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The continuing imperative to measure workload in ICU: impact on patient safety and staff well-being

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The twin challenges of an increasingly co-morbid but more easily rousable patient population arguably increase workload for all professionals providing critical care. Over the past two decades there has been a greater focus on measuring workload for ICU nurses than for physicians [1]. At the same time evidence has been building of the impact of excess workload on patient safety, although it is also clear that high workload does not ‘ipso facto’ result in decreased safety [2]. Hence there is clearly some interaction of factors that changes an ICU with a high workload from a safe to an unsafe environment for patients.

Added to this complexity is the lack of agreement on what constitutes workload, ranging from the deceptively simple ‘capacity to respond’ [3] or ‘cost of accomplishing a task’ [4] to the detailed definition of ‘a multidimensional and complex construct, that is affected by external

task demands, environmental, organizational and psychological factors, and perceptive and cognitive abilities’ [5]. The notion of cost is reflected in the three imperatives for studying workload: patient safety costs, staff well-being costs and service provision costs.

The impact of ICU workload on safety indicators is evidenced in studies investigating infection rates [6, 7] and medical errors [8] whilst attempts to find associations between nursing workload and patient mortality have yielded contradictory results [9, 10]. However, it is clear that patient volume can also have a positive effect on patient outcomes [11].

There is enduring evidence of links between workload and stress [10, 12, 13], both in terms of volume of work and the type of patients managed. The Conflicus study investigators found greater conflict between staff when nurses and physicians had been caring for dying patients or providing pre/post mortem care within the last week [14]. Physiological measures known to be sensitive to stress (such as heart rate, pupil diameter and respiratory rate) are used in some studies as indirect measures of workload [15], indicating an expectation that higher workload equates with higher stress.

Workload can be measured from the perspective of the tasks/patients or the ‘worker’ [1, 15]. The patient-based approach uses two methods: the dependency method, for example nurse to patient ratio and patient acuity, which is often undermined by use of a ‘fixed’ approach such as 1:1 or 1:2 to staff all beds in a unit, or the activity method, which examines time spent on patient activity as a percentage of total time, using measures such as TISS-28 [16] or the nursing activities score (NAS) [17]. Both of these patient/task-based approaches are used for organising tasks, deciding on the staffing establishment and coping with patient severity and patient turnover. This approach is driven by increasing effectiveness and efficiency, with the goal of decreasing unnecessary nursing costs. Debergh and colleagues [18] report on the use of

NAS to delineate between the workload of different shifts; in an increasingly cost-conscious environment, this is an important further piece of the workload puzzle, with shift work potentially impacting on patient safety and staff well-being, as well as the more obvious financial costs. However, the ability to take account of unit-based factors influencing workload remains unsolved and is necessary before these data can be used for comparison across units, a key consideration in an increasingly 'benchmark-orientated' health-care environment.

The worker-based approach takes the experience of the ICU nurse into account and is generally used for conceptual work, rather than for day-by-day staffing decisions; the purpose of this approach is to determine the amount of nursing effort resulting from each activity, examine causes of high workload and compare interventions for managing workload. Attempts to apply this type of measure on a routine basis have led authors to describe workload as 'uncountable' [19].

In an attempt to move this type of measurement forward, a 'worker-based' workload measure developed 20 years ago for aviation (the NASA task-load index—NASA-TLX) was applied to ICU nursing workload [15]. The NASA-TLX contains workload dimensions grouped into six domains: mental demand, physical demand, temporal demand, frustration, effort and performance; hence, it was felt by the research team (a combination of

ICU and aviation experts) to encapsulate the complexity of ICU nursing workload. As part of the analysis, they compared this operator-based tool with two patient-based tools (nurse to patient ratio and NAS) and demonstrated at best a moderate correlation (NASA-TLX with NAS: $r = 0.45$, $p < 0.01$) or no correlation (NASA-TLX with nurse to patient ratio: $r = 0.10$, $p > 0.05$). This indicates that they are measuring different constructs and emphasises the need to continue with these parallel approaches to workload measurement.

The paper by Debergh and colleagues [18] sheds light on a previously ignored but important aspect of workload—comparison across shifts; the usefulness of this approach will only be evident when units replace a global nurse to patient ratio with some form of workload tool to plan staffing.

It is likely that ICU in the future will entail "application of more complex and costly procedures to an increasingly fragile population, where complications will have greater consequences due to increasingly narrow cost-effectiveness margin of interventions" [20]; hence, the spotlight will continue to fall on the most expensive ICU resource—nurse staffing. We need to continue to explore workload from the patient-based and worker-based perspective to improve both the way in which we staff ICUs and our understanding of sources of workload and ways in which excess workload can be ameliorated.

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