

even predictions of drug shortages.<sup>9</sup> For example, during the peak of the coronavirus disease 2019 (COVID-19) crisis in April 2020, analysis of medication utilisation in one institution provided visibility of the dramatic increased use of critical care medications, and enabled that institution and drug manufacturers to anticipate increasing demand.

Aggregate data derived from medication infusion smart pumps is underutilised to enhance patient safety. The use of built-in institution-specific decision drug library support capabilities greatly diminishes accidental programming errors, but analysis of aggregate data from thousands of pumps has the potential to determine how often these safety mechanisms are bypassed. Electronic bidirectional functionality between the infusion pump and the anaesthesia electronic record has the potential to further reduce errors and provide tracking back to the patient in the event of a clinical complication. In addition to error reduction, analysis of aggregate pump data allows one to determine patterns of clinical care that might not otherwise be evident by individual chart review. Although anaesthesia has a long way to go to implement all aspects of the medication safety paradigms described above, analysis of aggregate infusion pump data represents another line of attack in the multifaceted approach that is the future of perioperative medication safety.

### Authors' contributions

Contributed to the ideas and written words contained within this editorial, and were involved in the editing and final approval: all authors.

### Declarations of interest

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## A call to action: evaluation of perioperative neurocognitive disorders in low- and middle-income countries

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Cognitive problems temporally associated with anaesthesia and surgery have been reported for more than 130 yr.<sup>1</sup> Since the mid-1980s research investigating these issues has grown exponentially. More recently, the possible overlap between the cognitive changes observed in the elderly associated with anaesthesia and surgery (perioperative neurocognitive disorders [PNDs]) and the cognitive changes occurring in older individuals in the community such as mild cognitive impairment (MCI) and dementia has gained traction, with the realisation that the two fields of research represent individuals from the same population.<sup>2</sup>

PNDs are rarely investigated in ethnically diverse populations with the bulk of the existing literature in English speaking, predominantly Caucasian, individuals. Thus, it is likely to be inappropriate to attempt to generalise the important findings of this research to ethnically diverse populations. In this issue of the *British Journal of Anaesthesia*, Amado and colleagues<sup>3</sup> investigate preoperative cognitive status in patients undergoing non-cardiac surgery at Chris Hani Baragwanath Academic Hospital in Johannesburg, South Africa. They use a structured question to elicit a subjective complaint of impairment from the patient and informant(s) where available, and the Mini-Cog for objective cognitive screening and the FRAIL (Fatigue, Resistance, Ambulation, Illness, and Loss of Weight) score for frailty.

PND including neurocognitive disorders (NCD) in the preoperative period, postoperative delirium (POD), and postoperative NCD are common disorders in those aged 65 yr or older and are associated with poor outcomes.<sup>2</sup> These are recent recommendations for nomenclature, and it will take some time for their implementation and interpretation to be fully reflected in the literature (Fig. 1). Individuals suffering from even subtle cognitive impairment before surgery are at substantially increased risk of an episode of POD, postoperative NCD, or both. Not only that, but an episode of delirium, in and of itself, is associated with increased risk of dementia, increased mortality and morbidity, increased risk of institutionalisation, and increased complications, all of which are associated with increased costs. Identifying those at risk of these poor outcomes before surgery is critical to developing strategies to reduce or prevent POD and postoperative NCD. Despite translation of the confusion assessment method for assessing delirium into more than 19 languages,<sup>4</sup> there remains little research investigating POD in culturally and ethnically diverse populations.<sup>5</sup>

There is a robust body of evidence confirming subtle cognitive impairment in the preoperative period is associated with increased risk of these poor postoperative outcomes. Work has been undertaken in several European and North American centres as part of the International Study on POCD (ISPOCD),<sup>6</sup> one of the first groups to provide a robust assessment for PND. Unfortunately, this work has been largely

confined to English-speaking individuals in high-income countries, so knowledge of the preoperative cognitive status of individuals from low- and middle-income countries (LMICs) is largely unknown. In older individuals presenting for elective surgery, previous work has found a prevalence of cognitive impairment of 24% using the same screening tool as that used by Amado and colleagues,<sup>3</sup> but a greater prevalence of 32% when a neuropsychological battery is implemented.<sup>7,8</sup>

Cognitive status is closely linked to increasing age and educational achievement. Education attained is often an effect of opportunity in LMICs. Disease burden is associated with increased risk of POD, and possibly longer-term postoperative NCDs. Given the impact of socioeconomic status on all these factors (except age), it is likely that PND are at least as prevalent in individuals in developing countries. Research investigating PND in Western countries generally uses age 65 yr or older as the threshold for increased risk of cognitive disorders, but a recent study reported a prevalence of subtle baseline cognitive impairment in 52% of vascular patients aged 50 yr or older,<sup>9</sup> highlighting the importance of co-morbid factors. Given that individuals in LMICs have a greater burden of disease at a younger age, it may be that research investigating PND in developing countries will need to consider a lower age threshold.

The work by Amado and colleagues<sup>3</sup> uses an age threshold of 60 yr or more and reports a prevalence of abnormal Mini-Cog scores in 57.2% of patients at baseline. Poorer Mini-Cog score was associated with lower education and unskilled occupation. A subjective memory complaint was made by 63.9% of patients and this was strongly associated with Mini-Cog score. Although an English-speaking cohort, these patients were mostly from a socially disadvantaged environment with a higher prevalence of low levels of education, and unskilled employment, than previous study populations in this field. This study emphasises the importance of socioeconomic factors on perioperative cognitive disorders, which are particularly relevant in LMICs. Non-surgical studies of rural South Africans have identified a number of socioeconomic predictors of lower cognitive scores, including amongst others, unemployment, low educational level, and low household wealth.<sup>10</sup> Education is an important modifier of cognitive impairment in this population.<sup>10</sup> Secondary education (8+ yr of schooling) results in a 25% reduction in the cognitive decline over 5 yr.<sup>10</sup> Furthermore, in a socially disadvantaged population, poor nutrition negatively impacts on cognitive function, and education also positively modifies this risk factor in rural South Africans.<sup>11</sup> The population described in the study by Amado and colleagues<sup>3</sup> is characteristic of patients at risk of food insecurity,<sup>12</sup> and after adjusting for confounders food insecurity is associated with MCI.<sup>12</sup>

The higher prevalence of cognitive impairment in the study by Amado and colleagues,<sup>3</sup> and the negative effect of

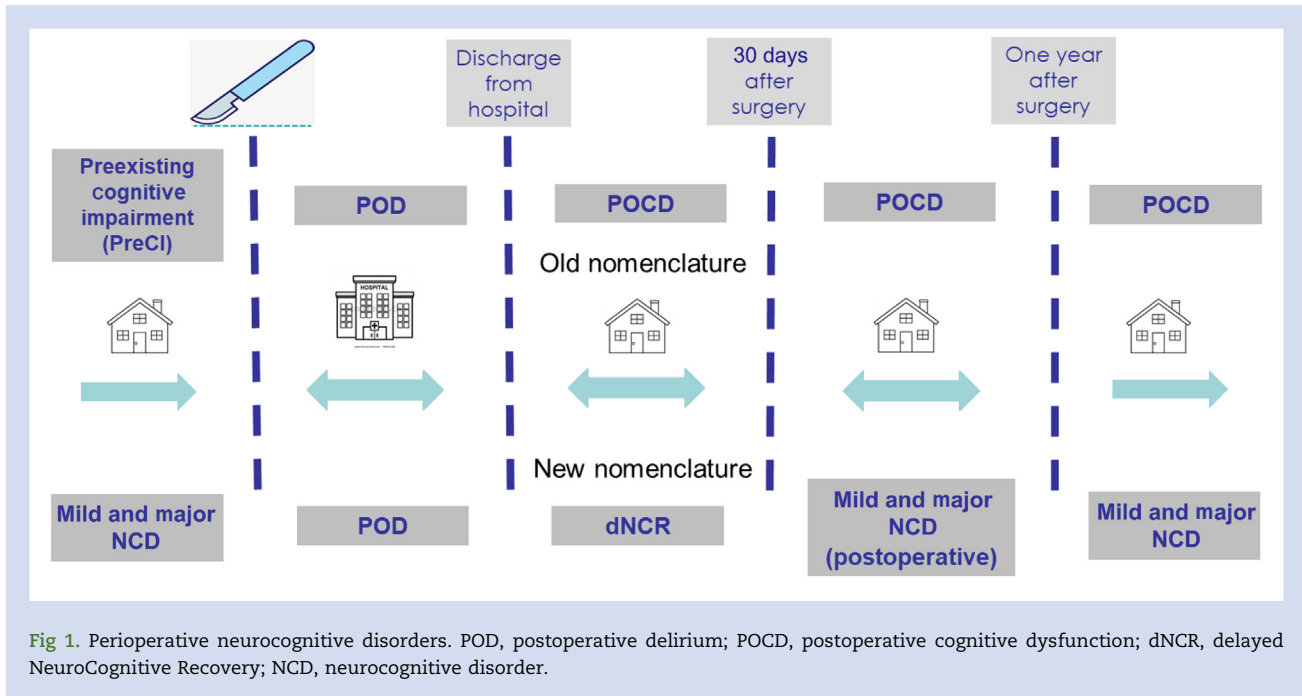


Fig 1. Perioperative neurocognitive disorders. POD, postoperative delirium; POCD, postoperative cognitive dysfunction; dNCR, delayed NeuroCognitive Recovery; NCD, neurocognitive disorder.

socioeconomic factors on cognitive impairment in LMICs, would suggest that a lower age threshold for preoperative cognitive assessment in these surgical populations should be considered.

Frailty is an area of increasing interest to perioperative medicine, with good evidence that more frail, older patients are at greatly increased risk of poor outcomes, including POD and postoperative NCDs.<sup>13</sup> It is reported to be present in more than 30% of individuals aged 65 yr or older presenting for elective surgery.<sup>14</sup> It is less well studied in ethnically and culturally diverse populations with Amado and colleagues<sup>3</sup> reporting pre-frailty or frailty in just more than 80% of their cohort. This is important information. Frailty is associated with cognitive impairment, and this is reinforced in this population by Amado and colleagues.<sup>3</sup> These findings also have important implications with respect to preventing further postoperative cognitive decline and POD.

Finally, this study has implications for preoperative consent for surgery in socially disadvantaged groups. A recent publication outlined the significant risks for patient and clinician when frail and cognitively impaired older individuals present for elective surgery, provide consent for surgery, but questions must be raised about whether this consent is informed.

There are several limitations to this study. Firstly, only English-speaking individuals were included, so although the population represents an ethnic and socioeconomic diverse population, they are not representative of the country where less than 10% of the population speak English as their first language. Secondly, the sample size is relatively small, although this is not dissimilar to other studies investigating preoperative cognitive impairment.

Overall, there is a significant lack of literature, and thus limitations in our understanding, of cognitive impairment, delirium, and frailty in LMIC populations. The work by Amado and colleagues<sup>3</sup> in this issue of the *British Journal of Anaesthesia*

is an important contribution to this field of research and demonstrates the necessity of further cognitive and frailty research in ethnically and culturally diverse populations, particularly from LMICs.

## Declarations of interest

The authors declare that they have no conflicts of interest,

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