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Opportunities Beyond the Anesthesiology Department: Broader Impact through Broader Thinking

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Abstract

Ensuring a productive clinical and research workforce requires bringing together physicians and communities to improve health, by strategic targeting of initiatives with clear and significant public health relevance. Within anesthesiology, the traditional perspective of the field's health impact has focused on providing safe and effective intraoperative care, managing critical illness, and treating acute and chronic pain. However, there are limitations to such a framework for anesthesiology's public health impact, including the transient nature of acute care episodes such as the intraoperative period and critical illness, and a historical focus on analgesia alone - rather than the complex psychosocial milieu - for pain management. Due to the often episodic nature of anesthesiologists' interactions with patients, it remains challenging for anesthesiologists to achieve their full potential for broad impact and leadership within increasingly integrated health systems. To unlock this potential, anesthesiologists should cultivate new clinical, research, and administrative roles within the health system - transcending traditional missions, seeking interdepartmental collaborations, and taking measures to elevate anesthesiologists as dynamic and trusted leaders.

This *special article* examines three core themes for how anesthesiologists can enhance their impact within the healthcare system and pursue new collaborative health missions with non-anesthesiologist clinicians, researchers, and administrative leaders. These themes include (i) reframing of traditional anesthesiologist missions towards a broader health system-wide context; (ii) leveraging departmental and institutional support for professional career development; and (iii) strategically prioritizing leadership attributes to enhance system-wide anesthesiologist contributions to improving overall patient health.

Amidst the massive disruptions to the clinical, administrative, and health research operations introduced by the Coronavirus Disease 2019 (COVID-19) pandemic, healthcare leaders who formerly may not have appreciated the dynamic skills of the anesthesiologist were given a unique glimpse of the skillset and value of a well-trained anesthesiologist work-force. These leaders witnessed firsthand the experience and ingenuity of anesthesiologists to maintain safe, reliable platforms for health delivery,[1] their ability to innovate in response to unanticipated needs,[2] and their willingness to deploy into non-standard front-line roles as trusted physicians, committed to providing safe patient care.[3]

Coincident with this front-line work, anesthesiologist Surgeon General Jerome Adams, MD, MPH, FASA demonstrated system-wide leadership in advocating for the evolving guidance of the Center of Disease Control and Prevention on social distancing and mask wearing amidst a highly politicized atmosphere,[4] calling upon anesthesiologists to be "physicians, not proceduralists"[5] and recognizing anesthesiologists as bringing critical "innovations to the field of medicine, health care delivery, and health policy"[6] during times of global strife. Additionally, in the 2020 Emery Rovenstine Lecture, Joanne Conroy MD, advocated for anesthesiologists to embrace disruptive innovation to enhance value, explore gender equity in leadership roles, and serve as change leaders for promoting patient safety.[7] During this fateful year, anesthesiologists rose to the occasion and faithfully worked to align COVID-19 patient care with the "Triple Aim" of the modern health system: to improve population

health, reduce unnecessary utilization and cost, and enhance patients' subjective experience of care.[8]

Beyond the COVID-19 pandemic, the value proposition of the anesthesiologist has remained an important consideration for defining future directions. In regard to the "Triple Aim", this model has served as a foundational principle leading to the redesign of fee-for-service care delivery systems in favor of coordinated, interdisciplinary models guided by leaders capable of championing collaboration and integration. Such models seek to increase healthcare value, through improving quality and outcomes while maintaining or lowering costs.[9,10] In support of this collaborative approach, clinical and research organizations such as the American Board of Anesthesiology, the Foundation for Anesthesia Education and Research, and the International Anesthesia Research Society promote core missions of advancing the highest standards of anesthesiology practice[11] and disseminating state-of-the-art basic and clinical anesthesia research.[12] Such overarching missions encompass opportunities for anesthesiologists to gain health systems leadership skills and collaborate with other health providers, researchers, and administrators to promote broad improvements in public health.

To fully realize anesthesiologist opportunities for health systems leadership, we first explore outside perspectives of anesthesiologists, followed by critically evaluating clinical, research, and administrative strengths of the field. Building upon this framework, the objectives of this article are to explore three core themes anesthesiologists can consider, when seeking opportunities to enhance impact within an increasingly value-driven, team-based health system. These include:

- Core Theme #1: Anesthesiologists can reframe traditional health care missions towards a broader system-wide context.
- Core Theme #2: Anesthesiologists can seek career development opportunities which enable candidacy for newly emerging health systems leadership roles.
- Core Theme #3: Anesthesiologists can cultivate a positive culture in the workplace, by anchoring to a set of leadership attributes which may in turn enhance anesthesiologist contributions to public health.

BACKGROUND

Outside Perspectives of Anesthesiologists

Despite the well-defined missions of anesthesiology clinical and research organizations, the roles and training of anesthesiologists are largely misunderstood by the lay public[13–15] and often other healthcare providers. Anesthesiologists are recognized as leaders in patient safety,[16] trusted authorities in emergency, trauma, and critical care,[17] and expert consultants in pain management.[18,19] However, anesthesiologists have also been confronted with questions of whether the specialty is fully aligned with value-based care, and separately, whether they are able to provide care and leadership beyond the individualized patient encounter in order to have a sustained public health impact.[20]

Through a systematic approach to improving intraoperative care, many complications of anesthesia have been reduced to "almost never" events.[21] Although such an accomplishment

once served as a testimonial to the utility of anesthesiologists within a health system, this standard of care is now largely perceived to be a solved problem, aided by continued advances in engineering safety design and systems-based practice.[22] In the modern health system, a safe and efficient intraoperative period - as is a standard expectation of the potentially commoditized anesthesiology team - may be regarded as a healthcare resource-intensive, yet ephemeral event. Furthermore, when considering the longitudinal management of chronic health conditions over a patient's lifetime, intraoperative care by an anesthesiology team may be perceived as having limited impact on long-term patient health trajectories and limited value relative to the surgical intervention itself.[23] Finally, in the context of pain management, anesthesiologist-administered medical and procedural interventions are no longer the central component: rather, analgesia is a facet of a multidisciplinary approach toward confronting pain in its psychosocial context, a challenge that has become increasingly relevant to non-anesthesia providers amidst the opioid epidemic.

Introspection: Relative Professional Strengths of Anesthesiologists

In an era of value-driven healthcare, integrated health systems leadership opportunities for anesthesiologists are ripe and well worth pursuing. By tackling these opportunities, anesthesiologists can leverage their field's relative strengths to make high-impact contributions to public health in collaboration with providers outside the specialty. To sustain collaboration opportunities, anesthesiologists must focus on sources of underrecognized value, leveraging clinical, operational, and research strengths of the anesthesiology specialty.[24]

Clinical strengths of anesthesiologists are driven by expertise in cardiovascular, pulmonary, and neurophysiologic systems, with an emphasis on evaluating results from interventions at reliable intervals, followed by rapid escalation and crisis management as needed. Anesthesiologists leveraging this expertise to achieve impact beyond the specialty have included Dr. Paul Barash in cardiovascular medicine, who served as chair of the Multicenter Study of Perioperative Ischemia Group[25,26] and later served as consultant to the National Aeronautics and Space Administration on the Perioperative Medicine for Manned Space Flight Working Group.[27] Additionally, Dr. Virginia Apgar, whose work in the assessment of a neonate's first expressions of essential neurological and cardiovascular function[28] led to a transformation in neonatal medicine that impacts every infant born today in the hospital setting.

Operational strengths of anesthesiologists are driven by experience designing safe, highly reliable workflow platforms and serving as impartial arbiters of scarce operating room and intensive care unit resources. Anesthesiologists exemplifying operational excellence have included Drs. Peter Pronovost and John Eichorn, whose respective work in reducing medical errors[29] and establishing standards of patient monitoring under anesthesia[30] laid the foundations for anesthesiologists as leaders in patient safety. Beyond patient safety, the familiarity of anesthesiologists with a wide variety of medical specialties has enabled opportunities for impact on national and global levels, via positions with the US congress,[31]

the Office of the Surgeon General,[32] and the Chief Medical Officer for the Centers for Medicare and Medicaid.[33]

Finally, *research strengths* of anesthesiologists include a data-driven focus on outcomes arising from novel pharmaceuticals, medical devices, and technologies implemented in highly monitored healthcare settings, as well as a basic science focus on neurophysiological mechanisms of pain, consciousness, and cognitive function. Anesthesiologists with notable research contributions extending beyond the specialty have included Dr. Elmer McKesson who was able to achieve transformational advances in patient safety by advocating for quantitative assessments of pulse, respirations, and blood pressure.[34] Additionally, Drs. Max Kelz and Emery Brown, whose work have advanced the understanding of neurobiologic mechanisms of unconsciousness,[35,36] exemplified how anesthesiologists can play key roles in cross-disciplinary research initiatives aimed at revolutionizing the understanding of the human brain.

Throughout the remainder of this article, we explore core themes that guide how anesthesiologists may answer calls to action for enhancing their scope of care and overall healthcare value. As aided by career development and leadership training, anesthesiologists may leverage clinical, operational, and research strengths to become leaders and disruptors, developing new collaborations with non-anesthesiologist health professionals in order to achieve greater public health impact.

CORE THEMES FOR ENHANCING ANESTHESIOLOGIST IMPACT

Core Theme #1: Reframing and Intelligent Branding of Anesthesiologist-Led Patient Care

Despite scores of anesthesiologists having successfully transcended traditional roles and impacted health care delivery more broadly, far too often anesthesiologists today have alternatively chosen to narrowly scope daily work. Anesthesiologists may be hesitant to seek broader responsibility due to concerns of liability, insecurity of expertise, or perhaps simply that fee-for-service reimbursement focuses efforts on predefined tasks that prioritize volume over long-lasting value. Furthermore, anesthesiologists may not be selected for leadership roles at the institutional level due to relatively higher salary costs incurred for purchasing non-clinical effort, compared to other medical specialties.

There are, however, significant cost savings, indirect revenues, and value-based incentives offsetting such costs, that anesthesiologists can influence in addition to the patient benefits directly derived by anesthesiologist efforts.[37] Pursuant to the “Triple Aim” of the modern health system, institutions have increasingly recognized that leadership positions should not be filled by the least costly physician but rather by who will provide the most value. Integrated health systems have begun to consider approaches aligning with the value added by anesthesiologists, such as an emphasis on safety and reliability when performing high risk tasks in an operationally efficient manner (i.e. high reliability organizations),[38] and a focus on the capacity to work in teams within a resource and revenue intensive environment.[39] Progressive and successful anesthesiology departments and practices have begun to navigate this new paradigm, overcoming prejudices against anesthesiologists as having limited leadership vision beyond increasing operating room revenue. Such innovative

paradigms will likely prove critical to the security of academic and private anesthesiology environments alike.

In recognition of newly developing health care paradigms, anesthesiologists may consider how clinical care models traditionally adopted within an anesthesiology department can be reframed to more broadly integrate across an entire health system, and what partnerships across disciplines would be reinforced in doing so. For example, in the operating room, anesthesiologists provide expert judgments to maintain hemodynamic stability in the face of anesthetic- and surgical-induced cardiovascular stressors, through the titration of potent medications while considering a patient's comorbidities and surgical goals. In doing so, anesthesiologists work to optimize end-organ perfusion, provide optimal surgical conditions, and minimize the risk of major adverse cardiac events. Similarly, in the preoperative clinic, anesthesiologists work to optimize a patient's pre-existing cardiovascular conditions in order to decrease perioperative risk.[40] However, if such principles were applied more broadly across the longitudinal health timeline of patients undergoing surgical procedures, anesthesiologists may establish a perioperative paradigm for the identification and primary care follow-up of patients with undiagnosed or undertreated hypertension,[41,42] hyperlipidemia,[43] or heart failure.[44] This reframing of anesthesiologists as physicians who are engaged with improving the longitudinal cardiovascular care of their patients - in collaboration with primary care physicians and cardiologists - provides an opportunity to improve the health trajectories of surgical patients beyond the day of surgery and may significantly enhance the public health impact of the anesthesiologist and operative episode.[45]

In Tables 1 and 2, we provide a *non*-comprehensive list of additional examples, spanning perioperative, critical care and pain medicine domains, and illustrating how clinical, research, and operational collaborations outside of the anesthesiology department may develop and evolve. To fully realize any collaboration however, an approach coordinating top-down strategic anesthesiology departmental sponsorship, with bottom up buy-in of clinician and researcher stakeholders must be carefully planned and implemented.

Core Theme #2: Anesthesiologist Career Development for Collaboration and Impact

Producing an anesthesiologist workforce that is prepared to lead new interdepartmental collaborations requires strategic professional and organizational development that may benefit from extending beyond traditional pathways of career advancement. As with any change management process, most success comes from small, deliberate, and consistent decisions made over years, rather than radical decisions implemented en bloc. This *kaizen* approach, a Japanese business philosophy of continuous improvement,[46] can be applied at both individual and departmental levels, and requires having a strategic long-term vision of success and the tools required to achieve it in order to guide decisions made at each next immediate step.

However, it is not a trivial problem for busy anesthesiologist clinicians, researchers, and administrators inundated with tasks to find the time to invest in skills and activities that support innovative collaborative efforts. In this regard, the operative volume-dependent nature of an anesthesiology department's daily work schedule may offer opportunities

amidst the staffing challenge. If appropriate staffing for clinical coverage is in place to accommodate surges in operative and critical care patient volume, the prepared anesthesiology team may find increased opportunities to advance non-clinical activities of team members including career development using novel flexible staffing models. Alternatively, a tendency to staff operating rooms according to schedule nadirs or even average utilization, and then strain to the peaks by working post-call, on vacation, or stretching care team concurrency, squanders a potentially valuable resource. As department revenues become relatively less dependent on direct fee-for-service care and increasingly incorporate indirect and value-based streams, it creates opportunity for anesthesiology departments to staff to surge capacity, yet have value-generating non-patient care work to maintain productivity during off-peak times. This creates a valuable flexibility to both the facility and anesthesiology group.

As an illustration of the flexibility that capitated and other similar payer/provider arrangements can provide, one only needs to recall the heights of the COVID-19 pandemic when such arrangements, which were previously thought of as ways for payers to share risk with providers, suddenly became an important hedge against an alternative risk - namely against major, system-wide declines in demand for elective surgical care in response to pandemic operations. The necessity to remain agile as a leader in perioperative care demands the skills to rapidly recruit team members when a critical need arises and being available to assist others when in steady-state. These essential skills of the anesthesiologist can be translated to recruiting or assisting others for non-clinical tasks such as teaching, research, administrative duties, or career development. Such creative and dynamic allocation relies on a foundation of team-based care where members see the value in others' advancement. A foundation of trustworthiness, as described in the following core theme, is an absolute necessity for such team-oriented behavior.

Despite an opportunity to capitalize on creative approaches for career development activities during non-surge periods, finding time for the extended career development efforts inevitably necessitates the availability of sponsorship, training, and a robust support network. Sponsorship is necessary for activities requiring an investment of time or buy-in from a larger group of stakeholders, and can occur at both the departmental and health system level, each offering unique advantages. At a departmental level, sponsorship is more likely to directly translate into protected time for an anesthesiologist, given the greater control of departmental leadership on the day-to-day schedules of its members. However at a health system level, sponsorship more naturally translates into positive acceptance of interdisciplinary efforts given the broad investment that has been made in an individual beyond the anesthesiology department.

Training for an expanded, interdisciplinary focus in anesthesiology may occur in many forms, often tailored to the clinical, operations, or research strengths of an individual, and should include consideration of interdisciplinary activities that extend beyond traditional paths. Opportunities for participation in professional or scientific communities are broad, and for the anesthesiologist looking to expand the scope of the specialty, opportunities can extend beyond traditional national society service. Participation in professional meetings outside the standard purview of anesthesiologists (e.g. the American College of Cardiology,

or the American Geriatric Society) may require peer support via networking or sponsorship from local leaders in those fields. The challenge to enter the national conversation in one's own field itself requires careful mentorship, and this need is further underscored when one's vision stretches beyond existing departmental mentoring networks. While a traditional perspective would hold that attendance at the American Society of Anesthesiologists (ASA), the International Anesthesia Research Society (IARS), or anesthesiology subspecialty meetings and participation in professional society committees are among the centerpieces of an academic anesthesiology career trajectory, an expanded role may incorporate other non-anesthesiologist professional society meetings as well.

Regarding formal degree and professional certificate programs, academic institutions - when affiliated with an anesthesiologist's healthcare system - provide many opportunities for professional training, sometimes in the context of hybrid programs focused on administration, education, or research specifically relevant to healthcare leadership and expanding beyond MPH or MBA pathways. Although traditional degree programs provide broad flexibility in training, hybrid professional programs include collaborations between experts in business leadership and health services research.[47] Another route for such interdisciplinary training may be found in military training where emerging concepts of multi-domain operations are increasingly a cornerstone of strategy.[48] Less time-intensive options for healthcare leadership development - targeting of both academic and community based anesthesiologists - are also available and enable interdisciplinary networking via robust and intensive leadership academy programs.[49–51]

Still, innovative interdisciplinary programs may be ahead of academia itself. For example, most academic institutions continue to rely on promotion criteria that emphasize first and senior author positions on scholarly work to the potential detriment of team science, and a team science perspective will require cultural shifts that are not yet evidenced in many parts of the academic world. It is perhaps instructive that the guidelines for authorship promulgated by the International Committee of Medical Journal Editors (ICMJE) are often cited by existing leadership to emphasize the need to exclude inappropriate authors.[52] Yet these same citations often completely ignore the ICJME's exhortation that any collaborators who participated in conception, design, acquisition, or analysis of data must be given the opportunity to fulfill all the other authorship criteria.[53] The overarching lesson is that expanding beyond the anesthesiology department requires not just academic department reorientation but may hinge on a rethinking of promotional criteria at the level of the medical school and university. Perhaps part of the challenge is that such a reorientation will depend on change agents who are prepared to redefine the culture from which they emerged. In response to this call to action, innovative groups have sought approaches to de-emphasize first- and senior-authored manuscript publications, and instead emphasize promotion criteria to accommodate variation in roles, contributions and professional interests of team members - especially for clinical- and operations-oriented faculty whose contributions are primarily to uphold safe, reliable, and efficient clinical care for patients.[54,55] Elevated roles of clinical- and operations-oriented faculty have more recently become promoted through the expansion of nontraditional Chief or Vice Chairperson positions, including the Chief/Chair of Strategic Planning;[56] the Chief/Chair of Diversity, Equity, and Inclusion;[57] and the Chief/Chair for Culture and Wellness.[58]

Outside of academics, private practice anesthesiologists may become similarly involved in leadership and career development opportunities in a variety of ways. Community-based hospitals often have tremendous opportunities for collaborative work among specialties, alignment of hospital and medical staff goals, and operational governance. Many institutions have internal leadership pathways available through their medical staff offices or mentorships, or may sponsor medical leaders to engage in outside leadership learning activities. Such activities have been recently promoted by the ASA, through web-based resources for leadership development,[59] and through collaborations with the American College of Healthcare Executives as a means for establishing a culture of patient safety.[60] Often such activities create an ability for a multidisciplinary team from a hospital to learn together, building rapport, and developing solutions to real time issues.

In addition, many private groups understand the need for at least some of their physicians to be knowledgeable in administrative and leadership activity. This can be crucial for a group to be successful at its core business, but also to engage facility administration and medical colleagues in providing value beyond intraoperative care. This may include operational administrative assistance, improved payer contracting, or tackling clinical issues such as resource utilization, infections, falls, or injuries. Private groups are wise to develop internal leaders in these areas, and do so by sponsoring interested members to (i) pursue training either through advanced degree or certificate programs, or (ii) simply become knowledgeable in the challenges of healthcare delivery beyond anesthesiology.

In Table 3 we provide a *non*-comprehensive list of innovative expanded pathways for anesthesiologist career development, to be encouraged by institutional and anesthesiology departmental heads of practice and pursued by anesthesiologists, spanning multiple dimensions as suited to individual interests and strengths. With consistent and dedicated efforts over time to address these expanded dimensions of career development, anesthesiologists may be poised to “swim outside their lane”, by taking on multidisciplinary health systems leadership roles and developing high-impact collaborations.

Core Theme #3: Prioritizing Qualities for Trusted Leadership

Through reframing of missions to public health and purposeful career development activities, anesthesiologists may better position themselves as leaders within their health system. Beyond the specific activities and career development which enable leadership opportunities, conceptual models for effective leadership can be considered, in order to maximize the potential for health impact. One such model centers upon *trust* - an essential prerequisite for strong and enduring leadership.[61] In a work developed by professional leadership consultants, *trustworthiness* can be described by four attributes: credibility, reliability, intimacy, and self-orientation (Figure 1)[62]

Within this conceptual model comprised by four attributes, *credibility* fundamentally refers to the spoken or written words of an individual, and how believable they are to others. Credibility can be built slowly over time, and comes through developing a mastery of a specific skill or practice. For anesthesiologists, tangible measures of credibility come from credentialing, degree training, board certification, and demonstrations of expertise including upholding excellent patient care, providing service as administrative leaders, and developing

scholarly work. *Reliability* refers to the actions of an individual, and how dependable they are perceived to be by others. Reliability is built through consistently delivering on key roles and promises, most notably when it isn't convenient or when an individual could have otherwise not. For anesthesiologists recognized as leaders in patient safety, reliability - as demonstrated by the consistent delivery of safe and effective perioperative patient care - often comes naturally but must not be overlooked. The third attribute of trust - *intimacy* - refers to how comfortable others feel with sharing thoughts and opinions with an individual. In anesthesiology, intimacy can be built through a patient-centered approach, and deepening connections with both patients and health care team members through the telling of stories as well as meeting in-person. Finally, a fourth attribute, *self orientation*, which is inversely related to trust, refers to the personal focus on an individual's interests versus interests of others. For anesthesiologists to limit self-orientation, a core component is the understanding of being part of a larger healthcare team, which transcends any degree training or past experiences. Counterintuitive in some ways, strong leadership frequently avoids the use of "command and control", i.e. an externalized and often rigid, coercive, and non-collaborative leadership style,[63] in order to limit self-orientation and maintain trust. This de-emphasis of self and ambivalence towards recognition, as learned through collaborating across specialties to safely enable complex and invasive procedural interventions, has been described as perhaps the strongest trustworthiness trait of anesthesiologists.[3]

By the nature of anesthesiologists' clinical work, key attributes for establishing and maintaining trust are continually reinforced, suggesting that our specialty is well-positioned to internalize this model of trustworthiness. Anesthesiologists are trained, positioned, and experienced in modelling trust-centered leadership, and such qualities should be leveraged to ensure successful leadership and collaboration with other professional domains.

SUMMARY AND CONCLUSIONS

For anesthesiologists to take full advantage of opportunities for enhanced impact across a rapidly evolving landscape of healthcare delivery, the profession can consider reimagining new roles which invoke collaborations with non-anesthesiologists, but which are, as exemplified in this article, grounded in some of the great forebearers of the specialty. These roles, requiring both sponsorship from local leaders and buy-in from anesthesiologist team members, can be aided by carefully planned career development and leadership training extending beyond traditional venues. The success of these pathways will both enhance and rely on cultural shifts that promote teamwork and innovation. Through these measures, anesthesiologists may follow in the footsteps of earlier vanguards and promote the Triple Aim of modern healthcare, enabling a path to sustained, impactful, and transformational change across the healthcare system as a whole.

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Glossary of Terms

ASA	American Society of Anesthesiologists
ASRA	American Society of Regional Anesthesia and Pain Medicine
COVID-19	Coronavirus Disease 2019
CRNA	Certified registered nurse anesthetist
IARS	International Anesthesia Research Society
ICMJE	International Committee of Medical Journal Editors
SCA	Society of Cardiovascular Anesthesiologists
SNACC	Society of Neuroscience in Anesthesiology and Critical Care
SOAP	Society for Obstetric Anesthesia and Perinatology
SOCCA	Society of Critical Care Anesthesiologists
SPA	Society for Pediatric Anesthesia

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Figure 1: The "Trust Quotient".
Adapted from *The Trusted Advisor* [62]

Table 1:

Reframing of Anesthesiologist-Led Clinical Care and Research - Expanded Horizons

Traditional Anesthesiologist Clinical Theme	Traditional Anesthesiologist Research Theme	Theme Expanded Toward an Interdisciplinary Orientation with Population Health Relevance
Maintain hemodynamic stability in the operating room and intensive care unit	Define targets for reduced morbidity (e.g. perioperative major adverse cardiac events, acute kidney injury)	Collaborate with primary care physicians and cardiologists to identify poorly controlled chronic conditions such as hypertension[41,64] or heart failure[44]; implement efficient and effective referral strategies
Reduce rates of postoperative cognitive dysfunction in older adults	Identify which medications at what doses enable the safest perioperative experience for older adults	Use perioperative and pain clinic encounters as an opportunity to identify occult mild cognitive impairment or dementia; collaborate with geriatricians to provide cognition-centered perioperative counseling, goal-setting, and/or care.[65]
Treat acute and chronic pain	Study the effectiveness of enhanced recovery after surgery protocols	Lead multidisciplinary clinical and research efforts to prevent the transition from acute to chronic pain[66]; collaborate with health policy experts and community leaders to address the opioid abuse epidemic[67]
Provide critical care to patients with major organ system dysfunction	Understand ideal care modalities to promote critical care recovery	Collaborate with health system leaders to provide critical care surge capacity during natural disasters / global pandemic (e.g. COVID-19)[3]; work with palliative care colleagues to elicit valued activities and define care goals for critically ill patients, and promote a philosophy of goal-focused treatment into critical care[68]
Limit exposure to potentially neurotoxic anesthetic agents in children	Study neurotoxicity of anesthetic agents and potentially safer alternatives	Use surgery as an index opportunity to obtain toxin levels (e.g. lead) in pediatric patients; and collaborate with pediatricians to provide referral for the estimated 5% of neurotoxic lead levels
Develop anesthetic plans with attention to pulmonary status and risk factors for postoperative pulmonary complications	Define lung-protective care modalities, particularly for patients with pre-existing pulmonary disease	Collaborate with primary care providers, psychologists, and pulmonologists, using perioperative period as a teachable moment to encourage smoking cessation and physical activity[69]
Reduce hospital acquired infections	Study and define optimal preoperative antibiotic coverage and ventilator-associated pneumonia / central line-associated bloodstream infection bundles.	Work with Infection Prevention and Facility teams to identify and address Environment of Care issues impacting infection risk[70] Work with primary care, endocrinologists, and laboratory medicine physicians to address preoperative anemia and diabetes and lessen perioperative transfusions and blood sugar perturbations[71]
Manage anesthetic implications of alcohol and drug abuse	Study the hemodynamic and cognitive effects of alcohol and drug abuse in the perioperative period	Collaborate with primary care and mental health providers, using perioperative period as a teachable moment to encourage abuse recovery[72]
Provide consultation and management of difficult airways	Study and define risk factors for difficult airways	Work in hospital leadership roles to develop protocols and educate non-anesthesia providers in safe airway management[73]
Provide lecture-based education for anesthesiology residents on anesthetic pharmacology and pain mechanisms	Study the impact of anesthesiology educational interventions on learning outcomes.	Develop a novel educational curriculum that enhances anesthesiology provider communication with patients, staff, and colleagues.
Participate in or support global surgical initiatives	Study limitations in access to safe and reliable anesthesiology care	Collaborate with diversity, equity, and inclusion experts to characterize disparities in access to anesthesiology, critical care, and pain management interventions.

COVID-19 = Coronavirus Disease 2019; CRNA = Certified registered nurse anesthetist

Table 2:

Reframing of Anesthesiologist-Led Operational Management and Research - Expanded Horizons

Traditional Anesthesiologist Operational Management Theme	Traditional Anesthesiologist Research Theme	Theme Expanded Toward an Interdisciplinary Orientation with Population Health Relevance
Manage tradeoffs guiding which surgery is performed in a capacity-constrained operating room environment with in-house call for obstetrics, level 1 traumas, and emergency surgery	Study and predict operating room case duration; study the impact of attending provider case concurrency and clinical handovers	Collaborate with hospital administrators to develop a triaging system based on patient acuity, risk assessment, health system wide operational impact, and evidence integration[74] Determine optimal staffing across multiple provider training levels (CRNA, resident, faculty) to achieve correct financial & clinical infrastructure enabling urgent surgeries to be performed
Determine safe and effective anesthetic medication alternatives during drug shortages	Study the impact of alternative anesthetic medication choices on long-term outcomes	Consult and collaborate with sustainability scientists to understand environmental implications of operating room choices[75] Work with facility pharmacists to help manage both cost and accessibility throughout the perioperative continuum
Provide safe anesthetics and perioperative care	Characterize and identify risk factors for perioperative adverse events	Partnering with hospitals to assist in certain hospital pay for performance initiatives including mortality, readmissions, and other quality measures
Provide traditional payer contracting	Perform cost-effectiveness analyses in the ambulatory surgical setting	Collaborate with hospital and facility partners on direct to employer healthcare contracting initiatives

COVID-19 = Coronavirus Disease 2019; CRNA = Certified registered nurse anesthetist

Table 3:

Opportunities for Expanded Career Development, Promotion and Scholarship Pathways

Traditional Career Development, Promotion, and Scholarship Pathways	**Expanded Pathways with Interdisciplinary Focus**
Anesthesiology society meetings (IARS, ASA)	Allied society meetings and participation (e.g. American College of Surgeons)
Anesthesiology specialty society Meetings (SCA, SNACC, SPA, SOAP, SOCCA, ASRA)	Involvement in interdepartmental specialty society meetings (e.g American Geriatric Society, American Cancer Society, American College of Cardiology)
Graduate training programs in public health or business management (e.g. MPH, MBA)	Hybrid graduate programs tailored to healthcare leadership,[76] [51] Certificate programs in process improvement, management, and leadership[77,78]
Academic promotion places exclusive emphasis on first author and senior author publications	Considerations for promotion expanded to appreciate “team science” and the need for large collaborations in which “middle authors” and non-author contributors (“collaborators”) are recognized as essential; development of promotional criteria oriented towards non-publication contributions of clinical-track faculty[79]
Siloes of specialists within existing professional schools (e.g. departmental or section defined specialist groups)	Interdisciplinary organizations that extend beyond traditional university or organizational borders (e.g. Institute for Healthcare Policy and Innovation; US Department of Veterans Affairs Center for Health Equity Research and Promotion; US Department of Veterans Affairs Pain Research, Informatics, Multi-morbidities, and Education (PRIME) Center)
Principal Investigator-driven research program focused on National Institutes of Health funding	Multi-center and multi-disciplinary collaborations, sourced from a variety of governmental, private-sector, or nontraditional funding entities (e.g. the Michigan Surgical Quality Collaborative)
Anesthesiology resident tracks at society meetings (IARS, ASA) focused on traditional anesthesiology research, clinical training, and resident advocacy	Early Stage Anesthesiology Scholars program at society meetings (IARS, ASA) focused on broadly integrative research training, cross-disciplinary team science, and leadership development[80]

ASA = American Society of Anesthesiologists; ASRA = American Society of Regional Anesthesia and Pain Medicine; IARS = International Anesthesia Research Society; SCA = Society of Cardiovascular Anesthesiologists; SNACC = Society of Neuroscience in Anesthesiology and Critical Care; SOAP = Society for Obstetric Anesthesia and Perinatology; SOCCA = Society of Critical Care Anesthesiologists; SPA = Society for Pediatric Anesthesia