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Social Drivers of Health in Pediatric Perioperative Care

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ABSTRACT

Social drivers of health influence every stage of pediatric perioperative care, shaping access to surgery, anesthetic readiness, and recovery. Social conditions, reflecting the circumstances of a family's daily life, and structural conditions, encompassing the systems and policies that shape those circumstances, contribute to missed appointments, delayed optimization, intraoperative vulnerability, and postoperative complications—outcomes not accounted for by physiology alone. Using the Gelberg–Andersen Behavioral Model for Vulnerable Populations, this Special Article synthesizes current evidence, outlines biologic and systemic pathways through which social drivers of health affect perioperative outcomes, and proposes strategies for integrating these insights into clinical practice and research.

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The perioperative period offers a uniquely concentrated view of how social conditions shape health. For many patients, surgery represents one of the few points of direct interaction with the healthcare system, requiring timely coordination among patients, families, and multidisciplinary teams. Success depends not only on clinical precision but also on a series of social conditions—transportation reliability, language comprehension, nutrition, insurance status, and home stability—that determine whether patients can meaningfully engage in perioperative care. These conditions, collectively termed the social drivers of health (SDOHs), influence every stage of perioperative care, from scheduling and optimization to recovery and long-term outcomes.[1]

SDOHs encompass the economic, environmental, and social conditions in which people are born, live, work, and age.[2] The World Health Organization (Geneva, Switzerland) conceptualizes these drivers as the "causes of the causes" of disease—forces that shape risk exposure, healthcare access, and physiologic vulnerability across the life course.[2] In anesthesiology, these forces often remain invisible to traditional risk models, which emphasize physiologic parameters while overlooking the contexts in which patients attempt to engage with healthcare.

Anesthesiologists are positioned at the crossroads of surgical care and health systems processes. They interface with nearly every surgical patient, steward intraoperative safety, and increasingly influence preoperative assessment, patient education, and recovery planning. As the specialty evolves toward perioperative medicine and population health, understanding and addressing SDOHs is not ancillary to our mission—it is essential to achieving it.

This Special Article synthesizes emerging evidence on the SDOHs in the perioperative period, outlines biologic and systemic pathways through which they affect outcomes, and proposes strategies for integration into clinical practice and research, with an emphasis on the structures, policies, and inequities characteristic of the U.S. society and healthcare system. By viewing perioperative care through the lens of social context, anesthesiology can expand its traditional focus on physiologic optimization to encompass the social conditions that ultimately determine who reaches the operating room, how safely they are cared for, and how fully they recover.

Conceptual Framework: From Neighborhood to Nervous System

Understanding how social context shapes perioperative outcomes requires a framework that accounts for both individual vulnerability and systemic forces. The Gelberg–Andersen Behavioral Model for Vulnerable Populations provides such a structure.[3] Within this model, perioperative outcomes arise from the interaction of three domains: predisposing factors (who patients are and the contexts they inhabit), enabling resources (supports or barriers that determine engagement with care), and need factors (the medical and physiologic imperatives that drive surgical risk and urgency; fig. 1). Together, these domains operate within structural forces such as neighborhood conditions, systemic discrimination, and policy environments, translating social disadvantage into physiologic stress and adverse outcomes.

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Abbreviations: **SDOH**, social driver of health

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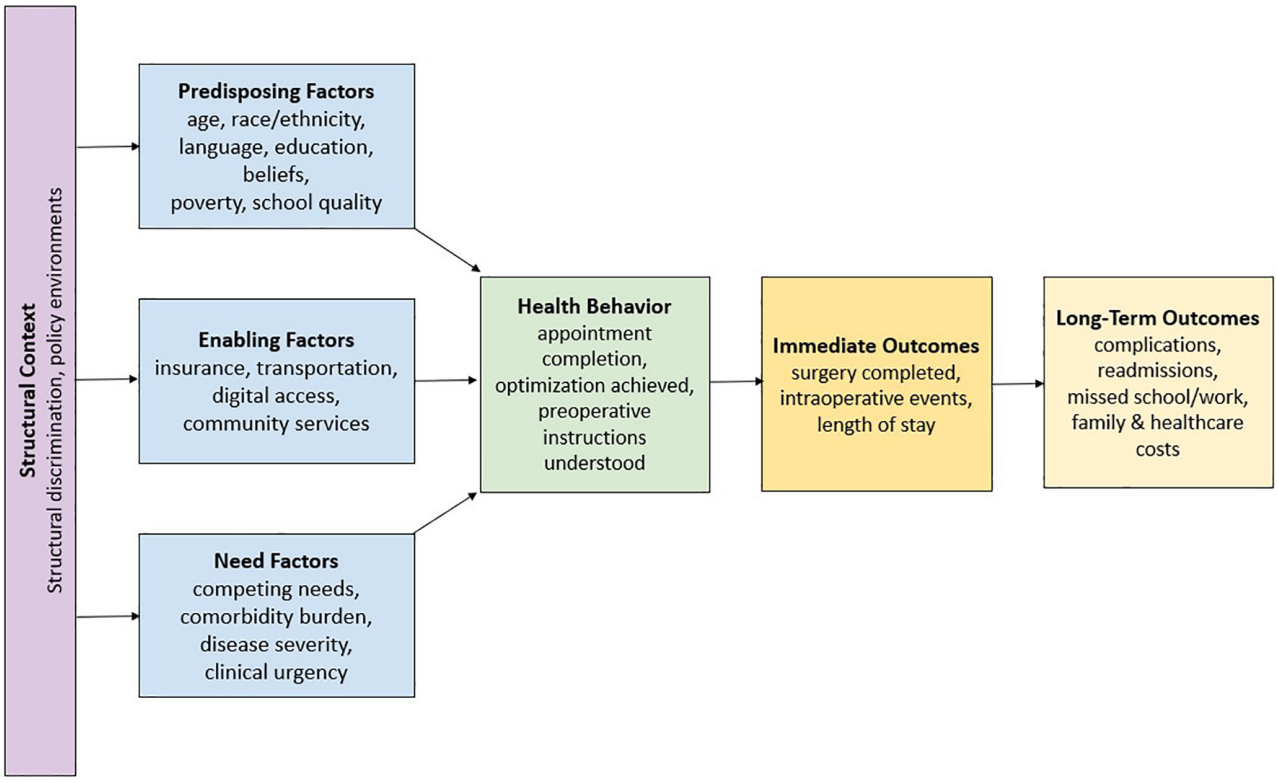

Fig. 1. Conceptual framework for pediatric perioperative care, adapted from the Gelberg–Andersen Behavioral Model for Vulnerable Populations.

Predisposing Factors: The Social Context that Patients Bring to the Operating Room

Predisposing factors encompass the demographic and social attributes that shape exposure to disadvantage long before surgical scheduling.[3,4] These include race, ethnicity, education, language, and health literacy—characteristics that influence how patients navigate complex healthcare systems. In the perioperative setting, these factors often manifest as differential access to resources, communication barriers, and mistrust stemming from previous inequities.

Race and Ethnicity. Race and ethnicity are social constructs, not biologic variables.[5] In healthcare, they function as surrogates for exposure to systemic discrimination.[6] During the past decade, numerous studies have documented racial and ethnic disparities in perioperative outcomes, including surgical access,[7] complications,[8] resource utilization and healthcare costs,[9] and mortality.[8,10,11] These inequities are frequently attributed to socioeconomic disadvantage, yet even minority children from socioeconomically privileged backgrounds have worse outcomes than their White peers, consistent with the "diminishing returns" phenomenon, in which social advantage confers fewer health benefits for structurally marginalized groups.[12,13] Perioperative disparities are therefore rooted not in intrinsic patient differences but in structural inequities that persist throughout the surgical care continuum. Cultural beliefs, previous experiences with discrimination, and institutional mistrust further influence how families perceive anesthesia and the healthcare system, creating gradients of vulnerability that remain invisible to traditional risk calculators.

Language and Communication. Language and communication barriers further modulate perioperative risk. Twenty-two percent of the U.S. population speaks a language other than English at home, and of these, approximately 60% feel comfortable using English only in certain settings.[14] Children whose caregivers prefer a language other than English have nearly double the odds of surgical cancellation, most often due to misunderstood fasting instructions rather than intentional nonadherence.[15] These events signal system-level communication failures rather than patient shortcomings. Intraoperatively, language barriers can compromise safety when miscommunication around consent, allergies, or medication reconciliation contributes to preventable errors.[16,17] Postoperatively, families with limited English proficiency have more severe complications, longer hospital stays, and higher rates of readmission and emergency department use, often driven by difficulties understanding discharge instructions and by lower likelihood of speaking up or questioning care.[17–21]

Limited Personal Health Literacy. Limited personal health literacy affects roughly one third of Americans, and nearly 9 in 10 lack the comprehensive skills needed to navigate the demands of today's complex healthcare system.[22] About 20% of adults read below a sixth-grade reading level,[23] yet most patient-facing materials are written between a ninth- and sixteenth-grade level,[24] creating a substantial mismatch between patient needs and the information provided. Low health literacy contributes to misinterpretation of fasting instructions, medication timing, and postoperative care plans.[25] Children of caregivers with low health literacy experience higher rates of postoperative emergency department visits and readmissions, underscoring persistent unmet needs during the transition from hospital to home.[26] In these situations, preventable postoperative utilization reflects gaps in communication and support rather than patient behavior.

Neighborhood Opportunity. Neighborhood opportunity illustrates that predisposing factors, although often framed at the individual level, are inseparable from the environments in which children live. Area-level SDOHs, including access to green space, safe housing, healthy food, high-quality schools, and freedom from community violence, are increasingly recognized as critical determinants of child health and well-being.[27] Neighborhood disadvantage, captured by measures such as the Child Opportunity Index,[28] is associated with diagnostic delay,[29] advanced disease at presentation,[30] delayed access to surgical care,[31,32] higher rates of day-of-surgery cancellation,[13] readmission risk,[33] and increased healthcare utilization and costs.[34] Indeed, children from very low opportunity neighborhoods have almost 30% higher risk of postoperative death compared to children from very high opportunity neighborhoods.[35]

Nutrition. Specific, measurable attributes of disadvantaged neighborhoods further clarify pathways to perioperative risk. Nutrition is a key determinant of a child's ability to withstand and recover from the physiologic stress of surgery; malnutrition alters drug metabolism, affects respiratory function, and impairs immune response and healing.[36] Malnutrition and undernutrition are closely tied to geography. Approximately 6% of children live in food deserts, which are low-income neighborhoods that have limited access to healthy food settings.[37] These children are up to twice as likely to be obese, putting them at risk for prolonged anesthetic and surgical times, perioperative respiratory adverse events, and other postoperative complications.[38–40] In contrast, about 18% of households are affected by food insecurity[41]—uncertain access to sufficient and safe food. Undernourished children have up to seven times the risk of postoperative complications, including wound infections, reoperation, readmission, and prolonged length of stay.[42–45]

Environmental Exposures. Short-term exposure to fine particulate air pollution is associated with risk of postoperative pulmonary complications and pneumonia.[46,47] Children living in areas with chronically poor air quality have higher rates of asthma and other lung diseases,[48] contributing to increased airway reactivity, more challenging anesthetic management, and greater perioperative complexity. Heavy metal exposures similarly impair immune function and promote inflammation, predisposing children to wound complications and infection.[49] These hazards are not evenly distributed: environmentally disadvantaged communities—such as predominantly Black neighborhoods with elevated lead levels in drinking water and Native American communities disproportionately exposed to household air pollution and contaminated water—bear a disproportionate burden of these toxic exposures, amplifying perioperative risk.[50]

Enabling Factors: Resources and System Capacity

Access to surgical care is shaped by the availability of resources that enable patients to engage with perioperative services. Enabling factors encompass both tangible supports—such as insurance, transportation, and interpreter services—and the broader institutional capacity to provide equitable perioperative care.

Insurance Status. Insurance status remains one of the strongest predictors of perioperative inequity. Nearly 4 million U.S. children are uninsured,[51] and more than half rely on Medicaid.[52] Uninsured children face a fourfold increase in postoperative mortality, while Medicaid-insured children have longer hospitalizations and greater hospital costs.[53] Medicaid and uninsured patients experience higher cancellation rates, longer delays to surgery, and increased postoperative morbidity.[54–56] Limited reimbursement for preoperative coordination, language services, and other essential supports further perpetuates these disparities, underscoring that healthcare financing structure functions as an anesthetic risk modifier in its own right.

Transportation Barriers. Transportation barriers are a leading preventable cause of day-of-surgery cancellation. Nationally, nearly 6 million people miss medical appointments each year due to inadequate transportation.[57] Among children, approximately 4% miss healthcare visits for this reason, with disproportionately higher rates among those living in rural areas.[58] Outside the largest metropolitan areas, public transit systems are limited, infrequent, or unreliable, making timely arrival for surgical appointments particularly difficult.[59] Although Medicaid covers nonemergency medical transportation to reduce these barriers, implementation varies widely across states. As a result, many families are unaware that the benefit exists, and even those who know often

encounter complex scheduling processes, long wait times, and inconsistent reliability.[60]

Digital Access and Literacy. Digital access and literacy have emerged as critical modern determinants of perioperative readiness. Approximately 17 million American children lack high-speed home internet access,[61] limiting their families' ability to complete preoperative education modules,[62] participate in telehealth evaluations,[63,64] or engage in remote patient monitoring.[65] Even when connectivity is available, disparities in digital literacy—from difficulty navigating patient portals to challenges using video platforms—further erode patients' ability to prepare for surgery.[66] These digital gaps, which disproportionately affect caregivers with less education or lower income and those who prefer a language other than English,[66] have measurable consequences: limited digital literacy is associated with later disease presentation, lower rates of indicated surgical intervention, reduced postoperative follow-up, and decreased survival.[67] In an era where preoperative optimization, postoperative monitoring, and care coordination increasingly rely on digital infrastructure, lack of access is not merely a technological inconvenience—it is a structural barrier that shapes perioperative outcomes.

Need Factors: Medical Urgency and Physiologic Vulnerability

Need factors reflect the interplay between disease burden and physiologic response to chronic stress. They represent the biologic translation of social adversity—the "neighborhood-to-nervous-system" pathway.

Allostatic Load. Allostatic load, the cumulative physiologic toll of chronic stress, provides the biologic link between social conditions and perioperative vulnerability. Repeated activation of stress pathways alters cortisol regulation, increases inflammation, and impairs immune response,[68] collectively increasing the risk of postoperative pain, delirium, infection, and delayed recovery.[69,70] While invisible to conventional preoperative assessment, these effects are measurable, modifiable, and central to understanding differential perioperative vulnerability. Allostatic load accumulates gradually in the context of economic hardship, discrimination, unstable housing, food insecurity, and caregiving strain, shaping the baseline health status with which children present for surgery.[71,72]

Medical Comorbidity Burden and Underdiagnosis. The physiologic consequences of allostatic load help explain why medical comorbidities and underdiagnosis cluster in communities facing social disadvantage. An estimated 25 million U.S. children do not have access to a usual source of primary care,[73] limiting opportunities for early detection and longitudinal management of chronic conditions. This gap, layered onto broader structural disadvantages, contributes to the higher prevalence and greater severity of conditions such as asthma, diabetes, and obesity observed among children from socioeconomically disadvantaged backgrounds.[74–76] Children with medical complexity are likewise disproportionately represented among families of low socioeconomic status.[77] These inequities have direct perioperative consequences: children facing socioeconomic adversity have higher rates of emergency department utilization, have fewer well-child visits, and are more likely to present with advanced or poorly controlled disease—patterns that translate into more challenging preoperative optimization and complex anesthetic management.[78]

Competing Demands. Although families may recognize the importance of surgical care, when experiencing socioeconomic adversity, competing demands may require them to deprioritize their child's health needs. Caregivers may have limited paid leave, unpredictable work schedules, or multiple jobs, making it difficult to attend preoperative appointments, secure transportation, or coordinate childcare for siblings.[79] These pressures can limit opportunities for routine preventive care, delay evaluation of new symptoms, and reduce capacity to follow complex perioperative instructions. Importantly, these patterns reflect constrained choices rather than caregiver indifference; families are navigating structural barriers that force trade-offs between medical care and other essential needs.[80,81] In the perioperative setting, these competing priorities manifest as incomplete optimization and higher day-of-surgery cancellations, underscoring the importance of supportive systems that reduce logistical and financial burden.

Outcomes Pathway: From Access to Recovery

The interaction of predisposing, enabling, and need factors manifests across the entire perioperative continuum. Access outcomes include delayed scheduling, incomplete preoperative optimization, and day-of-surgery cancellations. Process outcomes involve intraoperative complications, communication failures, and extended length of stay. Health outcomes encompass postoperative pain, infection, readmission, and mortality—each reflecting the cumulative influence of social context. Together, these tiers capture how social and structural conditions shape the patient's journey through the surgical system—from the opportunity to undergo surgery, to the quality of care received, to the ultimate health achieved. This framework positions anesthesiology to examine inequities across the entire continuum rather than at a single procedural moment.

Addressing SDOHs in Perioperative Practice

Recognizing SDOHs as determinants of surgical access and outcomes compels anesthesiologists to act not only as perioperative experts but also as architects of equitable systems. While many drivers lie outside the walls of the operating room, their effects can be mitigated through structured

preoperative assessment, culturally responsive communication, and intentional system design.

Clinical Level: Integrating SDOH into Perioperative Care

Systematic SDOH Screening and Documentation. Standardized screening and documentation of social needs is endorsed by the American Academy of Pediatrics (Itasca, Illinois) as a means to indicate early barriers such as transportation challenges, food insecurity, and housing instability.[82] Incorporating these screenings into the perioperative setting is both feasible and well-accepted by families, and emerging evidence suggests that identifying unmet social needs can help detect patients at increased risk for postoperative complications.[83,84] Although many institutions have begun to embed social needs questions into clinic workflows, these data are often updated only every few years—far too infrequently to reflect the rapidly changing circumstances many families face. Because social conditions can shift between appointments and directly affect perioperative readiness, social needs should be reassessed and documented at every visit, including during preoperative evaluation.

Communication and Language Concordance. Culturally tailored, plain-language materials—written at a fifth- to sixth-grade reading level and supported by images or videos—enhance comprehension for all patients. Applying "universal precautions" for health literacy by assuming limited understanding until proven otherwise complements language access strategies.[85] Techniques such as teach-back confirmation, checklist-based fasting instructions, and visual aids can improve adherence and decrease cancellations.[86–88] Importantly, these principles apply equally to verbal communication, yet clinicians are not uniformly trained to adapt spoken language, tone, and framing to patients' levels of understanding or to avoid terminology that may inadvertently increase stress, highlighting an important opportunity for targeted communication training in perioperative practice.

Hospitals that have systematically integrated professional interpreters report better comprehension, improved process-of-care measures, enhanced patient experience, and lower preventable healthcare utilization.[17,18,89] Although relatively few high-quality studies directly link consistent interpreter use to surgical complication rates, the broader evidence clearly supports its safety and quality benefits. Every perioperative encounter involving language discordance should default to trained professional interpreters, with support proactively arranged for preanesthesia communication, consent discussions, and discharge counseling.

Transportation and Scheduling Flexibility. Transportation vouchers and hospital-supported ride-share partnerships have been shown to reduce missed appointments.[90–92] Because transportation barriers often interact with inflexible scheduling, complementary strategies that reduce the number of required visits and better align the timing of care may further improve attendance. While direct perioperative evidence is limited, outpatient studies indicate that greater flexibility or patient control over scheduling is associated with improved attendance and patient satisfaction,[93,94] suggesting that similar approaches might reduce day-of-surgery cancellations among families with logistical constraints. Hospitals have also reported success with "same-day surgery" models, in which preoperative assessment and surgery occur within a single visit. This approach reduces travel burden, childcare disruption, and the risk of last-minute cancellations, benefiting both patients and health systems.[95] Where resources allow, evening preanesthesia clinics may further reduce barriers.

Nutritional and Environmental Assessment. Preoperative nutrition is the most readily modifiable preoperative risk factor associated with poor surgical outcomes; however, only 1 in 10 malnourished patients is ever diagnosed, and even fewer are appropriately treated.[96] Screening for food insecurity, followed by collaboration with hospital dietitians, community food programs, or public health agencies, allows timely intervention that can improve wound healing and recovery.[97] Environmental exposures warrant similar attention: exposures in the home, school, transportation settings, relatives' homes, and neighborhoods, such as environmental tobacco smoke, allergens, and mold, can meaningfully affect anesthetic and postoperative management.[98] The preoperative assessment also offers a valuable "teachable moment," as parents who smoke are more likely to attempt cessation after a child's surgical encounter.[99] Clinicians should recognize that children who have recently immigrated from low- and middle-income countries may have experienced higher levels of toxic environmental exposures, which may influence perioperative risk.[50]

Institutional and System-level Strategies

While individual clinicians play a pivotal role, enduring progress depends on institutional commitment to structural change.

Embedding SDOHs in Quality and Safety Dashboards. National accrediting and quality bodies are increasingly embedding equity into performance expectations. The 2025 National Patient Safety Goals of the Joint Commission (Oakbrook Terrace, Illinois) now require hospitals to stratify quality and safety data by sociodemographic factors to identify disparities and to develop written action plans targeting at least one inequity.[100] Similarly, Centers for Medicare & Medicaid Services (Baltimore, Maryland) is incorporating equity adjustments into value-based purchasing programs.[101] In response, about 40% of hospitals have adopted disaggregated diversity, equity, and inclusion data, two thirds of which use such data to inform decisions about patient care.[102] Despite this progress, substantial gaps remain in

how equity is measured. A recent scoping review found that while safety and effectiveness are frequently assessed, equity is often addressed indirectly through risk or severity adjustment rather than through dedicated disparity indicators; moreover, most health equity dashboards disaggregate outcomes only by race and ethnicity, omitting critical predictors such as language and area-level SDOHs.[103,104] As a result, current approaches tend to stratify existing quality metrics rather than develop new, equity-specific measures that directly evaluate inequitable care. This gap is particularly salient in perioperative care, where delays in obtaining surgery often mirror how effectively institutions mitigate social disadvantage. Accordingly, perioperative programs should implement equity-focused process measures—such as tracking scheduling delays, day-of-surgery cancellations, and rescheduling intervals—as core indicators of equitable care delivery.

Perioperative Care Navigation. Systematic reviews show that patient navigation can meaningfully enhance access to care. In a recent meta-analysis, navigated patients were more than twice as likely to complete recommended care compared with those receiving usual care.[105] Pediatric studies, though fewer, similarly demonstrate improved completion of care processes, better caregiver communication and understanding, and greater emotional and social support.[106] Evidence specific to surgical populations remains limited, but early findings are promising, suggesting that navigation may shorten time to discharge and reduce emergency department use and readmissions—benefits that appear most pronounced among medically complex patients.[107]

Digital Inclusion. Hospitals' growing reliance on telehealth and patient portals makes digital inclusion a prerequisite for equitable perioperative care. Ensuring access requires more than simply offering virtual services: platforms should be mobile-friendly, incorporate text-based reminders, and provide multilingual interfaces that meet patients where they are. Partnerships with community organizations can further close the digital divide by supporting broadband access, device lending programs, and digital literacy assistance for families who need it.[108]

Research and Innovation Priorities. Research is the engine that can transform equity from an ethical imperative into a measurable scientific discipline. Priorities for the coming decade include mechanistic studies that illuminate how chronic stress and inflammation shape perioperative outcomes; implementation science that tests scalable interventions—such as transportation support, embedded interpreters, and digital communication platforms—within real-world perioperative workflows; and predictive modeling that integrates neighborhood and social-risk indices into preoperative risk stratification tools. To ensure relevance, acceptability, and sustained impact, these research efforts should incorporate community-engaged and codesigned approaches, particularly when interventions target populations disproportionately affected by social disadvantage. Advancing equity will also require linking perioperative registries with population-level SDOH measures, including the Child Opportunity Index and Social Vulnerability Index, as well as evaluating policy levers that align reimbursement and accountability with equity-centered care. These research directions mirror National Institutes of Health (Bethesda, Maryland) and American Society of Anesthesiologists (Schaumburg, Illinois) strategic agendas focused on precision medicine, population health, and health equity,[109,110] positioning anesthesiology to lead the development of data-driven solutions that improve both outcomes and justice in perioperative care.

Operational and Resource Considerations

The feasibility and cost of strategies to address SDOHs in perioperative care vary widely across settings. Relatively low-cost approaches—standardized screening, plain-language communication, teach-back techniques, and routine use of professional interpreters—can often be integrated into existing workflows.[16,85,111] In contrast, interventions that require greater institutional investment, such as patient navigation, transportation assistance, and preoperative optimization clinics, may be more feasible in high-volume or well-resourced centers.[112–115] Importantly, the costs of implementation must be weighed against the substantial downstream consequences of unaddressed social risk, including delayed presentation, more advanced disease at the time of surgery, higher complication rates, day-of-surgery cancellations, prolonged hospitalizations, and preventable readmissions. Framing SDOH-informed perioperative care as both a patient safety and resource utilization strategy may facilitate broader adoption and institutional support.

Limits of Perioperative Approaches to SDOHs

An inherent limitation in perioperative approaches to SDOHs is that perioperative care, by definition, begins only after patients have successfully navigated referral pathways that are themselves profoundly shaped by social disadvantage. Many of the most consequential effects of SDOHs—including delayed presentation, untreated chronic disease, and malnutrition—occur upstream of anesthesiology involvement, particularly among children lacking access to primary care. Consequently, perioperative interventions such as patient navigation, interpreter services, and preoperative optimization may improve safety, communication, and care processes without fully addressing the underlying social conditions that drive inequities. Available evidence suggests that such interventions are most effective for discrete, process-oriented barriers and may preferentially benefit patients with fewer baseline social risks.[106] Recognizing these constraints underscores the importance of situating perioperative SDOH efforts within broader health system

and policy initiatives rather than viewing them as standalone solutions.

Call to Action: Beyond the Operating Room

The perioperative setting exposes how social disadvantage disrupts care, from day-of-surgery cancellations to hospital readmissions. Because anesthesiologists care for every surgical patient and oversee key safety processes, our specialty is well positioned to identify where inequities arise and to redesign systems that perpetuate them.

Social determinants influence access, anesthetic readiness, and recovery—not by chance, but through modifiable features of how care is organized. Incorporating social context into perioperative assessment, communication, and quality improvement can make risk prediction and outcomes more reliable.

Beyond implementing changes within the perioperative domain, anesthesiologists and other perioperative clinicians can also serve as advocates—supporting community engagement in the design of equity-focused interventions and contributing clinical insight to policy efforts aimed at mitigating the broader social determinants that shape perioperative risk.

Advancing equity is therefore central to safe perioperative care. Integrating SDOHs into our science and practice will help ensure that every child reaches surgery prepared and recovers fully, regardless of circumstance.

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