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Loud and Clear: Sensory Impairment, Delirium, and Functional Recovery in Critical Illness

Numerous landmark studies confirm the profound impact that critical illness and intensive care have on the long-term health of patients and their families (1, 2). This so-called "post–intensive care syndrome" manifests itself through increased risks of mortality and disability after discharge as well as through neuropsychiatric sequelae afflicting patients and caregivers alike (2, 3). As our population ages, the toll of critical illness on the most vulnerable—elderly patients who consume a growing proportion of intensive care unit (ICU) services—is expected to further increase (4). It comes as no surprise then that diverse stakeholders are eager to uncover the mechanisms of post-ICU disability and identify interventions to attenuate their long-term impact (2).

In this issue of the *Journal*, Ferrante and colleagues (pp. 299–307) help to highlight potential clinical targets for improving functional outcomes by identifying patient factors associated with post-ICU functional recovery in the Precipitating Events Project (PEP) (5). The PEP study was an impressively detailed long-term study of 754 elderly and initially nondisabled patients followed prospectively from 1998 with comprehensive home-based assessments at 18-month intervals for 180 months. In addition, investigators conducted monthly phone-based assessments of functional status based on 13 activities (e.g., needing assistance with bathing or managing finances) for up to 14 years. By 2012, a total of 218 ICU admissions, involving 186 participants, were eligible for analysis and included patients who survived hospitalization, were alive for at least one posthospital functional assessment, and also exhibited worsened post-ICU disability. The authors evaluated the association between post-ICU functional recovery and 21 potential *a priori* predictors.

Functional recovery occurred after the majority (52.3%) of ICU admissions evaluated in the study. When recovery occurred, it came at a median of 3 months after the ICU episode. That most elderly patients who survived the ICU recovered within a relatively short interval could be seen as providing a great measure of hope. Factors positively associated with recovery included higher body mass index and functional self-efficacy (a measure of confidence with performing certain activities), whereas factors negatively associated with recovery included significant prior weight loss, frailty, low physical capacity, and increased disability from baseline.

Perhaps the most intriguing finding in this study is that elderly patients with a history of hearing or visual impairment had greatly worsened odds of functional recovery. The authors posit that uncorrected sensory impairment leads to increased delirium; delirium then adversely affects hospital outcomes and subsequent recovery. This explanatory model has considerable appeal because it points to modifiable factors that may impact a large number of patients; for example, at least half of patients in the study had baseline sensory impairment.

Additionally, the association between sensory impairment and delirium is well described and amenable to intervention (6). Inouye and colleagues demonstrated that a multicomponent intervention including elements specifically designed to address visual impairment (e.g., providing glasses and magnification aids or placing fluorescent tape on the call bell) and hearing impairment (e.g., providing amplification devices) significantly reduced the number and duration of delirium episodes in the hospitalized elderly (7).

A significant body of research further demonstrates that delirium is a potent risk factor for adverse outcomes during and after hospitalization (8). The incidence of delirium during a hospital stay can be as high as 74%, depending on the clinical environment studied (9). A recent metaanalysis of 42 studies found that delirium was associated with a doubling in the risk of hospital mortality as well as a significantly increased duration of mechanical ventilation and length of stay (10). Inpatient delirium is also known to impair cognitive recovery. At 6 months after cardiac surgery, significantly fewer patients who experienced delirium returned to their baseline cognitive function when compared with patients without delirium (11). Similarly, among patients with severe critical illness, a longer duration of delirium was associated with significantly worsened cognitive recovery at 1 year (12).

Although the explanatory model is appealing, and the corroborating evidence is compelling, the current study is ultimately limited in its ability to demonstrate the direct link between sensory impairment, delirium, and functional recovery. A primary challenge is the inability to reliably identify delirium either through clinical records or diagnosis codes due to the study's design; inconsistent identification and coding of delirium within medical records is common (13). Lacking this direct evidence, it is plausible that other potential mechanisms could contribute to the lack of functional recovery among patients with sensory impairment. Whether the type or degree of impairment impacts recovery also remains unresolved. Thus, further study is needed to clarify the potential mechanism that links sensory impairment and functional recovery in elderly ICU patients.

In the meantime, critical care clinicians must work harder to routinely address visual and hearing impairment in ICU patients. Without focused efforts, we often fail miserably to reliably provide

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patients with their basic assistive devices (14). In addition to suffering from delirium, patients in the ICU are also known to be at risk for developing post-traumatic stress disorder (3); it is not surprising that terrifying and disorienting experiences during critical illness are heightened when patients' sensory aids are unavailable to them (15). It is humbling that a modest intervention—providing visual or hearing aids—might significantly impact long-term patient outcomes. And with concerted efforts to improve, large gains in the provision of sensory aids in the ICU can be achieved (14). The benefit of providing these basic human necessities to our patients is becoming loud and clear. It is time we listened. ■

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Airborne Transmission of Viral Respiratory Pathogens
Don't Stand So Close to Me?

Airborne transmission via droplet nuclei has rightfully been called the "elusive pathway" of infection (1). With the exception of tuberculosis, airborne transmission was traditionally viewed as an uncommon and ephemeral phenomenon for many bacterial and viral respiratory pathogens. It remains controversial, too, with widely differing conclusions about its importance being drawn from the same studies (2, 3). The evidence to support either side of the airborne debate has been thin on the ground compared with the relative wealth of knowledge on hand hygiene and large-droplet precautions. This reflects the difficulty in sampling and growing microorganisms from the air, because they are present in very low concentrations compared with nonbiological particles, and it requires specialized equipment and a nuanced approach. For example, viable airborne *Pseudomonas aeruginosa* have been found in cough aerosols from patients with cystic fibrosis, with the levels related to the infectious burden. Such potentially infectious cough aerosols remain viable up to 4 m away and for up to 45 minutes (4). However, it is difficult to place these results in a meaningful context, as the infectious inoculum is unknown. This is a recurring theme in many studies of airborne transmission.

The prescient work of Dr. William F. Wells and his mentee Dr. Richard L. Riley on tuberculosis transmission in the post–World War II period (5) still underpins much of what we know about the mechanisms and modeling of airborne transmission. Despite the justifiably long shadow cast by their studies, progress has been sporadic since then. Regardless of one's interpretation of existing data on the relative importance of airborne transmission, it is hard to argue against the need for more good-quality experimental data.