Automation, Artificial Intelligence, and the Anesthetist

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You likely have been deeply enmeshed with multiple forms of artificial intelligence (AI) in daily life without giving it much thought: smartphones harness it for predictive texting and facial recognition, on- and offline sellers harvest metadata to predict consumer interest, big data techniques mitigate financial fraud while we sleep, search engines employ AI to rank relevant query results and autocorrect features fix minor spelling *terrors*. These subtle technological applications rarely jeopardize specialist healthcare careers. Yet the latest AI debutantes fueling media frenzy, such as Chat Generative Pre-Trained Transformer (ChatGPT), are generative AI. This designation means they can produce unique artistic and written creations, engage users in a conversational manner, and develop functional computer code. Thus, they offer a substantially more tangible example of what the technology is capable of and have reignited the debate surrounding job automation. No one bats an eye at the fact that an app on your phone can give you directions across town while taking numerous time-sensitive traffic conditions into account better than any gas station attendant can, yet we may balk at the fact that similar technology might refine our anesthetic practices. Already, it is less a question of whether AI will perform Certified Registered Nurse Anesthetist (CRNA) duties in the next 20 years but to what degree. These ramifications will influence CRNAs from across the continuum of academia and on into their professional and personal lives.

In particular, the field of education is grappling with how to respond to the impact that generative AI tools such as ChatGPT will have on the classroom.[1] Educator responses range from banning the technology to deeming it deserving of a Master of Business Administration degree.[2,3] Indeed, concerns over potential abuse already spurred the development of AI-detecting software in an academic arms race; teachers are paradoxically utilizing AI to resist AI. However, ChatGPT's functionality is more limited than many instructors and students assume. As it relies

on predictive language, the program struggles with attribution, frequently failing to provide citations that simultaneously support its assertations and are not outright fabricated. While ChatGPT can mimic a writing style (eg, Hemingway prose), its claims lack nuance or context. Also, its developers state that ChatGPT may reply confidently using "plausible-sounding but incorrect or nonsensical answers" not justified by its training data—the phenomenon of AI hallucination.[4] Nor does the program incorporate lived experiences into its writings as a student might. Instead, educators and learners could embrace AI technologies to analyze grammar and style, create simple study guides, and improve information literacy by analyzing ChatGPT's shortcomings. If math curricula can accept pocket calculators, then writing pedagogy can stomach generative AI. If anything, ChatGPT exposes the banality inherent in many student compositions and instructor evaluations thereof; it excels at pablum but fails at critical appraisal.

While ChatGPT might struggle to write cogent term papers or management plans, other forms of AI are likely to reshape anesthesia practice. Does this threaten CRNAs' livelihoods and role autonomy? Breaking down procedures of skilled workers into "if-then" rules, like computer programming, is not a paradigm shift in healthcare; the historical use of these routinization methods spans from the latest advanced cardiovascular life support iterations to ancient Egyptian surgical treatises.[5] Today, the computerization of these routines is increasingly commonplace. Given large enough data pools to draw from, artificial neural networks (ie, brain-inspired computer systems) may detect early signs of Parkinson's disease via deep learning and can provide rudimentary radiographic interpretation to expedite workflow.[6,7] Similar themes emerge with AI in anesthesia. Depth of anesthesia monitoring via AI-interpreted encephalography performs favorably versus bispectral index monitoring.[8] Likewise, automated anesthetic delivery processes (eg, target-controlled infusion and closed-loop delivery systems) have demonstrated

improved performance over manual methods; however, whether the benefits of these systems exist, are clinically relevant, and outweigh their unforeseen risks remains contentious.[9,10] As with AI-diagnosed Parkinson's disease, anesthesia-related AI shines at early event prediction, being able to alert clinicians in advance of significant hypotension, readiness to wean from ventilation, and can detect sepsis in early stages.[8] The performance of anesthesia-related skills can also be machine-augmented, with AI-powered ultrasound anatomical structure overlays on the horizon. As deep learning is oft predicated on large datasets, operating room logistics may also become computer-optimized for efficacy and safety. However, due to the complexity of neural networks, obtaining rationales for AI decisions is challenging. Thus human-machine hybrid work, with anesthetists guiding and refining AI prompts, remains the methodology of the foreseeable future.

Intuitively, computers seem incapable of supporting socially related human needs, yet several AI ventures have also begun to open this avenue. For example, AI has been used to diagnose post-traumatic stress disorder (PTSD) in war veterans, and social robots can provide simple therapeutic interventions.[11,12] As the pandemic helped underscore, expanded access to essential mental health services is sorely needed, and automation of this kind could also support CRNAs on the continuum of stress, burnout, second-victim syndrome, and PTSD. However, just as pulse oximeter trials failed to ensure diversity in their subjects, AI facial recognition and job-candidate screening technologies suffered from homogeneity in their initial models, leading to inadvertent discrimination.[13] One blend of social and clinical applications in which AI may yet augment anesthesia practice is in performing patient medical histories. Automated interviews offer opportunities for safety redundancy or efficiency in anesthesia and could increase medical access for the public, but time-savings have yet to be definitively proven.[14,15] Although AI is unlikely to supplant patient interaction and CRNA role socialization, its scalability indicates that

proven efficacy in social-based endeavors would result in rapid adoption. Still, even if smartphones suggest exceptional music on-demand, people will pay to attend live performances at concerts.

Education, work, and leisure continues to be impacted by AI, ultimately undermining our intuition of what it means to be human. Even before Deep Blue defeated Gary Kasparov at chess in 1997, AI had blurred the boundaries between clever programming and actual artificial intelligence, thus recontextualizing Cartesian dualism—the idea that mental events are somehow distinct from the physical world. Yet, as American philosopher John Searle states, without it having understanding or intentionality, we cannot argue that a device is thinking.[16] Thus, even the term AI is somewhat of a misnomer. However, technical jargon such as symbolic processing, analytical computation, or predictive language generation does not evoke an equally visceral response in public minds. It behooves forward-thinking, entrepreneurial CRNAs to consider the potential of harnessing AI's power to expand their ability to autonomously deliver safe and effective anesthesia. Then again, how certain are you that a human penned this piece?

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