surgery, such as trocar port infiltration, is not based on measured nociception values in either group. As this is one of the first studies on this topic, there is room for further clinical investigations exploring the impact of nociception monitoring on postoperative pain using different analgesic regimens.

Their last question is whether 'we believe there were false positive NOL index values, i.e. NOL index values above 25 despite adequate antinociception'. We have no indication that any of the NOL index values were falsely positive. The NOL is a validated parameter that is able to distinguish between no, mild, moderate, and intense noxious stimuli.[2,3] We did observe in three (6%) patients that high NOL index values were not reduced by fentanyl. Reviewing the data, we noted that in these patients high NOL index values coincided with high blood pressure values (and *vice versa*, depending on the study group), an indication that the NOL index correctly tracked high nociception. We previously showed that fentanyl potency varies considerably among humans.[4] In addition, we observed that low fentanyl analgesic potency does not coincide with low potency for side-effects.[4] Hence, we advise not to continue dosing when the opioid effect is small or absent but to rotate to another opioid or another analgesic regimen (e.g. ketamine). In our study, we rotated our patients from fentanyl to remifentanil when high NOL index values or high arterial pressures did not change in response to high doses of fentanyl. Remifentanil controlled nociception in these patients well, and there was no indication of hypercapnia or fluid imbalance.

Finally, it of interest to briefly discuss two differences in outcome between the SOLAR trial and our earlier published paper on NOL-guided during remifentanil and propofol anesthesia (with acronym NOLA), both randomised controlled trials.[1,5] The current SOLAR trial studied NOL-guided fentanyl dosing during sevoflurane anaesthesia,[1] whereas earlier we studied NOL-guided remifentanil dosing during propofol anaesthesia.[5] The SOLAR trial showed no effect of NOL guidance on haemodynamics (there were very few haemodynamic events) but a large beneficial effect on postoperative pain scores, whereas the NOLA trial showed that NOL-guided remifentanil dosing had a remarkable positive effect on the number of haemodynamic events, but did not influence postoperative pain scores.[1,5] We relate this to the differences in pharmacokinetics and pharmacodynamics between the two opioids under investigation. In the NOLA trial, subjects experienced no residual analgesic effect of remifentanil during stay in the PACU, whereas some residual effect from fentanyl may have occurred in the SOLAR trial. Consequently, the fentanyl dosing strategy aimed at reducing nociceptive effects during surgery may have caused the difference in pain scores between the two study groups in the SOLAR trial. Finally, it is our clinical experience that fentanyl causes less vasodilation than remifentanil during anaesthesia. Fewer haemodynamic events were observed in the SOLAR trial compared with the NOLA trial. More importantly, NOL guidance in the NOLA trial resulted in less remifentanil administration and consequently less haemodynamic instability. We agree that further studies are warranted to corroborate our observations, but our data do show different outcomes depending on anaesthesia technique. This explains the sometimes-large differences in findings between different research groups that test the effect of nociception monitors on patient outcome but that use very different protocols.

Acknowledgements

Medasense Ltd. (Israel),supported the NOLA and SOLAR trials.

Declarations of interest

AD received a speaker fee from Medasense. All other authors report no conflict of interest.

References

1. Coeckelenbergh S, Vereecke HEM, Richebé P. Nociception Level-guided fentanyl titration: potential impact of multimodal anaesthesia and false positives. Comment on Br J Anaesth 2020. *Br J Anaesth* 2020; **125**: 1070–8
2. Meijer F, Honing M, Roor T, et al. Reduced postoperative pain using Nociception Level-guided fentanyl dosing during sevoflurane anaesthesia: a randomised controlled trial. *Br J Anaesth* 2020; **125**: 1070–8
3. Martini C, Boon M, Broens SJL, et al. Ability of the Nociception Level, a multiparameter composite of autonomic signals, to detect noxious stimuli during propofol-remifentanil anesthesia. *Anesthesiology* 2015; **123**: 524–34
4. Dahan A, Olofsen E, Niesters M. Pharmacotherapy for pain: efficacy and safety issues examined by subgroup analyses. *Pain* 2015; **156**: S119–26
5. Meijer F, Martini C, Broens S, et al. Nociception-guided *versus* standard care during remifentanil-propofol anesthesia: a randomized controlled trial. *Anesthesiology* 2019; **130**: 745–55

doi: 10.1016/j.bja.2020.11.015
Advance Access Publication Date: 13 December 2020

Doing more and doing better: improving racial and ethnic disparities research in anaesthesiology

Julia M. Rosenbloom[1,*], Michael R. King[2,3] and Thomas A. Anderson[4]

[1]Department of Anesthesia, Critical Care, and Pain Medicine, Massachusetts General Hospital, Boston, MA, USA, [2]Department of Pediatric Anesthesiology, Ann and Robert H. Lurie Children's Hospital of Chicago, Chicago, IL, USA, [3]Northwestern University Feinberg School of Medicine, Chicago, IL, USA and [4]Department of Anesthesiology, Perioperative and Pain Medicine, Stanford University School of Medicine, Stanford, CA, USA

*Corresponding author. E-mail: jmrosenbloom@mgh.harvard.edu

Keywords: disparities research; health services research; meta-analysis; race and ethnicity; regional anaesthesia

Editor—We write in disappointment about the state of disparities research in anaesthesiology and its subspecialties. We share the findings of our recent literature review with the hope that they will inspire rigorous reflection and critical investigations.

In July 2020, we attempted a meta-analysis to ask and answer a question related to racial and ethnic anaesthesia health services disparities in the USA. This project seemed apt because medical literature consistently produces evidence of racial and ethnic healthcare inequities (most recently related to coronavirus diseases 2019 [COVID-19]), and because recent events have made the consequences of racism impossible to ignore.[1–3]

We sought to determine whether Black, Latino, Asian, or Native American ('minority') patients in the USA are less likely to receive regional anaesthesia (peripheral nerve blocks or neuraxial) than White non-Latino patients. A difference would indicate disparities in care as defined by the US Agency for Healthcare Research and Quality: 'difference between population groups in the way they access, experience, and receive healthcare' with lower quality for 'disadvantaged groups'.[4] We selected regional anaesthesia as an endpoint for three reasons: it is fundamental to many different anaesthesia subspecialties and has been well studied for decades; numerous meta-analyses and reviews demonstrate that regional anaesthesia provides superior perioperative analgesia and improves patient outcomes compared with parenteral opioids; and previous literature has linked discretionary practices to health disparities.[5–7] Our focus was on the USA because race and ethnicity are social constructs evolving from particular histories and manifesting in particular norms. The importance of slavery to the founding of the USA, for example means that many Black Americans face particular health challenges as the descendants of American slaves; it also means that we are often bound by a rigidity such that Barack Obama is considered our first Black president (he has one White parent and one Black parent, but the rule of hypodescent/'the one drop rule' dictates that he is Black).[8,9] We acknowledge, of course, that although slavery, racism, and racial/ethnic disparities exist around the world, the peculiar consequences and meanings are not the same everywhere. This project would be a key step toward disparities research in other anaesthesia settings.

We adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement and registered our study on PROSPERO (CRD42020202303). Further details of our methods and results can be found in Supplementary Table 1. Out of 2776 records, 22 articles met the inclusion criteria. Thirteen obstetric studies presented 30 yr of practice and uneven sample sizes. Three of the five orthopaedic articles used the same non-governmental database. Two studies focused on paediatric patients and two on adults undergoing general surgery. We concluded that a meta-analysis on this topic could not be conducted owing to sparsity and heterogeneity of the existing literature.

Despite numerous publications on regional anaesthesia and the 20 yr since the Institute of Medicine's landmark report,[1] we found an absence of literature on regional anaesthesia practice disparities. This indicates a need for our specialty to invest monetary, time, and print resources to investigating this issue. We suggest these actionable steps: utilise current disparities research concepts, theory, and frameworks, such as social determinants of health and intersectionality[10,11]; collect accurate, specific, and complete data about race and ethnicity; quantify disparities in practices/outcomes with real clinical impact; and test hypotheses of underlying mechanisms such as provider attitudes or social determinants of health. With appropriate effort, we can delineate how disparities matter in our specialty. Researching, writing, and publishing about race, ethnicity, and disparities are imperative for anaesthesiology and its practitioners.

Acknowledgements

The authors gratefully acknowledge T. Houle, Massachusetts General Hospital, Boston, MA, USA and S. Weber, Atlanta, GA, USA.

Declarations of interest

The authors declare that they have no conflict of interests.

Funding

US National Institutes of Health grant T32 GM007592 (Research Training for Anesthetists; to JMR). Institutional and departmental sources.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.bja.2020.11.003.

References

1. Smedley BD, Stith AY, Nelson AR. *Unequal treatment: confronting racial and ethnic disparities in health care*. Washington DC: NAP; 2003
2. Robinson WR, Cheng MM, Howard AG, et al. For U.S. Black women, shift of hysterectomy to outpatient settings may have lagged behind white women: a claims-based analysis, 2011-2013. *BMC Health Serv Res* 2017; **17**: 526–35
3. Belanger MJ, Hill MA, Angelidi AM. COVID-19 and disparities in nutrition and obesity. *NEJM* 2020; **383**: 10–2
4. *2018 National Healthcare Quality and Disparities Report*. Rockville, MD: Agency for Healthcare Research and Quality; September 2019. AHRQ Pub. No. 19-0070-EF
5. Guay J, Johnson RL, Kopp S. Nerve blocks or no nerve blocks for pain control after elective hip replacement

(arthroplasty) surgery in adults. *Cochrane Database Syst Rev* 2017; **10**: CD011608
6. Bosenberg A. Benefits of regional anesthesia in children. *Pediatr Anesth* 2012; **22**: 10–8
7. Bloche MG. Race and discretion in American medicine. *Yale J Health Policy Law Ethic* 2001; **1**: 95–131
8. Kramer MR, Black NC, Matthews SA, James SA. The legacy of slavery and contemporary declines in heart disease mortality in the U.S. South. *SSM Popul Health* 2017; **3**: 609–67
9. Ho AK, Kteily NS, Chen JM. 'You're one of us': Black Americans' use of hypodescent and its association with egalitarianism. *J Pers Soc Psychol* 2017; **113**: 753–68
10. Braveman P, Gottlieb L. The social determinants of health: it's time to consider the causes of the causes. *Publ Health Rep* 2014; **129**: 19–31
11. Williams KC. Mapping the margins: intersectionality, identity politics, and violence against women of color. In: Fineman MA, Mykitiuk R, editors. *The public nature of private violence*. New York: Routledge; 1994. p. 93–118

doi: 10.1016/j.bja.2020.11.003
Advance Access Publication Date: 27 November 2020

A student's perspective on the relevance of anaesthesia and critical care to the medical school curriculum. Response to *Br J Anaesth* 2018; 121: 993–6

Aditya Krishnan

University Hospitals Birmingham NHS Foundation Trust, Birmingham, UK

E-mail: adityakrishnan@doctors.org.uk

Keywords: anaesthesia; critical care; curriculum; medical education; medical school; reflection

If you seek his monument, look around you

– Epitaph of Sir Christopher Wren

Editor—The manner of the anaesthetist is virtually revered by medical students: how they effortlessly glide that green cannula into a haemodynamically shocked patient; the way they take charge of the otherwise turbulent cardiac arrest; or their composed manner in assessing an airway no matter how low-pitched the machine beside them beeps. Anaesthetics and critical care are uniquely positioned at the crossroads between medicine and surgery, consolidating practice with principles of physiology and pharmacology, the same principles intensively taught to preclinical students, yet so frequently felt to be dissociated from clinical medicine.[1]

I pen this reflection as a young professional seeking the origin of my enthusiasm in these specialities: was I drawn to the critical care unit because of a sudden clinical interest, or had I been inculcated by years of subliminal teaching in intensive care medicine? This correspondence in response to Smith and colleagues[2] addresses the role played by anaesthesia and critical care from the perspective of the medical student, highlighting the development of skills essential for qualification. By drawing on educational research and personal experience, I reflect on the role played by these specialities in medical students' progress.

As members of the largest hospital speciality, anaesthetists interact with up to 68% of hospital patients.[1,3] Noting that they are at the forefront of rapidly flourishing empirical medicine, one realises that they are exceptionally well equipped at executing their key roles in education. As identified by Smith and colleagues,[2] the role of the anaesthetist embodies the very tenets upon which our curricula are founded, as seen by navigating the General Medical Council's latest 2018 iteration of *Outcomes for Graduates*.[4] The anaesthetist is a team worker (Outcomes 1): collaborating with a multidisciplinary cardiac arrest team. The anaesthetist is a holistic practitioner (Outcomes 2): drawing upon humanity and navigating polypharmacy to alleviate the multidimensional pain experience. And, of course, the anaesthetist is a scientist (Outcomes 3): stretching to first principles in applying acid–base physiology when interpreting an ABG (arterial blood gas).

Hiding in plain sight

In addition to the inclusion of anaesthetic tools such as ultrasound in preclinical teaching, attitudes in critical care to handover and checklists are highlighted to students. Euliano and colleagues[5] rightfully argue that anaesthetics offers 'more procedural experience and real-time physiology… than that available elsewhere'. This is as true for me as a final-year student practising preoperative airway management, as of me in first year describing the receptors of pain modulation in an anaesthetist-led tutorial. I benefit from context-based learning in both situations. As a preclinical student yet to encounter an ill patient, I engage in the anaesthetic scenario to discuss pain modulation anatomy, gate control theory, the WHO Analgesic Ladder, and patient rights. And as a final-year