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Editorial

Quality Indicators in Critical Care

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Editorial

Quality indicators (QIs), sometime indicated as "performance indicators", were first introduced in 1970 in the USA in order to asses in a reproducible and objective way the performance of higher education institutions and are now widely used by corporates and public utility management to evaluate various aspects from production to customer satisfaction [1,2]. When appropriately used, QIs can contribute to increase quality of goods and services, customer satisfaction and to improve cost effectiveness [2].

In medicine, according to the US agency for healthcare research and quality, QIs are: "standardized, evidence-based measures of health care quality that can be used with readily available hospital inpatient administrative data to measure and track clinical performance and outcomes" [3]. Accordingly, medical QIs can address 4 aspects of clinical practice: prevention, intended to evaluate hospital admissions that might have been avoided; inpatients-treatment, which include mortality indicators, utilization indicators, and volume indicators; patient safety, to identify potentially avoidable safety events; pediatric-treatment, to address safety issue specifically for the children care [3,4]. Appropriate selection of medical QIs is complex and depends on the setting and the purpose they are intended to be used for, this is even more complex in critical care medicine where "case load" (selection of patients admitted), "structural" features (technology and staffing) and the role of each individual "professionalism" (quality and commitment) play a substantial role [5-7]. An alternative paradigm for QIs is resilience engineering, a fairly novel discipline, envisioning the need for more systemic approach in settings such as critical care departments [8]; for example, a set of systemic indicators have been proposed to match structural needs (e.g. management pressure) with process issues (e.g. communication deadlock among personnel involved) [9].

In the last decade, 13 countries (Australia/NZ, Austria, Canada, Denmark, Germany, India, Ireland, Netherland, Norway, Scotland, Spain, Sweden and UK) have published a list of nationally qualified critical care QIs in order to optimize resources utilization in healthcare [10]. Various and different QIs have been listed (from the 7 of Norway to the 58 of UK) that include substantial differences on variables and typology; for example QIs are categorized into 3 major groups: structural/organization-related, i.e. the attributes of the settings in which care is provided (personnel, facilities etc.); process-related, i.e. the activities of the practitioner and how are accomplished; outcome-related, i.e. the change in health status of the patient [11].

Because of this considerable heterogenicity in critical care's QIs, a rational selection is extremely complex and controversial and indeed only a small number of quality indicators with strong supporting evidence could be considered for adoption into clinical practice [12].

In 2012 the European Society of Intensive Care Medicine (ESICM) selected on the basis of available literature 111 QIs and chose –according arbitrary an expert opinion- 9 QIs criteria: 3 structural (if ICU fulfills national requirements, presence of 24-h consultant level intensivist and adverse event reporting system); 2 process (presence of routine multi-disciplinary clinical ward rounds and standardized handover procedure for discharging patients); 4 outcome (ICU readmission <48h, rate of unplanned extubations, the rate of central venous catheter-related blood stream infection and standardized mortality ratio) to be tested for quality of care and better patients outcome [13].

"Structural/organization QIs" are generally defined at political level and often are limited by the availability of economic resources, thus allowing little room for doctors and medical personnel to intervene in their selection [5]. "Outcome QIs", when measured to evaluate the ICU performance are frequently biased by case load criteria, thus inducing the paradox of better outcome in those unit that poorly define admission criteria [6,10]. "Process QIs" are often in the range of individual commitment and professionalism. Those "process QIs" proposed by ESICM (presence of routine multi-disciplinary clinical ward rounds and standardized handover procedure for discharging patients), can certainly contribute to improve the delivered quality of care, but seems rather to relate to structural/organizational features rather than actual "process control" [11].

As possible "process QIs" it is important to focus on specific aspect of the clinical management in ICUs like: titration of the continuous infusion vasoactive drugs, expressed by the ratio between the number of hours of infusion and the delivered changes in dosing; optimal O_2 administration avoiding hyper or hypoxia, expressed by the values of PaO_2; adequate nutrition and blood glucose management, expressed by blood glucose concentration (BGC) and hours from first nutrition; and also clinical research activity (as number of research protocol ongoing and year/publication) can possibly be included among "ICU process QIs" [14].

The use of short acting vasoactive drugs (dopamine, nitrates, etc.), that are among the most used and abused drugs in critical care [15], can provide a meaningful indicator of delivered quality of care and be used as QIs: to reach and to maintain a clinically defined hemodynamic endpoint during the stay in ICU can influence survival and complications rate of treated patient, and considering the inter-individual variability in response to vasoactive drugs and the evolving

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clinical conditions it is of paramount importance to clearly define a tailored end point and to titrate the infusion accordingly [16]; these adjustments should prevent pressure extremes that can cause severe harm even in a short time. At the same time the collateral effects associate to the vasoactive drugs can be minimized [15,17].

Therapeutic O_2 delivery is associated with higher mortality when inappropriately excessive [18]. For patients that stay in critical care >72h a "conservative" PaO_2<100 mmHg is associated with better survival rate than the "traditional" approach that often imply to deliver PaO_2>100 mmHg, indeed the patients with the latter have a double mortality than the first approach [19]. Furthermore, excessive O_2 has also harmful effects on neurocognitive functions caused by the neuroinflammation secondary the hyperoxia, generating in some subjects a condition with symptomatology and a cortical degeneration comparable to the one of Alzheimer's disease [20]. Therefore, the correct management of the O^2 administration with regular controls and monitoring has also a critical role in the quality of care provided to the patient [18].

Appropriate and early nutritional support and optimal BGC management, as proven by recent evidence, can improve survival rate and shorten length of stay of ICU patients [21-23]. The relationship between BGC and mortality in critical care treated patients has an "U-shaped" curve, with lower (<80 mg/dL) and higher (> 180 mg/dL) BGC values associated with higher death rate, and it is has been demonstrated that even a unstable glucose blood concentration it is linked to a higher ICU mortality [22]. Therefore, preventing hypoglycemia hyperglycemia and swings in BCG can also effectively contribute to reduce the length of stay and ICU costs [21].

Last but not least for importance, the active role in producing clinical research (that can be evaluated by the number of active research protocol and the ratio publication/year) can serve as QIs in critical care; active research groups within the personnel have been linked indeed to a higher expertise and consequentially quality of care provided [24,25].

In conclusion, in a sensitive setting as critical care medicine that absorb a huge amount of economical and professional energies, it is extremely important to define criteria that can serve to address and –when possible- to improve the quality of delivered care. We have proposed 4 simple criteria that can be easily included in the everyday practice to address the delivered care and to provide quantitative feedback to intensive care medical team.

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