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Redefining the "Standard of Care": Is Non-Robotic Surgery Becoming Negligence?

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ABSTRACT

The rapid integration of robotic-assisted surgery into modern surgical practice has created a paradigm shift in how we conceptualize "standard of care" in surgery. As minimally invasive robotic procedures demonstrate superior outcomes in terms of reduced complication rates, shorter hospital stays and improved patient recovery, a critical legal and ethical question emerges: Can the continued performance of conventional open or laparoscopic surgery-when robotic alternatives are available and demonstrate better outcomes constitute negligence? This article examines the evolving definition of standard of care, reviews contemporary evidence comparing robotic-assisted and conventional surgical techniques and analyzes the medicolegal implications of technological advancement in surgical practice. Through analysis of landmark legal cases, peer-reviewed literature and regulatory frameworks, we argue that while current jurisprudence has not yet established robotic surgery as a universal standard of care, the trajectory of evidence and professional adoption suggests that selective failure to utilize superior technology may increasingly be viewed as deviation from accepted practice standards.

Keywords: Standard of care, Negligence, Robotic-assisted surgery, Minimally invasive surgery, Surgical innovation, Medical malpractice, Technology adoption, Surgical outcomes

INTRODUCTION

The concept of "standard of care" has long served as the cornerstone of medical negligence litigation. Defined broadly as the level of skill and care that a reasonably competent healthcare provider would provide under similar circumstances, the standard of care is fundamental to establishing whether a physician's conduct constitutes negligence[1][2]. However, the surgical landscape has undergone a dramatic transformation in the past two decades, particularly with the advent and proliferation of robotic-assisted surgical systems. Since the FDA approval of the da Vinci Surgical System in 2000, robotic-assisted surgery has expanded from its initial applications in urology and gynecology to encompass colorectal surgery, gastric surgery, thoracic surgery and complex general surgical procedures[3]. Multiple systematic reviews and meta-analyses conducted between 2020 and 2024 have consistently demonstrated that robotic-assisted procedures, when compared to conventional open and laparoscopic techniques, result in measurable improvements in patient outcomes[4][5][6].

Despite this growing evidence base, a significant proportion of surgical procedures continue to be performed using conventional techniques-open surgery or standard laparoscopy even in centers with robotic capability[7]. This raises a provocative but important question: At what point does the demonstrated superiority of a surgical technology become sufficiently established that its omission constitutes deviation from the standard of care? This article explores the intersection of surgical innovation, evidence-based medicine and medical law. We examine how the legal definition of standard of care has evolved, review the current evidence regarding robotic-assisted versus conventional surgical approaches and discuss the emerging jurisprudential and practical implications for surgical practice in an era of technological advancement.

THE LEGAL CONCEPT OF STANDARD OF CARE: DEFINITIONS AND EVOLUTION

Medical negligence is fundamentally a matter of tort law. In most common law jurisdictions, establishing negligence requires proof of four essential elements: (1) duty-the clinician owed a duty to meet the standard of care to the patient; (2) breach of duty-the clinician did not meet the standard of care; (3) causation-the breach of duty directly caused harm; and (4) damages-the patient suffered quantifiable injury[8][9]. The standard of care itself has evolved significantly through case law and statutory frameworks. The foundational principle emerged from the 1954 landmark case *Bolam v Friern Hospital Management Committee*, which established that a professional's conduct is not negligent if it is in accordance with a practice accepted as proper by a responsible body of medical opinion, even if other doctors adopt different practices[10]. This principle has been refined through subsequent litigation, including the Bolitho case, which introduced the requirement that the body of opinion relied upon must be logically defensible[10].

In legal terms, standard of care is generally defined as "the degree of care that a physician should exercise in the diagnosis and treatment of a patient, dependent upon the medical judgment expected to be exercised by reasonable, competent practitioners under similar circumstances"[11]. Key legal concepts include:

- **Duty of care**: The legal obligation a healthcare provider owes to their patient to exercise reasonable skill and diligence
- **Breach of duty**: A deviation from the accepted standard practice that results in failure to provide the level of care that a reasonably competent professional would provide
- **Causation**: A direct link between the breach of duty and the patient's injury
- **Proximate cause**: The breach must be the substantial factor in bringing about the harm

Historically, the standard of care was largely determined by expert witness testimony regarding what other practitioners in the same specialty customarily did. This approach, while recognizing that multiple acceptable practices could exist, had a significant limitation: it allowed the mere prevalence of a practice to justify its acceptance without necessarily requiring robust evidence of efficacy or safety[1]. Recent legal scholarship and case law have shifted toward a more evidence-based approach. A 2018 analysis examining legal and evidence-based definitions of standard of care found that modern jurisprudence increasingly

requires testimony to be based on scientific evidence, rather than solely on what practitioners customarily do[12]. This represents a meaningful evolution-from "standard practice is what most doctors do" to "standard practice should reflect what the best evidence indicates works best for patients."

Importantly, legal precedent recognizes that more than one standard of care may exist in medicine and surgery. The same 2018 analysis concluded that "scientific evidence indicates that there is often more than one standard of care" and that "recent legal decisions suggest that testimony should be based upon scientific evidence"[12]. This plurality of acceptable approaches becomes critically important when evaluating the status of robotic-assisted surgery.

ROBOTIC-ASSISTED SURGERY: EVIDENCE AND OUTCOMES

Clinical Outcomes Across Surgical Specialties

- **Colorectal Surgery:** Multiple meta-analyses comparing robotic-assisted surgery (RAS) with conventional laparoscopic surgery (CLS) and open surgery in colorectal cancer have been published in 2023-2024[5][13]. Key findings include:

Table 1: Robotic vs Conventional Laparoscopic Colorectal Surgery: Comparative Outcomes

Outcome Parameter	RAS Advantage	CLS Advantage	Similar
Conversion to open surgery	9.1% vs 16.1%	✓	
Operative time		✓ (30 min faster)	
Estimated blood loss	✓		
Length of hospital stay	✓		
Oncologic outcomes (CRM+)			✓
Pulmonary complications	✓		
Anastomotic leak rates	✓		

A 2025 systematic review and meta-analysis of randomized controlled trials comparing robotic and laparoscopic rectal cancer surgery concluded that "Compared to laparoscopic surgery, robotic surgery demonstrated superior safety, efficacy and prognosis"[14]. Specifically, robotic surgery showed significantly higher conversion rates to open surgery (9.1% vs 16.1%, P<0.001) and lower rates of incomplete total mesorectal excision specimens (2.7% vs 4.9%, P=0.04)[15].

- **Esophageal Surgery:** A 2024 systematic review and meta-analysis of 18,187 patients comparing robot-assisted minimally invasive esophagectomy (RAMIE) with conventional minimally invasive esophagectomy (cMIE) demonstrated significant advantages for robotic approaches in several parameters: estimated blood loss (71.78 mL less, P<0.00001), total lymph node harvest (2.18 additional nodes, P<0.0001), pulmonary complications (RR 0.70, P=0.001) and length of hospital stay (3.03 days shorter, P<0.0001)[16].

- **Gynecological Surgery:** A 2024 comparative study of robotic versus laparoscopic hysterectomy found statistically significant differences favoring robotic assistance: mean operative time was significantly lower in the robotic group (P<0.0001), blood loss was significantly higher in the laparoscopic group (P<0.0001), mean hospital stay was significantly shorter in the robotic group (P<0.00001) and IV analgesia requirements were lower in the robotic group[17].
- **Spinal Surgery:** Recent comparative analysis of robotic-assisted versus conventional free-hand spinal surgery demonstrated that robot-assisted surgery significantly reduced complication rates, accelerated postoperative recovery, lowered reoperation rates (2.5% vs 13%, P=0.0133) and showed shorter length of hospital stay and time to return to work compared to conventional techniques[18].
- **Hernia Surgery:** A retrospective analysis from the Swedish National Ventral Hernia Register comparing robotic-assisted, laparoscopic and open surgery for ventral incisional hernia repair found zero recurrences in the robotic group compared to higher recurrence rates in other groups with significantly shorter hospital stay in the robotic group (1 day vs 4 days for open surgery, P<0.001) and the lowest rate of 30-day complications (2.7%)[19].

Consistency and Safety Profile

A comprehensive 2024 umbrella review analyzing clinical outcomes of robot-assisted versus conventional laparoscopic surgery concluded that robotic-assisted surgery demonstrated consistent benefits across multiple procedures for cholecystectomy, colectomy, hysterectomy, nephrectomy and prostatectomy[20]. The evidence consistently shows that for all outcomes except operative time, robotic-assisted surgery demonstrates either positive or neutral effects compared to open and laparoscopic surgery[21]. Importantly, the long-term oncologic outcomes of robotic-assisted surgery have been demonstrated to be equivalent or superior to conventional approaches. A 2022 meta-analysis examining long-term outcomes of robotic versus laparoscopic/thoracoscopic and open surgery for colorectal, urologic, endometrial, cervical and thoracic cancers found no safety signals and outcomes similar to or better than conventional techniques[22].

Perioperative Benefits

Beyond oncologic outcomes, robotic-assisted surgery consistently delivers measurable perioperative benefits[23]:

- **Reduced blood transfusions**: RAS compared to open surgery is associated with 68% reduction in allogeneic red blood cell transfusion (RR: 0.32, 95% CI: 0.27–0.37) with shorter length of hospital stay (4.29 days reduction)[24]
- **Enhanced ergonomics**: Three-dimensional visualization, enhanced instrumentation that approximates human wrist articulation and tremor-filtering reduce surgeon fatigue and improve precision
- **Faster functional recovery**: Patients experience earlier return to work and normal activities
- **Reduced postoperative pain**: Smaller incisions and minimized tissue trauma result in less postoperative discomfort

- **Lower readmission rates**: Reduced complications and faster recovery reduce hospital readmissions.

CURRENT LEGAL STANDARDS AND SURGICAL INNOVATION

In the United States, the FDA approval of surgical devices, while necessary for market entry, does not establish these technologies as standard of care. Rather, professional societies, through practice guidelines, recommendations and consensus statements, typically play a larger role in determining what becomes recognized as standard of care[25]. However, there exists a tension between innovation and standardization. Professional societies must balance encouraging technological advancement against premature or unwarranted adoption of new technologies without adequate evidence. The Royal College of Surgeons of England has noted that "the haphazard adoption of innovative surgical technologies without proper evaluation has the potential to cause significant harm to patients"[26].

Notably, the legal standard of care does not typically require that a particular technique be universally superior in every parameter to justify its adoption as standard practice. Rather, what matters is whether the technique produces outcomes that are at least equivalent, if not superior, in clinically relevant measures and whether a responsible body of professional opinion would endorse its use under appropriate circumstances[12]. By this standard, the evidence for robotic-assisted surgery appears robust: across multiple surgical specialties, robotic approaches demonstrate equivalent or superior outcomes to conventional techniques in most clinically meaningful parameters (complications, hospital stay, functional recovery, quality of life), while accepting the trade-off of increased operative time in exchange for these benefits.

While no major case law has yet established failure to use robotic surgery as per se negligence, there is evidence of evolving judicial attitudes toward technological adoption. In cases involving other surgical innovations-such as minimally invasive techniques versus open surgery-courts have generally held that once an innovation demonstrates superior outcomes and becomes widely available, failure to offer it to appropriate patients may constitute a breach of the standard of care[27]. The Bolam doctrine, still influential in common law jurisdictions, has been increasingly scrutinized for allowing practices that lack robust evidence. Courts in several jurisdictions have held that mere conformity with a practice followed by others is insufficient if that practice is not supported by sound logic or contemporary evidence[28].

THE ARGUMENT FOR REDEFINING STANDARD OF CARE TO INCLUDE ROBOTIC-ASSISTED SURGERY

Strength and Consistency of Evidence

Several factors suggest that we may be approaching a tipping point where robotic-assisted surgery transitions from "innovative alternative" to "standard of care" in certain procedures[29][30]:

- **Volume and quality of evidence**: Over 25 years of clinical experience with robotic surgical systems have generated thousands of peer-reviewed publications, multiple meta-analyses across surgical specialties and increasing randomized controlled trial data

- **Consistency of outcomes**: Unlike some surgical innovations that show promise in single specialties, robotic-assisted surgery consistently demonstrates benefits across diverse surgical fields-from oncology to benign procedures
- **Long-term data**: No major safety signals have emerged and long-term oncologic outcomes are equivalent to or better than conventional approaches
- **Widespread adoption**: Robotic systems are now available in approximately 65% of US hospitals and are increasingly common in developed healthcare systems globally[31]
- **Economic feasibility**: While initial capital costs are significant, robotic surgery's benefits in terms of reduced complications, shorter hospital stays and faster return to work increasingly justify these costs[32]

Patient Preference and Informed Consent

Contemporary patients increasingly expect access to advanced surgical technologies. Courts have recognized that patients have a right to understand the risks and benefits of available treatment options, including technological alternatives[33]. When a patient is not informed about available minimally invasive options-including robotic assistance-and subsequently suffers complications that the alternative approach might have prevented, this can constitute failure to obtain informed consent[34].

Specialty-Specific Considerations

It is important to note that the argument for robotic surgery as standard of care is not universal across all procedures. The strength of evidence varies by surgical specialty and procedure:

Table 2: Robotic Surgery Evidence Strength by Specialty and Procedure Type

Surgical Specialty	Evidence Strength	Assessment
Prostate cancer surgery	Strong	Widely accepted as preferred approach
Gynecologic oncology	Strong	Increasingly recognized as standard for appropriate candidates
Colorectal cancer	Strong	Increasingly recognized as standard, especially complex cases
Rectal cancer	Strong	Recent RCTs support superiority
Esophageal cancer	Moderate-Strong	Growing evidence base; procedures often complex
Pancreatic surgery	Moderate	Acceptable alternative; ongoing evaluation
Ventral hernia repair	Moderate	Effective for appropriate cases
Cholecystectomy (simple)	Moderate-Weak	Open or lap generally sufficient; RAS not necessary

This variability is crucial: the argument that failure to use robotic surgery constitutes negligence must be contextualized to specific procedures and patient populations where evidence of superiority is most robust.

COUNTERARGUMENTS AND LIMITATIONS

The most substantial counterargument to establishing robotic surgery as universal standard of care is the economic burden. Robotic systems cost between $1.5 to $2.5 million to acquire with annual maintenance costs of $100,000-$150,000. Operating costs per procedure are typically $3,000-$5,000 higher than conventional approaches[35][36]. In healthcare systems with limited resources, particularly in developing nations, mandating robotic surgery as standard of care could be impractical or impossible. This raises the question: should "standard of care" be defined differently based on available resources and healthcare system capacity? Current medicolegal frameworks typically recognize that the standard of care must be achievable within the context of the available healthcare environment[37].

While robotic surgery delivers superior outcomes in many parameters, it often requires longer operative time than conventional laparoscopy (median 29-30 minutes longer in some studies)[16][38]. This increased operative time carries its own risks, including longer anesthesia exposure and increased risk of complications related to prolonged surgery. In emergency settings or in patients with significant comorbidities for whom operative time is particularly critical, the argument for robotic surgery as mandatory standard of care is weakened.

Robotic systems require specific training and experience. While the learning curve is generally shorter than for laparoscopic surgery, there is an initial period during which outcomes may not be optimal[39]. Early adoption by inexperienced surgeons could theoretically harm rather than benefit patients. This has medicolegal implications: establishing robotic surgery as standard of care might simultaneously require establishing standards for surgeon training, credentialing and case volume-an additional regulatory burden. As previously noted, legal precedent recognizes that multiple standards of care can coexist. Even if robotic-assisted surgery offers superior outcomes, the existence of other technically acceptable approaches-if performed competently-may still meet the standard of care[12].

IMPLICATIONS FOR SURGICAL PRACTICE AND MEDICOLEGAL LIABILITY

Current Practical Reality

At present, failure to use robotic-assisted surgery, standing alone, is unlikely to be found as evidence of negligence in most jurisdictions. However, the trajectory is toward closer examination of this issue[40]. Several practical implications emerge:

1. **Documentation becomes critical**: Surgeons must clearly document their reasoning for surgical approach selection. If robotic surgery is available and appropriate but not used, the surgeon should document clinical justification for this decision
2. **Informed consent discussions must evolve**: Patients should be informed about available minimally invasive options, including robotic-assisted approaches and their relative benefits and risks

3. **Expert witness testimony will evolve**: As robotic surgery evidence accumulates, expert witnesses may increasingly testify that failure to offer robotic approaches-in appropriate cases-falls below contemporary standards
4. **Institutional protocols**: Hospitals with robotic capability are increasingly developing protocols for when robotic approaches should be offered

The Future Legal Standard

Looking forward, several scenarios could reshape the legal standard of care:

- **Scenario 1: Specialized procedures.** For specific high-risk, high-complexity procedures (e.g., rectal cancer surgery, esophageal cancer surgery) where robotic surgery is widely available and evidence of superiority is strongest, courts and professional bodies may increasingly recognize robotic-assisted approaches as standard of care within 5-10 years[41].
- **Scenario 2: Institutional context.** Hospitals that have invested in robotic systems may increasingly be held to a higher standard for offering robotic approaches to appropriate patients. A surgeon's negligence claim might not hinge on the mere failure to use robotics, but rather on the failure to follow institutional protocols that specify when robotic approaches should be offered[40].
- **Scenario 3: Informed consent.** Even if robotic surgery is not yet established as mandatory standard of care, the failure to offer it as an option-when available and appropriate-may increasingly be viewed as inadequate informed consent, particularly if complications occur that robotic surgery might have prevented.
- **Scenario 4: Resource-stratified standards.** In high-resource healthcare settings where robotic systems are widely available, robotic approaches may become standard of care for specific procedures, while in resource-limited settings, conventional minimally invasive approaches remain acceptable standard.

Recommendations for Risk Mitigation

For surgeons in 2025 and beyond:

- **Understand the evidence**: Surgeons should be familiar with the peer-reviewed literature comparing their preferred surgical approaches to available alternatives
- **Articulate clinical reasoning**: Develop clear, evidence-based criteria for when different surgical approaches are appropriate and communicate these to patients and teams
- **Maintain institutional protocols**: Work with your institution to develop transparent protocols for approach selection
- **Enhance informed consent**: Ensure that informed consent discussions include discussion of available alternatives, their benefits, risks and relative evidence base
- **Document decision-making**: Maintain detailed operative records explaining the surgical approach selected and the clinical reasoning behind this choice
- **Continue education**: Maintain competence in current surgical technologies and techniques through continuing education and training
- **Consider patient preferences**: Factor in patient preferences, comorbidities and specific clinical circumstances in approach selection

CONCLUSION

Robotic-assisted surgery is a major 21st-century advance, with strong long-term evidence showing outcomes that are superior or at least comparable across many specialties. As robotic systems become more widely available especially in developed, high-resource settings-the medicolegal "standard of care" is likely to evolve to reflect the best available evidence, even though courts have not yet treated failure to use robotics as automatic negligence. This signals a broader shift in medical standards: from following what most clinicians traditionally do to following what evidence shows works best. For patients, this can improve access to better outcomes for surgeons, it increases the responsibility to stay updated, adopt technology appropriately and ensure robust informed consent, patient selection and fair resource use. The key issue is not whether non-robotic surgery is negligence, but how to integrate evidence-based innovation ethically while respecting autonomy and real-world constraints-an approach that will shape surgical and legal expectations in the next decade.

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