were 'negative', leading to the questionable conclusion that targeting ScvO2 is useless.

Common beliefs and economic pressure

Such 'extra-medical' factors as workload and cost help to explain why the results of some studies were easily and universally applied, while others (based perhaps on more solid scientific background) have never been implemented.

5. An observational study in 1996 concluded that the pulmonary artery catheter (PAC) was associated with higher mortality and higher utilization of resources [10]. This influential paper eventually led to the abandonment of the PAC, an action which was aided by the rise of non-invasive ultrasonography and was attractive for three reasons: less practical work to insert the catheters, less intellectual effort to interpret the results, and (apparently) lower costs. Data obtained from the PAC, however, are often still useful and sometimes fundamental to appropriate care.

6. Tight glycemic control [11] is one of the best examples of the immediate impact that a paper may produce on our beliefs and clinical practice. Soon after its publication, clinicians started to apply the findings to practice for diverse, untested populations and industry invested in technical solutions.

7. In contrast, selective decontamination, described decades ago [12] and demonstrated effective in dozens of studies, has never been widely adopted outside the Netherlands. We believe that the different rates of acceptance of these strategies have little to do with the scientific merit of the proposals (we are not discussing that here), but primarily with 'extra-medical' factors.

Indeed, tight glycemic control was published in the *New England Journal of Medicine*; its application was easy to understand and the workload costs were limited.

In contrast, the selective decontamination approach was first published in the *Acta Anaesthesiologica Belgica*; its application was quite difficult to master, the workload was quite significant and the costs were not irrelevant.

8, 9, 10. Prone positioning [13], extracorporeal support and transpulmonary pressure measurement are three further examples of how 'extra-medical' factors may impact our beliefs and readiness to adopt. Prone positioning, a relatively safe procedure which reduces mortality by ~10% in severe ARDS [13], is used only in 16.3% of the ARDS patients for which it is indicated [2], likely due to the nursing skill and workload required for its implementation. In contrast, despite a relative lack of evidence for survival benefit and the real hazards it carries, extracorporeal support is increasingly used, at least in part incented by the economic advantage of doing so [14]. Despite clear indications [15], very few clinicians measure the transpulmonary pressure for the prevention of ventilator-induced lung injury, as it requires conceptual understanding, careful interpretation and a practical workload.

It is not important what we personally believe or not, but it is important for us all to understand how our beliefs are formed and transmitted into our practices. Indeed, as human beings, several factors other than logic and science influence our minds and condition our practice. It is sometimes necessary to question and understand what is the real scientific content that underpins our practice of intensive care.

Author details
[1] Department of Anesthesiology, Emergency and Intensive Care Medicine, University of Göttingen, Robert-Koch-Straße 40, 37075 Göttingen, Germany.
[2] University of Minnesota, Minneapolis, Saint Paul, MN, USA.

Acknowledgements
We thank Prof. Pierpaolo Giomarelli for the constructive discussions we continuously have on these issues.

Compliance with ethical standards

Conflicts of interest
On behalf of all authors, the corresponding author states that there is no conflict of interest.

Received: 22 January 2017 Accepted: 11 February 2017
Published online: 24 February 2017

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