Current Concepts Review

A Review of Medical Ethics in Orthopaedic Surgery

Current Foci and Future Considerations

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- Medical ethics education is a required component of orthopaedic surgery resident training per the Accreditation Council for Graduate Medical Education (ACGME) guidelines, although no standardized curriculum currently exists.
- Beyond the 4 principles of bioethics (autonomy, beneficence, nonmaleficence, justice), additional ethical concepts relevant to orthopaedic care include utilitarianism, deontology, virtue ethics, moral intuitionism, microethics, and narrative ethics.
- Ethical themes identified in the literature relevant to orthopaedic surgery include the ethics involved in medical decision-making, use of new technologies, caring for vulnerable patients, performing high-stakes procedures, the impacts of trainee status on patient care, and patient attitude regarding conflict of interest.
- Ethical themes that we sought to identify in the literature but found lacking include the ethics of providing orthopaedic care in low-resource settings, orthopaedics entrepreneurship, disability ethics, trainee mistreatment by their supervisors, and the ethics involved in the recognition and reporting of child and elder abuse.

Ethical considerations in orthopaedic surgery are essential as medical practice continues to evolve[1]. Bioethics, defined as principles governing conduct in health care, is a required component of orthopaedic education, as outlined by the Accreditation Council for Graduate Medical Education (ACGME) guidelines[2]. Current training largely focuses on the 4 principles of bioethics: autonomy, beneficence, nonmaleficence, and justice[3]. Although these principles provide a crucial foundation, they may not fully address the diverse and complex ethical challenges that orthopaedic surgeons encounter throughout their careers.

As orthopaedic surgeons progress from medical school through residency and into practice, they are exposed to a variety of ethical dilemmas that influence their decision-making frameworks. For example, residency is known to introduce challenges such as burnout[4], which can affect how ethical principles are applied in clinical settings[5]. Later, in practice, factors such as workload, financial considerations, and professional responsibilities can further complicate ethical decision-making processes. These scenarios extend beyond the scope of the 4 principles, highlighting the need for additional ethical frameworks.

This article seeks to deepen the understanding of ethics in orthopaedic surgery by exploring additional ethical models such as virtue ethics, utilitarianism, and deontology. We also present a scoping review of ethics-related articles in orthopaedics, highlighting recurring ethical challenges and offering guidance on ethical decision-making in this field.

An Overview of Moral Philosophy and Medical Ethics

Here, we discuss several concepts in ethics, which will be useful in contextualizing the ethical themes reviewed in this article. (It

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should be noted that we take ethics and morality to mean the same thing for the purposes of this article.) Our purpose for discussing these concepts was not to endorse one to which all orthopaedic surgeons should ascribe; all of the discussed topics can be applicable in certain cases and inapplicable in others. The intent of this section is to shed light on the richness of moral thought that is available for orthopaedic surgeons to draw upon in their clinical practice. These concepts are summarized, and examples are provided in Table I.

The 4 Principles

The most notable framework for medical ethics are the 4 principles taught nearly universally in medical education: autonomy, beneficence, nonmaleficence, and justice[6]. These principles represent 4 dispositions that should be emphasized in the delivery of ethical medical care: norms of respecting patients' autonomous choices, norms of maximizing benefits for patients, norms of avoiding causing harm to patients, and norms of fairly distributing services and resources among patients. In ethically challenging situations, ≥2 of these principles are at odds with one another, and it is up to the decision-maker to engage in a process of fact-gathering and judicious balancing of these principles to "generate solutions considered moral."[3]

Moral Philosophy Beyond the 4 Principles

Medical ethics as it is known today arose in the 1970s in response to the mistreatment of human research subjects, culminating in the introduction of the 4 principles[7]. These

TABLE I Summary and Examples of Concepts in Medical Ethics

Concept Name	Description	Example
4 principles		
Autonomy	Adhere to patients' autonomous choices	Performing arthroscopy for a degenerative meniscal tear in an athlete as a primary treatment because the athlete wants to return to sport sooner
Beneficence	Promote the well-being of patients, acting in their best interests	Referring a complex case to a more experienced surgeon
Nonmaleficence	Avoid causing harm to patients	Declining to perform a surgery because the hospital does not have the resources required for optimal postoperative care
Justice	Fairly distribute goods, services, and resources to those who need care	Operating on a volunteer basis for underfunded patients to ensure that patients across socioeconomic levels are able to receive care
Rationalist ethics		
Deontology	The right action is the one that one is duty-bound to perform	Treating a patient who has made rude remarks to a colleague out of a duty to care for the ill
Utilitarianism	The right action is the one that produces the most good for the greatest number of people	Postponing an elective procedure so that a surgery that is a greater emergency can be performed
Non-rationalist ethics		
Virtue ethics	A morally right action is one that a virtuous person would do in a given situation; virtuous traits such as wisdom or courage should be cultivated and exhibited in moral actions	Embodying the virtue of generosity to stay to talk with a concerned patient after the clinic has closed
Moral intuitionism	Moral intuitions are formed through one's interactions with the society they are in; they are strongly held and can serve as initial or final moral judgments	Having a "gut feeling" that a pediatric patient does not want to undergo a procedure that his or her parents are requesting and asking to speak alone with the patient
Additional moral considerations		
Microethics	Focuses on the ethical aspects of small behaviors such as word choice or comportment rather than on addressing major ethical dilemmas	Speaking with patients at a level that matches their health literacy to ensure that the patients understand their treatment options
Narrative ethics	Patients seek medical care because something about their condition has disrupted their anticipated life story; hearing the patient's story will reveal what matters to them and can guide the care that they receive	Learning that a patient is afraid of surgery because their parent had severe intraoperative complications and offering nonoperative treatment for a hip fracture

principles are described as being derived both from common morality, a pre-theoretical and globally shared understanding of moral conduct[8], and from ethical theories such as deontology and utilitarianism[6]. Under utilitarianism, the right action is the one that maximizes benefits and minimizes harm, thereby serving as a basis for beneficence and nonmaleficence. In contrast, deontology stresses the importance of not using individuals as a means to an end, which supports the principle of respecting autonomy.

Some critics find that the aforementioned moral theories, called rationalist theories, are objectionable because they do not realistically represent the way in which humans make moral decisions[9] and have instead advanced non-rationalist theories to be used in medical settings. Virtue ethics, one such non-rationalist theory with a strong foothold in medical ethics, describes moral action as what a virtuous person in an identical situation would do, and enumerates some common virtues such as courage, generosity, honesty, intelligence, and justice[10]. Endorsing such a conception of medical ethics affords the conscientious physician more independence in moral thought and circumvents the impartial analysis demanded by rationalist approaches, allowing for the physicians' desire to provide care for their patients to motivate their decision-making processes.

Similar to the common morality that serves as the foundation for the 4 principles, moral intuitions, or beliefs about a moral situation that are not made through the application of rules or principles[11], are acknowledged to be powerful, stable, and consistent beliefs about what is right or wrong in a given situation[11-13]. As such, these moral "gut feelings" can be relied upon by orthopaedic surgeons as a reasonable starting point when approaching ethically challenging cases, either as an initial awareness that there is an ethically troubling situation at hand, or as a way to evaluate the ethical judgments made through the application of moral theories.

Ethics of the Ordinary

There exists an additional dimension to medical ethics, beyond the adjudication of ethical dilemmas, that is often neglected in medical ethics education: the ethics of everyday medical practice. This "ethics of the ordinary," or "microethics," has been described as something that is "unique to each situation, arises spontaneously at a particular moment in time, and is created in the relational space between the participants."[14] Microethics, then, is not concerned with the ways in which physicians should approach the infrequent ethical quandary, but, rather, the ways in which physicians should comport themselves in their everyday medical practice to optimize the care that they are able to provide. As such, microethics is not in itself a theory, and any of the above ethical concepts can be applied in a microethical way.

An example of microethics that may be familiar to orthopaedic surgeons is the American Academy of Orthopaedic Surgeons (AAOS) guidelines on ethics and professionalism, which describe desirable qualities and dispositions that orthopaedic surgeons should strive to embody[15-18]. These guidelines do not aim to provide a framework for orthopaedic surgeons to employ when faced with ethical dilemmas, but, rather, seek to promote ethical practice by emphasizing the importance of attributes such as patient-centered therapeutic relationships, truthful and compassionate personal conduct, disclosures of conflicts of interest, and continued education[15].

Complementary to microethics is narrative ethics, which emphasizes the role of the physician not as one of treating a diagnosis, but of offering medical expertise in order to restore the aspects of a patient's life that matter most to him or her[19]. In many cases, the restoration of a patient's life narrative necessitates the treatment of a diagnosis. However, within the framework of narrative ethics, the treatment of the diagnosis is the means to an end and not the end in itself. Understood this way, an orthopaedic surgeon might view the arthroplasty of a dancer's hip as a surgical procedure to allow the patient to do what he or she loves doing again, rather than as a surgical procedure to replace a degenerated hip.

Ethical Themes in Orthopaedic Surgery

To identify ethical themes pertinent to orthopaedic surgery, we searched the literature with the assistance of a medical librarian (L.O.) for articles that contained terms related to "orthopaedic surgery" and "ethics" (see Appendix I for the full search strategy). This search yielded 10,005 records, which were screened by us (R.X.L., Z.M.S.H., R.T., M.W., D.G.B., and M.M.) to determine which articles contained substantive discussions of ethical issues relevant to the clinical practice of orthopaedic surgery; 682 articles were retained, and common themes were identified through inductive content analysis. The relevance of these themes to orthopaedic practice was agreed upon by multiple resident and attending orthopaedic surgeons (U.G., T.J.C., M.B.P., B.B.R., O.H.A., C.H.P., J.R.D., W.M.G., M.A.H., D.R.D., and L.R.D.).

Because of the qualitative nature of this study and the large amount of literature corresponding to each theme, rather than exhaustively discussing the content of every theme, we have elected to highlight the aspects of each theme that we believe to be most relevant to orthopaedic practice. In order to exemplify some of the ethical topics discussed in the following sections, we analyze several hypothetical cases in Appendix II.

Decision-Making

Informed consent and medical decision-making are practices paramount to promoting patient autonomy and have become the most emphasized concepts in medical ethics[20,21]. As such, it is important to highlight topics related to medical decision-making in orthopaedic surgery.

Several studies investigated the ability of patients to recall information provided to them in the informed consent discussion. The recall rates for operative risks were found to be 12% to 16% at 1 month after knee arthroplasty[22] and 13% to 16% at 4 weeks after total hip arthroplasty[23]. Another study found the patient recall rate for spine surgery complications to be 45% immediately after watching an informative video, dropping to 18% at 6 to 8 weeks postoperatively[24]. These results

demonstrate the need for the informed consent process to be improved in orthopaedic surgery, especially as a lack of informed consent is a major basis for malpractice lawsuits, ranging from 24% to 64% of malpractice cases in spine surgery[25-27].

Many articles investigated strategies to augment the decision-making process to better inform patients. For instance, studies found an increase in patients' understandings of their own articular fractures and their treatment options when personalized 3-dimensional (3D)-printed models were used in the informed consent discussion compared with traditional imaging[28,29]. Several studies investigated ways in which consent forms could be made more understandable to patients, including the use of preprinted and procedure-specific consent forms that are written to be easily readable and avoid the use of medical jargon[30,31], as well as the use of artificial intelligence (AI) to increase the understandability of consent documents[32,33]. Humbyrd endorsed a narrative approach to medical decision-making by using a "Best Case/Worst Case" tool that details the best, most likely, and worst immediate and long-term outcomes of the treatment options available to patients, thereby allowing patients to determine which option most aligns with their values with greater transparency[34].

Other studies have advocated for the inclusion of additional information in the informed consent process that might not be routinely included, such as the need to mention the risk of postoperative visual loss for patients undergoing prone spine surgery[35], possible x-ray exposure during the surgical procedure[36], or the risk of developing complex regional pain syndrome[37]. Several articles studied the effects of implementing opioid use agreements during the informed consent process[38,39] and were able to identify a clinically important decrease in the number of opioid doses prescribed for those who received preoperative consenting for opioid use[39].

Ethics in Emerging Technologies

As the field of medicine progresses, new technologies emerge that are designed to aid orthopaedic surgeons in maximizing patient outcomes, efficiency, and quality. At the forefront of technological development is the usage of machine learning and artificial intelligence (AI) in everything from consenting to clinical decision-making, imaging interpretation, and outcome modeling.

One application of generative large language models such as ChatGPT (OpenAI) is in the patient consenting process. Although ChatGPT can improve the readability and accessibility of both research and preoperative consent forms[33], errors, optimization limitations[32,40], and possible training-induced bias[41] make it more appropriate for use as a supplementary tool rather than a primary one[42].

Robotic, computer, and virtual reality (VR)-assisted surgical procedures constitute another arm of technological advancement in orthopaedics. The ethical concerns of using VR in orthopaedics include data privacy risks[43], as well as the potential shift of decision-making from surgeons to machines, impacting surgeon autonomy and judgments of liability[44]. The integration of robotics into surgery also poses ethical challenges, including ensuring surgeon competence with new technologies[45-47], high costs leading to potential health-care inequities[46,47], balancing human intervention with robotic decision-making[48], and legal liabilities of using these technologies in patient care settings[46-48].

Increasing internet usage by both patients and surgeons also introduces new ethical considerations. Orthopaedic surgeons should ask patients if any online content contributed to their decision-making, as social media or advertisements may influence patients' decisions[37,49], and patients increasingly search for information regarding their medical conditions and procedures on web sites such as YouTube, which was found to contain low-quality information[50]. Concerns were also raised with regard to surgeon smartphone use, as the benefits of rapid communication and access to applications and information must be considered against the risks of patient privacy and data misuse[51,52]. Surgeons also increasingly promote their practice on social media, highlighting the need for surgeons to adhere to legal and ethical guidelines in social media interactions, ensuring professionalism and secure communication to avoid U.S. Health Insurance Portability and Accountability Act (HIPAA) violations[53-57]. Alan et al. suggested early training in social media professionalism, as well as providing disclaimers and disclosures alongside social media content[58].

Lastly, advancements in medical devices and bioengineering such as allograft tissue transplantation, bone graft substitutes, and 3D-printed implants also introduce ethical issues primarily focusing on patient safety, informed consent, and the responsible use of emerging technologies. The use of engineered implants raises concerns about quality control[59], equitable distribution, conflicts of interest[47,60], patient identity, and transparency in clinical research, especially when new and untested technologies such as 3D-printed implants are involved[61,62]. It is crucial to ensure that patients are properly informed of the risks and benefits[63], and that novel devices such as 3D-printed implants are rigorously tested before use[63-65]. Evolving regulatory frameworks are needed to keep pace with technological advancements and ensure patient safety, particularly when assessing prostheses' biocompatibility[47]. Biomodeling using 3D-printed models as surgical guides or for preoperative preparation introduces ethical concerns about the accuracy and reliability of models and the impact on health-care costs and accessibility[28,66].

Populations with Special Ethical Considerations

Orthopaedic surgeons treat a wide range of patients, and some patient populations necessitate special ethical considerations because of their vulnerable status. As such, it is pertinent for orthopaedic surgeons to be familiar with some of the ethical challenges that may arise when caring for these patients. We summarize pertinent ethical considerations for several such populations in Table II.

Orthopaedic Procedures with Special Ethical Considerations

In our review of the literature, several high-stakes procedures that warrant heightened ethical scrutiny were identified, which we summarize in Table III.

TABLE II Population-Specific Ethical Considerations

Population	Ethical Considerations
Body integrity identity disorder (BIID)	Ethical arguments surrounding BIID broadly focus on the conflict between nonmaleficence and patient autonomy in choosing to amputate a healthy limb[96-102]. Patrone, in arguing against performing elective healthy limb amputation, stated that there is not sufficient evidence to claim that amputation is the only way to manage BIID[99]. Gibson argued that the belief that the amputation of a healthy limb will necessarily result in the infliction of disability is flawed[97]. In addition, neuroprostheses may provide functionality comparable with biological limbs, further weakening the ethical argument against elective amputation[98].
Pediatric patients	Decision-making with pediatric patients can introduce conflict when there are competing interests between children, their caregivers, and their physicians. It is important to promote beneficence and respect patient autonomy when caring for pediatric orthopaedic patients[103,104] and to ensure that children have an appropriate understanding of the risks and benefits of treatment options[103]. This is especially important to consider, as surgeons may encounter patients with the short-term goal of rapid return to sport despite the long-term risks of a surgical option[105,106].
Geriatric patients	Age is a major risk factor for both chronic and acute musculoskeletal injuries. With age-related decline in cognitive function, there are concerns related to obtaining informed consent from this population[107,108]. Hip fractures in this population are associated with high mortality, and articles discussed the importance of shared decision-making and early discussions with regard to patient preferences for surgical or nonoperative management, noting that, although nonoperative management is associated with higher mortality, patients may prefer less invasive palliation at the end of life[109,110].
Diminished decision-making capacity	For orthopaedic patients lacking decisional capacity, Taylor et al. underscored the importance of attempting to restore capacity prior to surgical intervention, to allow patients as much as possible to make autonomous, informed decisions[111]. Furthermore, Kahler and Davis discussed the importance of recognizing avenues to respect patient autonomy in surgical decision-making, such as the use of court-appointed surrogates[112].
Social vulnerability	Studies have noted that the use of bundled payment systems for joint replacement surgeries can exclude patients who are likely to have complications from receiving care, including those with diabetes and those who are above a certain body mass index[113,114]. This method of choosing which patients should undergo a surgical procedure poses many ethical questions with regard to autonomy, social justice, and beneficence. Additionally, orthopaedic surgeons must be cognizant of their perceived high social status and be aware that patients, particularly those of lower sociodemographic backgrounds, may defer to their surgeons' recommendations against their own desires from a fear of retribution or the provision of lower-quality care[115,116] and should mitigate these perceptions by establishing a strong rapport with patients.
COVID-19	As most orthopaedic procedures are intended to treat non-life-threatening conditions, an ethical dilemma emerged for orthopaedic surgeons during the COVID pandemic with regard to balancing patient autonomy with justice in the setting of limited resources[117,118]. For elective surgical procedures, larger concerns for justice should override a patient's individual choice, given that delays in procedures can be considered "safe delays."[119,120] In future crises, the use of telehealth may help to aid in shared decision-making and adequate follow-ups[121-123].
Cultural considerations	Patients' cultures can affect patient decision-making in orthopaedic care; in particular, certain cultural practices may restrict medical interventions, such as blood transfusions for Jehovah's Witnesses[124] or the use of animal-derived biomaterials for patients with religious restrictions on the use of certain animal products[125]. For Muslim patients, orthopaedic surgeons should be aware of the functional outcomes of hip and knee surgery on patients' abilities to pray after surgery[124,126]. Culture also affects the perception of disease, which, in turn, can affect a patient's decision to undergo a procedure; for instance, in a systematic review, Black patients were reported to tend to view osteoarthritis as a natural part of aging and may have preferred nonoperative remedies, whereas White patients were reported to tend to view surgical interventions as beneficial[127]. Such considerations require orthopaedic surgeons to expand their informed consent discussions to include these multifactorial cultural considerations in order to deliver care that aligns with patients' values.

Conflicts of Interest

In orthopaedic surgery, conflicts of interest are particularly concerning because of the close financial relationships between surgeons and the orthopaedic industry. Although collaboration between physicians and industry can contribute to advancements in medical products, the financial ties involved raise concerns about potential impacts on patient care.

TABLE III Treatment-Specific Ethical Considerations

Treatment	Ethical Considerations
Arthroplasty	As the number of joint arthroplasties increases, there are many ethical issues that arise, including the role of industry, implant type, cost, and risk factor modification[47,128,129]. Ethical concerns involve conflicts of interest in working with industry, and new technologies that stem from industry-sponsored research may require greater scrutiny[47,130]. Several articles have analyzed body mass index cutoffs for arthroplasty, noting that shared decision-making is crucial to mediate the increased risk of complications with improvement in patient quality of life[115,128,131].
Hand transplant	Hand transplants and other vascularized composite allografts provide the unique benefit of functional and aesthetic restoration at the cost of lifelong immunosuppression[132,133]. These procedures should not be offered only as a last resort but rather introduced earlier in the reconstruction process, as prior autologous reconstruction attempts may limit the success of transplantation and limit the amount of viable tissue for contingency reconstruction should the transplant fail[132]. One article argued that it is not enough to understand the risks of hand transplantation from the perspective of the provider, but there must be information and understanding gathered from many different experiences to allow a patient to make the most informed decision[134].
Cosmetic limb lengthening	Limb lengthening has been performed to address skeletal deformities and limb-length discrepancies, but new potential has been discovered in using limb lengthening cosmetically. Several articles explored the ethical implications of such procedures in patient decision-making capacity as well as whether such procedures can be morally justified[135,136]. Such dilemmas call upon patient autonomy in determining a patient's decision-making capacity to undergo such a surgical procedure; there also remain the considerations of beneficence and nonmaleficence, both physically and psychologically.
Amputation	The literature discusses the ethics associated with pursuing amputation rather than limb salvage. To promote ethical decision-making, Smith et al. underscored the importance of integrating the psychosocial factors that influence patient decisions with provider knowledge of risks and benefits[137]. A way to promote patient autonomy and to ensure informed consent is offering the option of amputation as early as possible, even if the limb is salvageable, so patients are aware of their choices for care[138]. It is important to not view pursuing amputation over limb salvage as a surgical failure, but rather realize that promoting patient autonomy and quality of life is paramount[111,139]. In settings of acute trauma, the stakes of informed consent are higher, as patients may be in distress or unconscious, and it can be difficult to gauge if a decision to amputate or salvage a limb was made in an informed manner. In such cases, Humbyrd recommended stabilizing the patient with provisional treatment such as irrigation and debridement and the application of a negative-pressure dressing so that a decision can be made at a later time in a nonemergency setting[34].

In assessing the influence of industry sponsorship on study outcomes, Dubin et al. found that 78% of the reviewed studies with conflicts of interest had positive outcomes, with a significant positive association between conflicts of interest and industry-sponsored research[67]. This raises concerns, as Dubin et al.[67] also found that 12% of industry-funded research did not report conflicts of interest, despite widespread consensus that company sponsorship should be regarded as a conflict of interest[67-69]. Although some have argued that certain conflicts of interest are unavoidable, the accuracy and transparency of disclosures necessitate more scrutiny[70].

When looking at patient attitudes toward physician-industry relationships, studies found that patients believe that collaboration between physicians and industry is essential for producing high-quality medical products, as patients trusted products made with the professional insights of an orthopaedic surgeon and believed that consulting surgeons should be compensated[71-73]. However, patients are still concerned about financial relationships between orthopaedic surgeons and industry and likely do not know what ties their orthopaedic surgeon has with the industry or whether it has impacted their quality of care[73]. These findings underscore the complexity of conflicts of interest and suggest that improved transparency in disclosing these relationships is essential for maintaining trust and integrity in patient care. As the Physician Payments Sunshine Act requires pharmaceutical and device companies to disclose payments to physicians, which are publicly accessible in the OpenPayments database[74,75], orthopaedic clinics can consider linking the OpenPayments profiles of their surgeons to promote full transparency and standardize conflict-of-interest reporting; however, emphasis should also be placed on self-regulation and transparent communication.

Ethics in Orthopaedic Surgery Training

Orthopaedic surgery training poses a distinct ethical challenge, as an inevitable aspect of resident training is the progression from novice to experienced surgeon, which requires hands-on surgical experience. Surgical procedures performed by residents early in training thus often result in longer operative times and increased complication rates[76], which may constitute harm to patients[77], even if long-term outcomes are largely unaffected[78,79]. Capozzi and Rhodes argued that these harms are justified, as training is necessary to achieve a broader societal goal to have skilled surgeons[77], although the potential for this harm can be mitigated through simulation training[80,81], especially as residents are spending less time in the operating

room[82,83]. One survey administered to residents found that 100% of respondents believed simulation training to be helpful, and 84% of respondents believed that simulation training should be mandatory[83]. Another survey found that 80% of residency program directors and 86% of residents believed that simulation training should be required, although the cost of implementation was identified as the primary barrier to implementing simulation training[84]. Porcine specimens have been suggested as an economically viable training model for arthroscopic procedures[85].

Concerns were also raised with regard to orthopaedic surgery trainees' abilities to obtain informed consent. One study found that, although 99% of residents believed that they were able to obtain informed consent from patients, many critical aspects of the informed consent process were not routinely included by residents, such as asking about goals of care, presenting treatment alternatives, or using supplemental decision-making materials[86]. Resident knowledge also posed a challenge to obtaining informed consent, with 1 study finding that 86.3% of residents believed that inadequate knowledge was a major barrier to obtaining informed consent[87]. Despite this, in another study, 60% of residents had obtained informed consent for procedures in which they had insufficient understanding of the risks and benefits[86]. The range of residents who had received formal training in obtaining informed consent in these studies ranged from 33.5% to 50%[86,87]. These findings demonstrate a need for structured informed consent education for orthopaedic surgery residents that encompasses both the core tenets of informed consent and procedure-specific information that is necessary to provide patients with the risks and benefits of the treatment options available to them.

Limitations

A major limitation of this article was the inability to summarize the results of our literature search in its entirety because of the expansive breadth of topics encountered. Additionally, articles that did not explicitly contain words such as "ethics" or "bioethics" were not included in our search results, meaning that there may be additional themes in the literature that were not identified. Lastly, we only discussed ethical concerns pertinent to clinical orthopaedic practice, and the ethics with regard to research and publication also need to be discussed.

Future Ethical Considerations

Future work must be done to identify additional ethical domains that are not present in the literature but are nonetheless important for orthopaedic surgeons to be cognizant of in their practice. For instance, although some articles have underscored the importance of providing longitudinal care and increasing the local capacity for patients in resource-limited settings[88,89], there has been a paucity of research describing the ethical challenges of providing care in resource-limited settings from the perspective of the providers who live and work in such settings, yet such perspectives are vital to understanding what interventions will be most effective in the contexts of each country's sociodemographic milieu. Additionally, the expanding role of business ventures involving orthopaedic surgeons introduces the risks of prioritizing profits over patient care and furthering the inaccessibility of orthopaedic care to underserved patients[90]. There is also a need for orthopaedic surgery training to include education with regard to disability ethics, as surgeons may need to discuss amputation with patients who sustained massive limb trauma or have musculoskeletal cancer, and it is important for surgeons to have an understanding of what differences exist between physical impairment and disability[91] and of the perspectives of amputees in order to be able to better educate patients on the anticipated changes to the patients' quality of life associated with a procedure as daunting as amputation. Further, the treatment of orthopaedic surgery trainees requires increased ethical scrutiny, as the prevalence of trainee mistreatment is alarmingly high, ranging from 24.7% to 59%[92,93], and increasing to 81% for female residents[93]. Lastly, as physical child and elder abuse commonly results in musculoskeletal trauma, it is imperative for orthopaedic surgeons to be aware of the hallmarks of abuse-related trauma in these populations so that they are prepared to safeguard these patients from further harm[94,95].

Summary

Despite being a required component of graduate medical education, there is no standardized medical ethics curriculum in orthopaedic surgery training. There are ethical considerations to be made in nearly every encounter that can improve the quality of care that orthopaedic surgeons can provide to their patients, which can be better identified through ethical frameworks beyond the commonly taught 4 principles. Ethical considerations involved in ordinary aspects of practice commonly discussed in the literature pertain to the ethics involved in obtaining informed consent, interacting with diverse patient populations, utilizing new technologies, performing high-stakes procedures, disclosing conflicts of interest, and residency training, although these themes do not reflect the entire range of ethical issues relevant to orthopaedic surgery. It is our hope that the discussion of these ethical concepts and themes inspires reflection and moral curiosity as to what ethics looks like in everyday orthopaedic surgery practice.

Appendix

eA Supporting material provided by the authors is posted with the online version of this article as a data supplement at jbjs.org (http://links.lww.com/JBJS/I622). ■

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