Journal of Pain Research

Dovepress
Taylor & Francis Group

Open Access Full Text Article

EXPERT OPINION

# The American Society of Pain and Neuroscience (ASPN) Guidelines for Advanced Practice Providers in Interventional Spine and Pain Management Practice

Casey Grillo[1], Alaa Abd-Elsayed[2], Tariq A Yousef[1], Brittney Misercola[3], Zohra Hussaini[4], Morteza Rabii[5], Ashley Comer[6], Kristen Durkin[7], Patrick McGinn[8], Timothy Deer[6]

[1]The Spine and Pain Institute of New York, New York, NY, USA; [2]Anesthesiology Department, University of Wisconsin- Madison, Madison, WI, USA; [3]Pain Specialists of America, Austin, TX, USA; [4]Department of Anesthesiology, the University of Kansas Health System, Kansas City, KS, USA; [5]Crimson Pain Management, Overland Park, KS, USA; [6]The Spine and Nerve Center of the Virginias in Charleston, Charleston, WV, USA; [7]NY Spine & Pain Specialists, Port Jefferson Station, NY, USA; [8]National Spine and Pain Centers, Shrewsbury, NJ, USA

Correspondence: Casey Grillo, The Spine and Pain Institute of New York, 860 Fifth Ave, Suite 1B, New York, NY, 10065, USA, Tel +1 212 724 7246, Fax +1 212 724 7256, Email Cgrillo@spinepainny.com



**Background:** Chronic pain management has advanced with minimally invasive interventions that reduce surgical trauma and recovery time. Specialized interventional spine clinics rely on multidisciplinary approaches to improve outcomes. Advanced Practice Providers (APPs), including nurse practitioners, physician assistants, and clinical nurse specialists, play increasingly important roles in these settings. However, standardized guidance on APP integration, training, and scope of practice remains limited. This guideline, developed by an expert panel, is the first to address APP roles in interventional pain management. It is intended for a broad audience including APPs, physicians, and healthcare administrators/policymakers who are involved in spine and pain management.

**Methods:** In 2024, a multidisciplinary American Society of Pain and Neuroscience (ASPN) panel conducted a targeted literature review and iterative consensus process. Relevant studies, regulations, and guidelines up to 2025 were reviewed. No formal Delphi or grading system was used; recommendations were finalized by group agreement. Topics included APP training, regulatory frameworks, collaborative care models, procedural involvement, medication management, and future directions.

**Results:** The panel identified nine domains central to APP practice. Recommendations emphasize structured specialty training with fellowship-style onboarding and ongoing competency maintenance; collaborative models in which APPs conduct evaluations, education, and peri-/post-procedural care, while physicians perform high-risk interventions; and strict adherence to state, payer, and institutional rules. ASPN does not endorse independent APP performance of advanced interventional procedures. APPs are key to patient safety through pre-procedure risk assessment, informed consent, and complication monitoring, and they play a central role in medication management, including reconciliation, non-opioid therapy, and opioid prescribing under collaborative frameworks with consistent risk-mitigation practices. Limitations include regulation variability, lack of standardized training pathways, and limited APP-specific outcome data.

**Conclusion:** These consensus-based guidelines can expand access, improve safety, and enhance patient satisfaction. Standardizing APP roles and training will allow practices to meet rising demand while maintaining high-quality care. Continued evaluation of APP-driven outcomes and development of formal fellowships and certification pathways will be essential to refine these recommendations.

**Keywords:** interventional pain, spine, advanced practice providers, nurse practitioner, physician assistant, clinical nurse specialist, guidelines

## Introduction

The management of spine and pain conditions has shifted toward non-surgical and minimally invasive techniques that reduce tissue trauma and recovery time compared with open surgery.[1] These approaches have become central to modern spine care and are increasingly delivered in specialized interventional clinics that use multimodal strategies to optimize outcomes. Within these settings, Advanced Practice Providers (APPs), including nurse practitioners (NPs), physician assistants (PAs), and clinical nurse specialists (CNSs), are increasingly integrated into team-based care models.

Received: 9 April 2025
Accepted: 13 November 2025
Published: 26 November 2025

Hamric's model of advanced practice nursing delineates six core competencies that define the role of advanced practice providers: direct clinical practice, guidance and coaching, evidence-based practice, leadership, collaboration, and ethical practice.[2] Collectively, these competencies underscore the versatility of APPs in clinical care, education, and systems-level leadership.

Evidence supports that APP integration enhances access and patient satisfaction. A randomized Canadian trial showed higher patient satisfaction on several measures with NP-led postoperative cardiac surgical care versus hospitalist-led care.[3] In emergency fast-track units, patients randomized to Emergency NP care reported higher satisfaction than those treated by physicians.[4] Beyond satisfaction, APPs expand service availability and improve access to care.[5] Studies also demonstrate comparable safety for common procedures, including cardioversion and large-volume paracentesis, when performed by APPs.[6–8] In surgical services, APPs have been associated with improved adherence to care protocols (eg, DVT prophylaxis).[9] Nurse-led rheumatology clinics have shown cost-effectiveness relative to physician-led care,[10] and surgical specialties such as oral–maxillofacial surgery and breast reconstruction report efficiency gains that offset PA salary costs.[11,12]

Despite these benefits, interventional pain medicine faces a training gap. Most graduate APP programs lack structured curricula in interventional pain, leaving new graduates with limited exposure to spine procedures, multimodal pharmacotherapy, and peri-procedural care. This absence of formal training pathways delays competency development and contributes to variability in role definition across practices.

The American Society of Pain and Neuroscience (ASPN) convened a multidisciplinary panel of physicians and APPs to develop consensus-based guidelines for APP integration in interventional spine and pain management to address this gap. These guidelines are designed for APPs, physicians, administrators, and policymakers to clarify roles, support competency-based training, and establish collaborative frameworks that enhance safety, efficiency, and quality of care.

The document focuses on several key areas. It considers how APPs can expand access, improve outcomes, and support continuity of care within interventional practices. It also defines the education, training, and competencies required for APPs to participate safely in procedures and peri-procedural care. In addition, the guidelines review legal and regulatory frameworks, including scope of practice laws, licensure, and supervision requirements, that shape APP activity. Responsibilities in assessment, procedural support, medication management, and follow-up care are outlined, with special attention to maintaining physician leadership for high-risk interventions. Together, these elements provide a structured approach to APP integration that balances safety with the growing demand for interventional spine and pain services.

# Methods

## Guideline Development Process

This project was conducted under the auspices of ASPN and followed an expert consensus model. In early 2024, ASPN convened a multidisciplinary panel of physicians and advanced practice providers representing a wide range of geographic locations, academic settings, and private practices. The panel included specialists in pain management, anesthesiology, physical medicine and rehabilitation, functional neurosurgery, and neurology. All panelists had significant experience in interventional pain management. No external funding or sponsorship was provided for this work, and all participants declared that they have no conflicts of interest related to the content of these guidelines.

## Literature Review and Evidence Gathering

The panel performed a targeted literature review to inform the recommendations. Relevant English-language publications were identified via PubMed, Google Scholar, and professional society resources. Search terms included combinations of "advanced practice provider AND pain management", "nurse practitioner AND spine interventions", "physician assistant AND pain clinic role", "clinical nurse specialist AND chronic pain", as well as specific topics (eg, APP opioid prescribing, APP outcomes, interdisciplinary collaboration in pain clinics). Foundational documents such as the HHS Pain Management Best Practices Task Force report and CDC opioid prescribing guidelines were also reviewed to ensure consistency with national standards. The search encompassed literature up to April 2025, focusing on clinical outcomes, safety, regulatory policies, and educational frameworks relevant to APPs in pain management. Where high-level evidence was lacking (as is common in emerging scope-of-practice topics), illustrative studies from analogous fields and expert opinion were used.

## Consensus Formation

Draft recommendations were formulated based on the literature findings and the panel's collective clinical experience. An iterative consensus process was employed: the panel held a series of virtual meetings and email exchanges to discuss and refine draft statements. No formal Delphi voting was performed; consensus was defined as unanimous or near-unanimous agreement among panel members on each recommendation after successive revisions. Key content areas (APP education, certification, scope-of-practice regulations, collaboration models, procedural roles, etc). were iteratively edited until consensus was achieved. Given the narrative consensus nature of this guideline, we did not assign formal levels of evidence or grades to recommendations. However, we cite supporting evidence or existing guidelines wherever possible to bolster each recommendation. All recommendations presented represent the agreed expert opinion of the panel, intended to complement (not replace) existing evidence-based guidelines. The scope of recommendations was reviewed to ensure consistency with US laws and regulations, and the context of this guideline is limited to the United States. No external validation outside the author group was performed before journal submission. The methodology for guideline development is summarized in Figure 1.

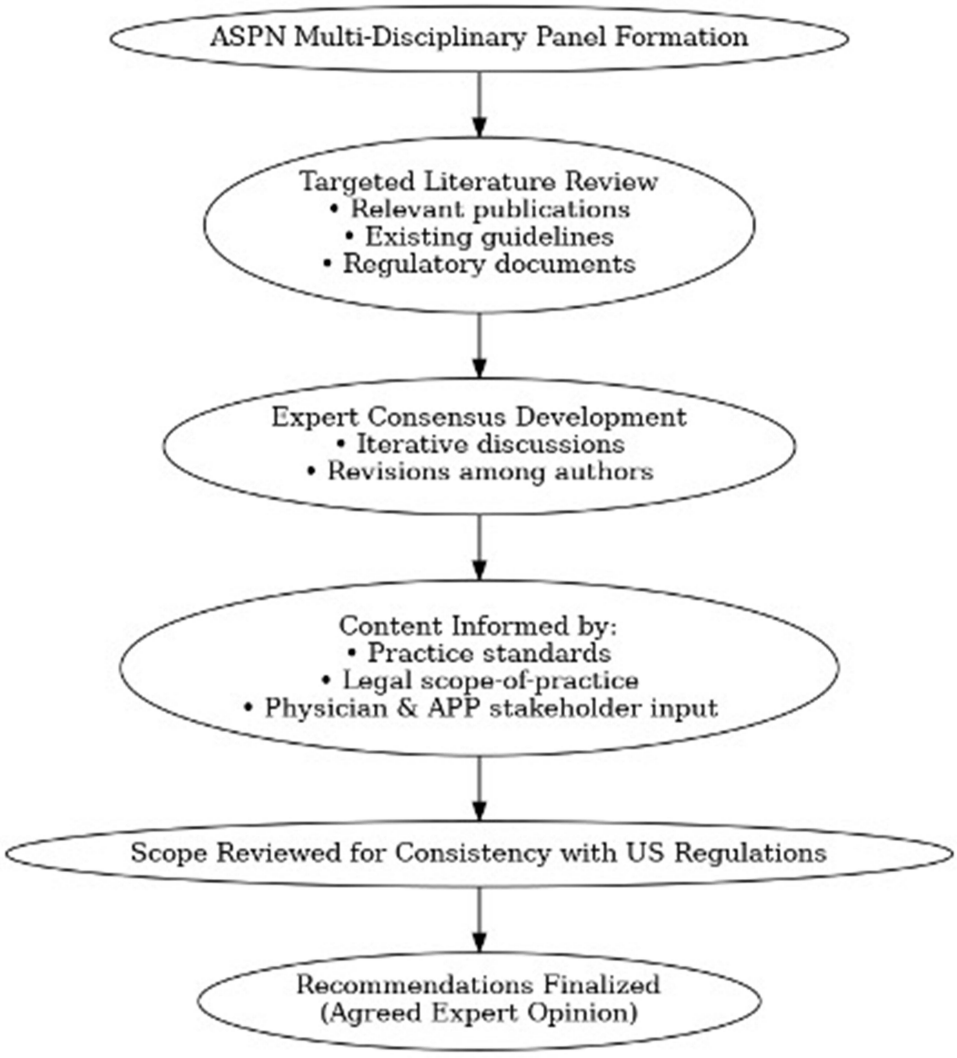


**Figure 1** Methodology for guideline development, from expert panel assembly to final consensus recommendations.


https://doi.org/10.2147/JPR.S533331

## Note on Terminology

For this guideline, APPs refers collectively to NPs, PAs, and CNSs working in interventional pain management. "Physician" refers to the board-certified or fellowship-trained interventional pain physician overseeing the practice. All discussions and recommendations assume compliance with relevant state laws, which may use specific terms like "Advanced Practice Registered Nurse (APRN)" for NPs or require distinct supervisory agreements for PAs; readers should interpret recommendations in light of their jurisdiction's terminology and regulations.

# Results

## Summary of Key Recommendations

The panel identified nine domains central to integrating APPs in interventional spine and pain management through literature review and expert consensus. These are summarized in Table 1 and expanded below, covering training, regulatory compliance, collaborative practice, communication, patient safety, pre- peri- and post-procedure care, and medication management.

## Recommendation #1: Education, Training, and Competencies

Licensure alone does not prepare APPs for interventional pain practice. Structured onboarding, often modeled after a fellowship, can help standardize skills across settings and improve safety. Effective programs combine didactic teaching,

**Table 1** Summary of Key Recommendations for APP Integration in Interventional Spine and Pain Management

| Rec # | Theme | Summary of Recommendation |
|---|---|---|
| 1 | **Education, Training, and Core Competencies** | APPs require structured training in assessment, diagnosis, treatment planning, and counseling. Fellowship-style onboarding and ongoing CME, cadaver/simulation labs, and proctored cases support competency (see Tables 2–6). |
| 2 | **Legal/Regulatory Compliance** | APP duties must follow state laws, licensure, payer requirements, and institutional rules. Agreements should outline oversight, communication, and billing. Compliance audits and privileging reviews are required. |
| 3 | **ASPN Position on Independent Practice** | APPs are valued team members but should not independently perform advanced spine procedures. High-risk interventions must remain physician-led, with APPs assisting under supervision. |
| 4 | **Collaborative Practice Model** | APPs and physicians collaborate in defined, team-based roles. APPs perform evaluations, education, peri-/post-procedure coordination, and may first-assist under supervision. Use protocols, agreements, and team huddles to maintain workflow safety and efficiency. |
| 5 | **Communication Strategies** | Standardized handoffs, closed-loop communication, debriefings, and checklist-driven workflows reduce error and enhance alignment across teams. |
| 6 | **Patient Assessment & Pre-Procedure Evaluation** | APPs should perform full pre-procedure assessments (history, exam, imaging, risk stratification). Contraindications must be addressed before scheduling. Procedure planning should document risks/benefits. |
| 7 | **Informed Consent** | APPs may obtain/document consent per institutional and legal policy. Must cover indication, procedure, risks/benefits, alternatives, and expectations. Plain language and teach-back are essential. |
| 8 | **Procedural, Peri-Operative, and Post-Procedural Roles** | APPs assist with patient preparation, sterile setup, and first-assist duties where permitted; optimize peri-operative risk factors; enforce infection-prevention protocols; monitor recovery; provide discharge education; and recognize complications early. They escalate promptly for red-flag findings and device-related issues (see Tables 7-9). |

(*Continued*)

**Table 1** (Continued).

| Rec # | Theme | Summary of Recommendation |
|---|---|---|
| 9 | **Medication Management** | APPs should reconcile medications, initiate/titrate non-opioid therapies, participate in opioid prescribing under collaborative frameworks, and monitor for safety, efficacy, and adherence. Risk mitigation (PDMP checks, UDS, opioid agreements) and patient counseling must be incorporated (see Tables 10 and 11). |

**Notes**: Summarized consensus recommendations for defining the role of advanced practice providers in interventional spine and pain management. These statements emphasize collaboration, compliance with regulatory standards, structured education, clear communication, patient safety, and medication oversight. Together, they outline APP practice's boundaries while highlighting opportunities to strengthen team-based care. The following discussion expands on these domains, considering their implications for clinical practice, workforce development, policy, and future directions in interventional pain medicine.
**Abbreviations**: PDMP, Prescription Drug Monitoring Program; UDS, Urine Drug Screen.

simulation or cadaver labs, proctored cases, and direct mentorship by experienced pain physicians. Training should also focus on diagnostic reasoning, risk assessment, and multimodal treatment planning. Ongoing CME, professional society workshops, and certification maintenance ensure APPs remain current with evolving therapies such as neuromodulation and regenerative medicine.

## Recommendation #2: Legal and Regulatory Framework

APP practice is shaped by state law, payer policy, and institutional rules. Variability in prescriptive authority, use of fluoroscopy, and billing creates differences in daily practice that must be managed carefully. Regular reviews of privileges, payer audits, and collaboration agreements help keep workflows transparent and compliant. Aligning APP roles with regulations protects patients and ensures practices remain defensible under scrutiny.

## Recommendation #3: Independent Practice Boundaries

The panel agreed that advanced interventional spine procedures such as spinal cord stimulator implantation, intrathecal pump management, and ablative neurotomy should remain physician-led. These require fellowship-level training and carry higher risk profiles. APPs contribute most effectively in peri-procedural roles, including first assist, patient screening, and post-operative care. Setting clear boundaries preserves patient safety while recognizing APPs as essential care team members.

## Recommendation # 4: Collaborative Practice Model

Team-based care is central to interventional pain management. APPs improve efficiency by handling evaluations, peri-procedural care, and follow-up, giving physicians more time to focus on complex decision-making and advanced interventions. Integration into multidisciplinary teams (physical therapy, behavioral health, pharmacy) further supports holistic care for chronic pain. Collaborative models have been associated with improved access, smoother clinic flow, and higher patient and provider satisfaction. Clear role definitions, structured mentorship, and strong physician leadership ensure this model works effectively.

## Recommendation # 5: Communication and Teamwork

Breakdowns in communication are a frequent cause of errors in healthcare. APPs often serve as continuity providers and help strengthen structured communication systems. Good practice includes using clear handoffs, short briefings before and after procedures, and confirming instructions to prevent missed details. Regular team huddles align providers on plans, escalation steps, and follow-up. Together, these strategies improve coordination, reduce risk, and support a culture of safety.

## Recommendation # 6: Patient Assessment and Pre-Procedure Evaluation

Pre-procedure evaluation is a key area of APP contribution. APPs identify medical risks such as uncontrolled diabetes, infections, or anticoagulant use that may complicate planned interventions. Using readiness checklists and evidence-

based tools, they optimize patients before procedures, obtain necessary clearances, and coordinate with primary care or specialty providers. This process improves procedural safety and reduces cancellations.

### Recommendation # 7: Informed Consent

Informed consent is both a legal requirement and an opportunity for education. APPs strengthen the process by explaining risks, benefits, and alternatives in plain language and confirming understanding with teach-back methods. Institutional policies determine the extent of APP involvement, but they help ensure patients enter procedures with realistic expectations across settings.

### Recommendation # 8: Procedural, Peri-Operative, and Post-Procedural Roles

APPs contribute throughout the procedural continuum. During procedures, they enhance safety by preparing patients, reviewing medications, supporting sterile setup, reinforcing expectations, and in some cases serving as first assistants where permitted. In the peri-operative setting, they optimize modifiable risk factors, enforce infection-prevention protocols, and strengthen team coordination. Post-procedurally, they monitor recovery, provide discharge education, and detect complications early while intervening directly for minor issues and escalating promptly when red flags arise. Their comprehensive involvement reduces complications and strengthens continuity of care.

### Recommendation #9: Medication Management

Medication management remains a cornerstone of pain practice. APP responsibilities include medication reconciliation, non-opioid therapy titration, and participation in opioid prescribing under collaborative agreements. Risk-mitigation strategies, including Prescription Drug Monitoring Program (PDMP) checks, urine drug screening, and opioid agreement contracts, should be routine. Ongoing patient contact allows APPs to track efficacy, monitor side effects, and provide counseling on safe use and disposal. Coordination with pharmacy, behavioral health, and primary care supports a multimodal approach while extending physician capacity.

## Discussion

This guideline represents the first consensus-based effort explicitly focused on the role of APPs in interventional spine and pain management. Although prior literature has described APP contributions in primary care, surgery, and anesthesiology, no structured framework has been developed for the unique demands of interventional pain practice. By combining available evidence with expert consensus, these recommendations provide a foundation for standardizing APP education, scope of practice, and collaborative models of care. The discussion below places these recommendations into context and considers their implications for clinical practice, workforce development, regulatory policy, and future research.

To understand how these recommendations can be applied, beginning with the setting in which APPs are practiced is essential. Interventional spine clinics are highly procedural environments that require detailed pre-procedure evaluation, careful patient selection, and close post-procedure monitoring. These demands have accelerated the integration of APPs as core care team members.[13,14] In hospital-based clinics, APP roles are further shaped by institutional policies and state regulations, underscoring the need for adaptable but standardized guidance.[15,16] This guideline addresses those variations by outlining best practices that can be implemented across diverse clinical models.

### 1. Education, Training, And Core Competencies

With the clinical context established, the first consideration is how APPs are prepared for practice. NPs, PAs, and CNSs each have distinct historical origins, training pathways, and regulatory frameworks, yet share a common purpose: to expand access to care, support physicians, and improve outcomes for patients with complex pain conditions. A side-by-side comparison of their educational backgrounds, licensure, prescriptive authority, and billing structures is provided in Table 2.[15,17–19]

NPs emerged in the 1960s to address gaps in primary care, and their numbers now exceed 385,000 in the United States, with varying levels of independent practice authority across states.[20–22] Their role in pain management has been associated with high patient satisfaction, fewer preventable hospitalizations, and cost-effective care.[3,4,23] PAs, developed at Duke University in the same era, now number more than 168,000 and practice across nearly every specialty, including

**Table 2** Comparison of Scope of Practice and Training for APPs (NP Vs PA Vs CNS)

| Aspect | Nurse Practitioner (NP) | Physician Assistant (PA) | Clinical Nurse Specialist (CNS) |
|---|---|---|---|
| **Education & Certification** | Registered Nurse (BSN) → Graduate NP program (MSN or DNP) → National board certification (eg, AANP or ANCC) in specialty; state APRN license. | Bachelor's degree → Master's in PA Studies (general medical education) → National certifying exam (NCCPA) → state PA license. | Registered Nurse (BSN) → Graduate CNS program (MSN or DNP) with clinical specialty focus → National CNS certification (ANCC or AACN) → state APRN license (in states recognizing CNSs). |
| **Regulatory Body** | Regulated by State Board of Nursing (as APRN). | Regulated by State Medical Board (or equivalent) in most states (as PA/PA-C). | Regulated by State Board of Nursing (as APRN) in states that recognize CNS role; some variance in title protection. |
| **Practice Autonomy** | 27 states grant Full Practice authority (NP can practice independently, incl. diagnosing, treating, prescribing). Other states require Reduced/Restricted practice (collaborative agreement or supervision by physician for certain acts). NPs typically have autonomy in patient care within their training, especially in primary care; pain specialty practice may still involve collaboration despite legal autonomy. | Physician supervision/collaboration required in all states, though the degree varies. "Optimal" PA practice: a few states (eg, WY, UT, ND) have moved towards greatly reduced MD oversight. Majority require a supervising physician agreement (can be off-site per state rules). PAs practice medicine in collaboration with physicians; legal independence is not as established as NPs, but PAs often exercise significant autonomy in daily practice within the scope delegated by their physician. | Varies by state. Many states align CNS practice with NP regulations, granting APRN status – which in some states means independent practice similar to NPs, and in others requires physician collaboration. In states not recognizing CNS as APRN, their scope may be limited to nursing functions unless practicing under an NP/physician. CNS practice often emphasizes specialized assessments, nursing interventions, and system-level consultation rather than independent medical management. |
| **Prescriptive Authority** | Yes, NPs can prescribe medications including controlled substances in all 50 states. In Full Practice states, no physician involvement is required for prescribing; in other states, MD oversight or delegated authority for certain drugs is required. DEA registration required for Schedule II–V. | Yes, PAs can prescribe medications including controlled substances in all states, as delegated by their supervising physician. Most states require the supervising physician's name on prescriptions or a written agreement. Some states limit certain high-level drugs or amount a PA can prescribe without extra approval. PAs must have DEA registration for controlled substances; often a supervising MD must authorize it. | Yes, in many jurisdictions that license CNSs as APRNs, they have prescribing authority (including controlled substances) similar to NPs, typically under a collaborative agreement. In states where CNS is not an independent role, they might not prescribe unless they obtain an NP certification or a special arrangement. Generally, CNS prescriptive authority exists but usually with physician collaboration and often limited to their area of specialty (eg, a CNS in pain management can prescribe pain-related meds if allowed). |

(*Continued*)

https://doi.org/10.2147/JPR.S533331



**Table 2** (Continued).

| Aspect | Nurse Practitioner (NP) | Physician Assistant (PA) | Clinical Nurse Specialist (CNS) |
|---|---|---|---|
| **Typical Roles/ Duties** | Takes comprehensive histories, performs physical exams, diagnoses conditions, orders and interprets tests, initiates treatment plans. Often manages patients independently (especially primary care NPs). In pain clinics, NPs may lead patient evaluations, manage medication regimens (including opioids per guidelines), perform trigger point injections or joint injections if trained, provide patient education, coordinate multidisciplinary care (PT, psychology). NPs can also serve as first assist in procedures/surgeries if trained (RNFA). Emphasis on holistic care and patient counseling is strong due to nursing background. | Performs medical histories and exams, diagnoses and treats illnesses, orders tests, assists in surgery, and carries out procedures. In pain practice, PAs often assist physicians in interventions, perform initial consults and follow-ups, and manage medications. PAs are trained in the medical model, so their approach aligns closely with physicians. They commonly act as first assist in the operating room or during injections. PAs can perform certain procedures (eg, joint injections, lumbar punctures) under supervision and have hands-on training in procedures during PA school. Their versatility allows them to switch specialties relatively easily, which means specific pain training often occurs on the job. | Focuses on three spheres: patient/family, nursing practice, and system. In pain management, a CNS might conduct detailed assessments for complex cases (especially with comorbid conditions), develop and educate on care plans, and lead quality improvement initiatives. They often serve as educators for staff and patients, ensuring evidence-based practices. CNSs might run a pain education program, oversee safe opioid use protocols, or coordinate multidisciplinary meetings. They may see patients for follow-ups especially regarding symptom management strategies. Generally, CNSs do fewer invasive procedures; their role is often consultative, addressing difficult pain syndromes through a nursing lens (eg, coping strategies, functional improvement). |
| **Billing and Reimbursement** | Bills under own NPI as an independent provider (in states where allowed) or under physician (incident-to) if required by payer. Medicare reimburses ~85% of physician fee for NP services when billed directly. NPs in collaboration can also bill "incident-to" at 100% if all criteria met (in physician office setting). Many NPs have their own patient panels. | Bills under supervising physician's NPI or own, depending on payer and state. Medicare reimburses PA-provided services at 85% when direct-billed, or 100% if meeting incident-to criteria (services billed under physician). PAs frequently use the incident-to billing in clinics. Recent changes allow PAs to be listed as rendering providers in some settings. PAs do not have independent practice status with payers, so a supervisory physician is often tied to billing. | Often reimbursed similarly to NPs if functioning as APRN providers (85% Medicare rate). However, many CNS positions are salaried roles focusing on internal quality or education, and they may not bill for services at all (eg, if working as a hospital clinical specialist). When in a clinical provider role (some pain CNSs do see patients for consults), they would bill like NPs with physician collaboration if required. |

**Notes**: Comparison of the scope of practice and training requirements for Advanced Practice Providers (APPs). Adapted from the American Association of Nurse Practitioners (AANP) Scope of Practice Policy Report, the National Commission on Certification of Physician Assistants (NCCPA) Competency Profile, the American Association of Critical-Care Nurses (AACN) CNS Scope of Practice Framework, and the American Nurses Credentialing Center (ANCC) certification guidelines.[15,17–19] "Full Practice" denotes that no physician oversight is required; "Optimal PA" refers to states with highly progressive PA practice laws where collaboration is not legally mandated. Prescriptive authority for APPs requires DEA registration for controlled substances and compliance with state-specific formularies. (Information current as of April 2025; laws are subject to change).
**Abbreviations**: RNFA, Registered Nurse First Assistant; NPI, National Provider Identifier.

interventional pain.[24,25] CNSs, rooted in system-level nursing practice, contribute through advanced assessment, quality improvement, patient education, and interprofessional coordination.[26–30]

## Ongoing Professional Development and Certification Maintenance

As interventional pain practice evolves, APPs must maintain competencies through structured professional development. Each profession has distinct recertification requirements, CME expectations, and pharmacology-focused mandates, summarized in Table 3.[30–33] Beyond formal requirements, clinics should promote mentorship, participation in professional societies (eg, ASPN, North American Neuromodulation Society (NANS)), skills labs, and conference attendance to support lifelong learning and alignment with emerging techniques and regulations. Clinics should actively support APPs in pursuing these opportunities to sustain clinical excellence and foster career-long engagement.

## Core Clinical Competencies for Apps

APPs must possess strong foundational competencies in patient evaluation and clinical reasoning. While detailed processes for history-taking, examination, and pre-procedural assessment are presented in the Pre-Procedure Patient

**Table 3** Ongoing Professional Development and Certification Maintenance for APPs in Pain Management

| Category | Nurse Practitioner (NP) | Physician Assistant (PA) | Clinical Nurse Specialist (CNS) |
|---|---|---|---|
| **Certification Renewal** | National NP certification is usually valid for 5 years (AANP or ANCC). Renewal requires ~1000 practice hours and 75+ CE hours (varies by certifying body) in the specialty, including pharmacology CEs. Alternatively, re-testing via exam is an option. Many NPs do a mix of CME conferences, online CE modules, and academic courses to meet these. | NCCPA certification (PA-C) is a 10-year certification (recently shifting to a 10-year cycle from 6). PAs must earn 100 CME credits every 2-year cycle (at least 50 Category 1 CME) and pass a recertification exam in the 10th year (PANRE). The NCCPA also now offers PANRE alternatives (focused, or take-home). Specialty CAQs (Certificates of Added Qualifications) exist, but currently none specific to pain – PAs in pain might do Anesthesia CAQ or Ortho Spine CAQ if relevant. | CNS certification (if ANCC) is typically 5 years. Renewal requires a set number of practice hours and CE hours similar to NPs (ANCC typically requires 75 CE hours with at least 25 in pharmacotherapeutics for those with prescriptive authority, plus evidence of professional development or academic credits). CNSs also may renew by re-exam. If the CNS holds a specialty certification (like pain management nursing certification or advanced oncology, etc)., those have their own renewal criteria (often 4-year cycle with CE hours in that specialty). |
| **State Licensure & Credentialing** | NP state licenses (APRN) require renewal every 1–3 years depending on state. Many states mandate a certain number of CEs in specific topics (eg, pharmacology, opioid prescribing) for license renewal. Additionally, if the NP has prescriptive authority, some states require a certain number of pharmacology hours each renewal cycle (eg, 6 hours in controlled substance prescribing). The NP must also maintain an RN license (renewal varies by state). Credentialing at hospitals or ASCs often requires documenting ongoing education and possibly peer references. | PA state licenses typically renew every 1–2 years. States might require a brief continuing education attestation (some require a specific number of CME hours, others accept NCCPA certification as proxy). Many states also mandate opioid or drug prescribing CEs (eg, 3 hours every renewal on pain management or opioid safety is common). Hospital credentialing for PAs in procedural roles will require proof of competence – often initial proctoring and then ongoing case logs for things like fluoroscopy privileges. PAs should also maintain ACLS/BLS as required by practice setting. | CNS state recognition (as APRN) renewal is tied to RN license renewal and maintaining national cert. Some states have separate CNS renewal with CE requirements similar to NPs. If a CNS has prescriptive authority, they may need to fulfill pharmacology CE requirements akin to NPs. Many CNSs also maintain basic life support or other certifications depending on their role (for example, a CNS working in a hospital acute pain service might keep ACLS, etc).. |

(*Continued*)

**Table 3** (Continued).

| Category | Nurse Practitioner (NP) | Physician Assistant (PA) | Clinical Nurse Specialist (CNS) |
|---|---|---|---|
| **Continuing Education Focus** | NPs in pain management should focus CEs on topics like advanced pain assessment, safe opioid prescribing (many states require this by law), injection techniques, and updates in pain therapies (neuromodulation, regenerative medicine). They often attend pain conferences (ASPN, AANP specialty workshops, etc).. At least 25 of their CE hours per 5 years must be pharmacology-focused for most certs, which aligns well with learning about new medications or opioid guidelines. | PAs typically use Category 1 CME from attending pain medicine conferences (eg, ASRA Pain, AAPA meetings with pain tracks) or online courses (there are pain management CMEs available via organizations like the American Academy of Pain Medicine). Because PAs have a recert exam, their CME often covers broad medical topics, but those specializing in pain will allocate many hours to pain-specific learning. PAs can also do Performance Improvement CME (PI-CME) by doing a QI project in their practice (NCCPA rewards 20 PI-CME credits for such projects), which encourages continuous improvement in, say, adherence to opioid agreements or patient education efficacy. | CNSs likely pursue CEs in advanced pharmacology for pain (especially if prescribing), non-pharmacologic pain management (since many CNS have interest in holistic interventions), leadership and program development (since their role may involve improving pain protocols hospital-wide). They might attend both pain-specific meetings and broader nursing conferences. If certified in Pain Management Nursing (a separate certification by ANCC), they must get CEs specifically related to pain management to renew that. CNSs often also engage in academic activities (publishing, teaching), which can sometimes count towards renewal credit in ANCC's system (professional development credits). |

**Notes**: Ongoing professional development and certification maintenance requirements for nurse practitioners (NPs), physician assistants (PAs), and clinical nurse specialists (CNSs) in pain management. Adapted from the American Association of Nurse Practitioners (AANP) Certification and Recertification Standards, the American Nurses Credentialing Center (ANCC) Certification Renewal Requirements, the National Commission on Certification of Physician Assistants (NCCPA) PANRE/PANRE-LA Guidelines, and the American Association of Critical-Care Nurses (AACN) CNS Renewal Standards.[30–33] (Information current as of April 2025; laws are subject to change).

Assessment section, the competency framework emphasizes integrating these findings into coherent diagnostic formulations and individualized treatment plans.

Once a working diagnosis is established, treatment planning requires a firm grounding in common orthopedic, neurosurgical, and neurologic conditions. APPs in spine care should develop fluency across key etiologic categories (Table 4),[34] ensuring diagnostic paths and treatment algorithms remain evidence-based and condition-specific. This structured knowledge base provides the clinical platform for informed patient counseling, efficient care coordination, and appropriate escalation. These skills directly support procedural planning and peri-procedural safety.

**Table 4** Core Knowledge Categories for APPs in Spine Care

| Etiology | Representative Conditions | Clinical Considerations |
|---|---|---|
| **Degenerative** | Spinal spondylosis, degenerative disc disease, facet arthropathy, spinal stenosis | Understand imaging correlations, recognize progressive disease course, and determine when to escalate from conservative to interventional management. |
| **Mechanical / Muscular** | Myofascial pain, lumbar strain/sprain, postural syndromes | Emphasize detailed physical exam skills, rehabilitation strategies, ergonomic interventions, and recurrence prevention. |
| **Radicular / Neuropathic** | Herniated disc with radiculopathy, foraminal stenosis, peripheral nerve entrapment | Differentiate dermatomal pain from referred pain, identify red flags for urgent intervention, and understand nerve healing timelines. |
| **Traumatic** | Vertebral fractures (compression, burst), ligamentous injury, post-traumatic instability | Recognize instability patterns, determine when to immobilize, and identify surgical indications; coordinate with trauma and spine surgery teams. |

(*Continued*)

**Table 4** (Continued).

| Etiology | Representative Conditions | Clinical Considerations |
|---|---|---|
| **Inflammatory** | Ankylosing spondylitis, psoriatic arthritis, infectious spondylodiscitis | Integrate rheumatologic evaluation, recognize systemic signs and laboratory markers, and initiate multidisciplinary management early. |
| **Neoplastic** | Primary spinal tumors, metastatic disease | Identify red flags (night pain, weight loss, neurological deficits), coordinate urgent imaging, and expedite oncology referral. |

**Notes**: Core knowledge domains for Advanced Practice Providers (APPs) in interventional spine and pain care. This framework emphasizes recognition of common etiologies, associated conditions, and key clinical considerations relevant to diagnosis, risk stratification, and timely referral. Adapted from *Hamric and Hanson's Advanced Practice Nursing: An Integrative Approach*, 7th edition[2] and *Bonica's Management of Pain*, 5th edition.[34]

## Procedural Competency and Specialized Training in Spine Procedures: Basic and Advanced Procedures

Interventional spine procedures can be categorized as basic or advanced. Fellowship-trained physicians perform advanced procedures, but APPs should build a strong foundation of knowledge to support patient evaluation, counseling, peri-procedural management, and follow-up care. Competency emphasizes understanding indications, contraindications, risks, documentation, and coordination, even when APPs are not independently performing the procedure. Supervised training may allow APPs to assist with selected basic procedures when permitted by institutional policy and state regulations.[34–36]

Educational priorities for APPs in interventional spine care include mastery of relevant anatomy, biomechanics, and the degenerative cascade, and a clear understanding of indications, contraindications, benefits, risks, and expected outcomes. Familiarity with payer and documentation requirements is equally important to reduce denials and delays in care. In addition, APPs must develop patient-facing skills that enable them to set expectations and address concerns effectively. Training should follow a progressive structure, which starts with didactic instruction and imaging review, moves into clinical observation, and culminates in supervised procedural participation.

Tables 5 [37–43] and 6 [37,41,44–54] summarize the basic and advanced procedures most relevant to APP education. These tables outline the purpose of each procedure, and the corresponding knowledge priorities APPs must develop to support safe, coordinated care.

APP competencies should be developed through structured training emphasizing observation, supervised practice, and progressive responsibility. While advanced spine interventions are physician-led, APPs may develop proficiency in minor procedures (eg, trigger point injections, peripheral joint injections, superficial nerve blocks) under appropriate supervision once competency is documented and privileges are granted. Proficiency at this stage is defined less by technical performance and more by the ability to recognize indications, contraindications, risks, and appropriate referral thresholds.

**Table 5** *Basic* Key Spine Procedures for APP Knowledge

| Basic Procedures | Primary Purpose / APP Knowledge Priorities | References |
|---|---|---|
| **Epidural steroid injections (interlaminar, transforaminal, caudal)** | Reduce inflammation, relieve radicular pain, confirm pain generator; APPs should understand imaging selection, approach differences, and complication risks. | [37–39] |
| **Facet joint injections / medial branch blocks** | Diagnose facet-mediated pain and guide candidacy for RFA; APPs should know exam correlates, technical considerations, and documentation standards. | [37,40,41] |
| **Sacroiliac joint injections** | Diagnose sacroiliac joint pain, guide candidacy for RFA or stabilization; APPs should recognize mimicking conditions and long-term management options. | [42] |
| **Radiofrequency ablation (facet, SI joint, or peripheral nerves)** | Provide extended relief by disrupting nociceptive input; APPs should understand lesioning principles, patient selection, and expected duration of effect. | [37,43] |

**Notes**: Standard basic interventional spine procedures relevant to APP education. These procedures form the foundation of interventional pain practice, and APPs should understand indications, imaging, technical considerations, and risk profiles to optimize patient care and peri-procedural coordination.
**Abbreviations**: APP, Advanced Practice Provider; RFA, Radiofrequency Ablation.

**Table 6** *Advanced* Key Spine Procedures for APP Knowledge

| Advanced Procedures | Primary Purpose / APP Knowledge Priorities | References |
|---|---|---|
| **Basivertebral nerve ablation** | Treat vertebrogenic low back pain; APPs should know MRI findings (Modic changes) and post-procedural expectations. | [44–46] |
| **Interspinous spacers** | Relieve neurogenic claudication in lumbar stenosis; APPs should understand device options, rehab protocols, and revision rates. | [37,47] |
| **Percutaneous direct lumbar decompression (ligamentum flavum debulking)** | Decompress central canal stenosis by removing hypertrophied ligamentum flavum; APPs should recognize imaging eligibility criteria and risk factors. | [37,41,47] |
| **Minimally invasive lumbar fusion** | Stabilize vertebral instability without open surgery; APPs should know peri-operative optimization, rehab expectations, and red-flag complications. | [37,47] |
| **Minimally invasive sacroiliac joint stabilization** | Stabilize symptomatic, unstable sacroiliac joints; APPs should understand surgical vs nonsurgical criteria and device-specific recovery protocols. | [37,47] |
| **Restorative peripheral nerve stimulation (PNS)** | Neuromodulate peripheral pain pathways; APPs should be familiar with implant selection, trialing processes, and troubleshooting device issues. | [48,49] |
| **Intrathecal pain pump** | Deliver targeted analgesia for refractory chronic pain or cancer pain; APPs should know PACC algorithms, refill protocols, and infection risk monitoring. | [50] |
| **Spinal cord stimulation (SCS)** | Neuromodulate dorsal columns for refractory neuropathic pain; APPs should be familiar with NACC guidelines, patient selection, trialing, and complication recognition. | [51–54] |

**Notes**: Advanced interventional spine procedures relevant to APP education. APPs are not expected to perform these high-risk procedures independently. Still, they should maintain familiarity with indications, mechanisms, perioperative management, and complication recognition to support patient education, care coordination, and team-based practice.
**Abbreviations**: APP, Advanced Practice Provider; PNS, Peripheral Nerve Stimulation; SCS, Spinal Cord Stimulation; PACC, Polyanalgesic Consensus Conference; NACC, Neurostimulation Appropriateness Consensus Committee.

Adherence to evidence-based standards is a cornerstone of safe practice. Key references include the American Society of Regional Anesthesia and Pain Medicine (ASRA) anticoagulation guidelines, the Neurostimulation Appropriateness Consensus Committee (NACC) recommendations for neuromodulation, the Polyanalgesic Consensus Conference (PACC) algorithms for intrathecal therapy, American Society of Interventional Pain Physicians (ASIPP) Guidelines, and consensus statements from ASPN.[37,39–44,48,50,52–55] These references provide the framework for consistent decision-making and serve as a bridge to the more detailed peri-procedural responsibilities discussed later in the Procedural, Peri-Operative, and Post-Procedure Roles section below.

## 2. Legal And Regulatory Considerations

### State Licensure and Scope of Practice

APP roles are primarily defined at the state level, with wide variability in autonomy, prescriptive authority, and supervisory requirements. NPs and CNSs are licensed as APRNs following graduate education, national certification, and state licensure, as outlined in the APRN Consensus Model.[56] Licensure and prescriptive authority, including controlled substances, are tied to state regulations, and some jurisdictions place restrictions on Schedule II medications.[57]

PAs complete a graduate program accredited by the Accreditation Review Commission on Education for the Physician Assistant (ARC-PA), achieve certification through the National Commission on Certification of Physician Assistants (NCCPA), and hold state licensure. Although some states permit near-independent practice, most continue to require a supervisory or collaborative agreement with a physician. These agreements and state laws shape the scope of practice. All states grant prescriptive authority, but specific allowances, such as fluoroscopy use, differ.[58–60]

## Federal and Institutional Requirements

Beyond state regulations, APPs must comply with federal standards for controlled substances (Drug Enforcement Agency (DEA)), prescribing safety (Center for Disease Control (CDC)), and reimbursement (Centers for Medicare and Medicaid Services (CMS)). CMS allows direct billing by NPs and PAs, though reimbursement is generally capped at 85% of physician rates. Federal policy guidance, such as the Human Health Services (HHS) Pain Management Task Force report, has emphasized multimodal pain strategies and the role of APPs in coordinated care. Institutions provide another layer of oversight through credentialing, privileging, and internal policy, often requiring procedure logs, mandatory training, or prescriptive limits to safeguard patient safety, in alignment with Medicare National Correct Coding Initiative (NCCI) policy requirements.[61–64]

## Professional Organizations and Policy Influence

National and specialty organizations influence both practice standards and policy. The American Association of Nurse Practitioners (AANP) and the American Academy of Physician Associates (AAPA) continue to advocate for reducing restrictive supervision requirements.[65,66] Specialty societies such as ASPN issue consensus guidelines that reinforce physician-led, team-based interventional pain care and delineate coordinated roles across the care team.[37,42–44,67] For structured comparisons of APP training, licensure, certification, and continuing education requirements, see Table 2 and Table 3.

## Independent Practice Boundaries

Independent practice, or "full practice authority", continues to evolve across the US. For nurse practitioners (NPs), 27 states have enacted laws eliminating barriers such as mandatory collaborative agreements, cosignature requirements, and prescribing restrictions. For PAs, independence is defined on a graded scale (Optimal, Advanced, Moderate, Reduced) depending on state laws. Currently, Wyoming, Utah, and North Dakota fall into the Optimal category, where physician oversight is minimal.[66,68]

# 3. ASPN Position on APP Independence

ASPN recognizes APPs as integral members of the interventional pain team but does not support independent performance of interventional spine procedures. Fellowship-trained physicians remain the standard for advanced procedures, while APPs contribute in preoperative evaluation, postoperative care, and peri-procedural collaboration.[67,69] This position underscores ASPN's commitment to safe credentialing standards and team-based care, affirming that privileges for high-risk interventions should rest on formal physician training. At the same time, APPs serve as critical partners in supportive and collaborative roles.

# 4. Collaborative Practice Model

In interventional pain care, APPs and physicians function best in structured teams with clear and complementary roles. Physicians carry primary responsibility for advanced interventional procedures, while APPs provide critical support through patient evaluations, peri- and post-procedure care, and ongoing follow-up. This division of labor broadens access and improves workflow and continuity of care. Studies show that collaborative models consistently lead to higher satisfaction for patients, physicians, and APPs, as well as measurable gains in productivity and chronic disease management.[70,71]

Broader healthcare data reinforce the value of collaboration. The *Future of Nursing* report demonstrated that nurse practitioners practicing to the full extent of their training can deliver high-quality, cost-effective care.[72] Similarly, Medicare analyses reveal reduced costs and greater patient satisfaction when integrating APPs into team-based models.[73] In interventional pain practices, this allows physicians to focus on complex decision-making and procedures while APPs streamline patient flow and maintain oversight during recovery.

Effective collaboration depends on thoughtful role delineation and physician leadership. When responsibilities such as triage, patient optimization, and postoperative management are clearly assigned to APPs, alignment with physician-led interventions is maintained. Trust, mentorship, and recognition of APP contributions are central to this process and form the foundation for safe, efficient, patient-centered care.[74–76]

## 5. Communication and Teamwork Strategies

Effective communication is fundamental to safe, coordinated care. Communication breakdowns are among healthcare systems' most common causes of preventable harm.[77] APPs play a critical role in reinforcing structured processes that help ensure patient details, care plans, and procedural information are accurately shared across the team.

Standardized tools, such as structured handoffs, daily team huddles, and closed-loop confirmation, can help reduce errors and promote consistency.[78,79] By implementing these tools, clinical teams create predictable workflows that minimize miscommunication at key points of care.

APPs often serve as consistent providers throughout a patient's journey. Because they participate in pre- and post-procedure briefings, multidisciplinary case reviews, and follow-up visits, they can bridge transitions between providers. In practice, this means APPs often reinforce treatment plans, clarify instructions for patients, and escalate emerging concerns quickly.[80]

Involving APPs in everyday communication helps make teamwork real and reliable. Regular dialogue between physicians, APPs, and staff fosters clarity, improves patient education, and enhances procedural safety.[81,82]

Once effective communication systems are in place, the focus naturally shifts to patient assessment and preparation before procedures. In that phase, APPs conduct detailed evaluations to confirm suitability for intervention and address potential risks, ensuring patients are appropriately ready for their procedure.

## 6. Patient Assessment and Pre-Procedure Evaluation

Building on the collaborative and communicative framework outlined above, the next step in the continuum of care is comprehensive patient assessment. APPs are uniquely positioned to perform these detailed evaluations, the cornerstone of patient safety and procedural success. Effective assessment identifies appropriate candidates for intervention and ensures coordinated planning across the care team.

### Comprehensive Pre-Procedural Evaluation

A comprehensive pre-procedural evaluation is essential to ensure safety and optimize outcomes for patients undergoing interventional spine procedures. This begins with a patient-centered interview to elicit the history of present illness, prior treatments, and relevant medical and surgical history, followed by a detailed physical and neurological examination to localize pain generators and rule out urgent conditions requiring neurosurgical referral.[34,38,83–85] Assessment should also include evaluation of health literacy, as low health literacy can contribute to disparities in understanding treatment plans and adherence. Tailored patient education and counseling can help mitigate these risks.[86–90] Medical comorbidities must be carefully reviewed, as conditions such as obesity, diabetes, or cardiopulmonary disease increase procedural risk. Hyperglycemia, for example, can impair oxygen delivery and wound healing, elevating the risk of postoperative infection.[91] Identification of active infections, coagulopathies, or other high-risk states is likewise critical and may necessitate medical clearance. Collaboration with primary care providers, anesthesiologists, and other team members ensures a coordinated peri-procedural plan.[75,76]

### Diagnostic Testing and Imaging

Pre-procedural diagnostic testing further informs risk stratification and procedural planning. Imaging studies, including X-rays, CT, or MRI, should be obtained when clinically indicated to confirm diagnoses, determine anatomical targets, and minimize complications. Laboratory testing is guided by patient comorbidities and institutional policies, such as CBC, BMP, or PT/INR in patients on anticoagulation. Specialized testing may be warranted for high-risk populations, including MRSA screening or cardiopulmonary evaluation. Baseline functional status should also be documented to provide a benchmark for outcomes assessment.[75,92]

### Identifying Contraindications and Assessing Risks

The APP plays a central role in recognizing contraindications to neuraxial and interventional procedures. Active infection, thrombocytopenia, and uncontrolled hyperglycemia are among the most critical. Systemic or localized infections must be resolved before proceeding, with appropriate completion of antibiotic therapy when indicated.[93,94]

Thrombocytopenia requires careful evaluation, as risk varies by procedure type. While many experts consider platelet counts >100,000/μL safe for neuraxial interventions, some evidence suggests lower thresholds (70,000–80,000/μL) may be acceptable for lower-risk procedures.[95] Similarly, hyperglycemia should be addressed preoperatively, with data supporting HbA1c <10% as a reasonable threshold.[96] APPs should collaborate with proceduralists to adjust steroid dosing and manage peri-procedural glucose in diabetic patients, recognizing the heightened infection risk with indwelling devices or percutaneous leads.

## Patient Education and Counseling

Patient education is integral to pre-procedural preparation. Studies show patients report higher satisfaction when clinicians dedicate adequate time to education. Lack of knowledge about planned procedures, pain expectations, or postoperative management is associated with increased anxiety, poor outcomes, and lower satisfaction. Conversely, effective education reduces both anxiety and opioid use. Counseling should cover the name and description of the procedure, anticipated benefits and limitations, expected postoperative pain, wound care instructions, activity restrictions, red-flag symptoms warranting follow-up, and scheduling of postoperative appointments.[97–100]

By ensuring patients are well-informed and engaged, APPs enhance satisfaction and adherence and create a natural transition into the formal informed consent process, where risks, benefits, and alternatives are explicitly discussed.

# 7. Informed Consent Process

The culmination of pre-procedural assessment and patient education is the formal informed consent process. Having been thoroughly evaluated and counseled, patients enter this stage with a clearer understanding of their diagnosis, treatment options, and expectations. The APP is important in reinforcing procedural details, clarifying patient questions, and confirming comprehension, while the physician assumes ultimate responsibility for obtaining and documenting consent. This structured, team-based approach ensures that consent is informed and ethically sound, bridging patient education with shared decision-making.

Regardless of whether a physician or an APP performs a procedure, the consent process must clearly communicate the goals, risks, benefits, and alternatives of the intervention in language patients can understand. Written consent must also meet institutional, local, and state requirements, while aligning with best practices for clarity and completeness. APPs, as skilled patient communicators, are often well-positioned to support this process by answering questions and ensuring patients grasp key information before proceeding.[101–103]

## Documentation Standards

Health literacy and accessibility are central to effective informed consent. Multimedia tools, such as video-based consent, have improved patient understanding, reduced preoperative anxiety, and increased overall satisfaction.[104–110] To make the process accessible, procedures should always be explained in clear, plain language that patients can readily understand.

While a signed paper or electronic form is legally required, best practice also includes a medical record note summarizing the discussion. This record should outline the patient's diagnosis or condition, the purpose of the procedure, the main risks and benefits, the reasonable alternatives, and evidence that comprehension was assessed.[103] Professional standards further reinforce these requirements. The American Medical Association emphasizes that informed consent must be a meaningful conversation, ensuring accurate information is provided, comprehension is assessed, and the patient's decision is voluntary.[111] Similarly, The Joint Commission requires documentation of these core elements to protect patient autonomy and institutional accountability.[112]

## Legal Considerations

State laws, institutional policy, and scope-of-practice regulations shape the role of APPs in obtaining and documenting informed consent. As licensed independent practitioners, APPs are legally responsible for obtaining informed consent for procedures they personally perform. In addition, nurse practitioners and clinical nurse specialists may act in their nursing role to witness and assist with the consent process, functioning as patient educators.[102]

In some settings, APPs also facilitate informed consent for their physician colleagues by guiding patients through forms and reinforcing education, while the ultimate legal responsibility remains with the performing physician.[103] However, state-specific regulations may limit APP involvement. For example, in Pennsylvania, only the performing provider may obtain and document consent.[113] As such, APPs should be familiar with their facility's policies and confirm compliance with applicable state and local mandates when engaging in the consent process.

By establishing a clear, well-documented, and legally compliant consent process, APPs help ensure patients proceed to intervention with an accurate understanding of risks, benefits, and expectations. Once informed consent has been obtained, the care focus moves into the procedure and perioperative period. This stage requires technical and team-based safeguards to ensure safety, efficiency, and quality outcomes. APPs contribute by preparing patients, assisting during interventions where permitted, and applying best practices that extend into the immediate post-procedure recovery phase.

## 8. Procedural, Peri-Operative, And Post-Procedure Roles

### Procedural Roles

After pre-procedure evaluation and informed consent, the next stage of care is the procedure itself. Physicians continue to lead advanced interventions, while APPs support procedural safety and reinforce team coordination. APPs help prepare patients by reviewing medications, assisting with sterile setup, and reinforcing expectations. APPs may also serve as first assistants in some settings, provided state law and institutional policy allow them to do so. This may require additional training, such as Registered Nurse First Assist (RNFA) certification for nurse practitioners. Evidence from surgical specialties shows that APP first-assist roles improve efficiency, reduce delays, and maintain safety.[11,12,114,115]

### Peri-Operative Roles

During the perioperative period, APPs help reduce risk and improve outcomes. Their responsibilities include optimizing modifiable risk factors such as glycemic control, smoking cessation, and nutrition. They also help implement infection-prevention protocols, reinforce sterile technique, and ensure correct antibiotic timing, following consensus guidelines such as those from the NACC.[53,116–118] By working closely with physicians and nursing staff, APPs enhance safety across the operative environment.

## Post-Procedural Monitoring and Complications

Once procedures are completed, the focus shifts to recovery and early detection of complications. APPs are often the first to identify problems, reinforce discharge instructions, and coordinate escalation when necessary, making them central to safe post-procedural care.

Table 7 [34,37,38,42,53,116–125] outlines common post-procedural complications and corresponding APP responsibilities. Management strategies range from conservative measures (eg, dressing changes, oral antibiotics, non-opioid analgesics) to urgent interventions such as imaging, surgical consultation, or device revision.

When patients experience limited or absent benefit, APPs should reassess the pain source, review procedural technique and selection, and consider additional imaging or diagnostic testing before repeating an intervention. This structured approach helps set realistic expectations and guides consideration of multimodal alternatives, including neuromodulation, behavioral health integration, or surgery when appropriate.[34,37,38,42]

Infections, bleeding or hematoma, device-related complications, and high-risk neurological events each demand a tailored response. While many issues can be managed conservatively under APP supervision, red-flag symptoms require rapid escalation to specialty care.[53,116–125] Early recognition also allows APPs to distinguish expected, self-limiting post-procedural effects from true complications, reducing unnecessary emergency visits and patient anxiety.[124–126]

## Recovery and Patient Education

Recovery expectations vary across procedures, and APPs are essential in preparing patients with clear, standardized instructions. Their responsibilities include reinforcing wound care and activity restrictions, educating patients on expected side effects, and identifying red-flag symptoms requiring escalation. Use of structured discharge protocols has been shown to improve safety, reduce anxiety, and support consistent follow-up care. Tables 8 [124,126,127] and 9 [125,128,129] summarize

**Table 7** Management of Post-Procedure Complications for the APP

| Complication | Recommended APP Actions | References |
|---|---|---|
| **Limited or absent benefit** | Reassess pain source, confirm procedure selection, consider new imaging. Refer for alternate interventional or surgical management if inadequate benefit persists. | [34,37,38,42] |
| **Infection** | Superficial: sterile dressing changes, oral antibiotics, and close follow-up. Deep (eg, at spinal cord stimulator or intrathecal pump sites): IV antibiotics, infectious disease consultation, and possible device explantation. Imaging if deeper spread suspected. | [116–118] |
| **Bleeding / Hematoma** | Monitor for new weakness, sensory changes, or saddle anesthesia. Urgent imaging and surgical consult if deficits progress. Smaller seromas (eg, at IPG pocket) may resolve with compression in ~6 weeks. | [119] |
| **Device-related complications** | For spinal cord stimulator (SCS) implants, monitor for lead migration, fracture, internal pulse generator (IPG) malfunction, or pocket erosion. Attempt reprogramming if possible; if unsuccessful, refer for revision/replacement. | [53,120–122] |
| **High-risk neurological events** | Recognize dural puncture, cauda equina syndrome, or paraplegia. Escalate urgently with MRI and surgical consultation. | [123–125] |

**Note**: APP responsibilities in recognizing and managing post-procedure complications, including inadequate benefit, infection, bleeding or hematoma, device-related issues, and high-risk neurological events.

**Table 8** Post-Procedure Discharge Instructions for Routine Interventional Procedures

| Discharge Instructions | Injections (eg, ESI, MBB) | Radiofrequency Ablation (RFA) |
|---|---|---|
| **Activity** | Resume baseline activity as tolerated. Clearance required before restarting physical therapy/exercise. | Resume baseline activity as tolerated. Clearance required before restarting physical therapy/exercise. |
| **Bathing** | Shower after 24 hours. Submersion allowed after 48 hours. | Shower after 24 hours. Submersion allowed after 48 hours. |
| **Wound Care** | Monitor for infection or bleeding. Treat soreness at injection site conservatively. | Monitor for infection or bleeding. |
| **Patient Education & Expectations** | Relief may begin 3–7 days after corticosteroid injections, up to 2 weeks. Diagnostic injections are short-term. Soreness for days expected; use ice, acetaminophen, NSAIDs. Re-evaluate at 2–4 weeks or as directed. | Pain relief may take 4–6 weeks. Encourage physical therapy, especially for deconditioned patients. Re-evaluate at 4–6 weeks or as directed. |
| **Low-Risk Complications** | Possible flushing, insomnia, palpitations, hyperglycemia from corticosteroids. Local irritation or pain flare common but temporary. | Possible increased pain or RF neuritis. Treat with ice, topical lidocaine, NSAIDs, acetaminophen, or oral steroids. |
| **High-Risk/Red Flag Signs** | Fever >101°F, chills, worsening pain, bleeding, new weakness, new numbness/tingling, saddle anesthesia, or paraplegia. | Fever >101°F, chills, worsening pain, bleeding, new weakness, new numbness/tingling, saddle anesthesia, or paraplegia. |

**Notes**: Standardized discharge instructions for common outpatient spine procedures (eg, injections, medial branch blocks, and radiofrequency ablation). Adapted from Lo Bianco et al,[124] Hynes et al,[126] and Wray et al.[127]

tailored discharge recommendations for routine procedures (injections, RFA) and advanced interventions (SCS, intrathecal pumps, minimally invasive spine surgery).

## Pain Management During Recovery

Pain control after interventional spine procedures should emphasize multimodal, non-opioid strategies. Acetaminophen and NSAIDs are generally first-line, while neuropathic agents or muscle relaxants may be added for select patients. When opioids are required, prescriptions should be time-limited and closely monitored, consistent with evidence-based

**Table 9** Post-Procedure Discharge Instructions for Advanced Interventional Procedures

| Discharge Instruction Domain | Spinal Cord Stimulators & Intrathecal Pain Pumps | Minimally Invasive Spine and SIJ Procedures (eg, PILD, SIJ fusion/stabilization) |
|---|---|---|
| **Activity Restrictions** | No lifting >10 lbs. Avoid strenuous activity and extreme movements. Restrictions usually 6 weeks or as directed. | No lifting >10 lbs. Avoid bending, twisting, or heavy lifting. Restrictions typically 1–2 weeks for PILD, 4–6 weeks for fusion. |
| **Bathing Restrictions** | Determined at wound check (1–2 weeks). No submersion until cleared. | Determined at wound check (1–2 weeks). No submersion until cleared. |
| **Wound Management** | Routine wound check 7–10 days post-procedure. Monitor for infection/bleeding. Escalate for suspected deeper infection. | Routine wound check 7–10 days post-procedure. Monitor for infection/bleeding. Escalate for suspected deeper infection. |
| **Patient Education & Expectations** | Most lead migration occurs in first 6 weeks (SCS). Pocket site discomfort possible. Healing for SCS/pumps 6–8 weeks. Engage device reps for education/support. | Effects may take weeks depending on procedure. Soreness expected at least 1 week. Lumbrosacral orthosis brace advised after interspinous spacer or fusion. Gradual activity increase recommended. |

**Notes**: Discharge instructions for advanced interventions such as spinal cord stimulator (SCS) and intrathecal pump implants, and for minimally invasive spine and sacroiliac procedures (eg, percutaneous image-guided lumbar decompression [PILD], sacroiliac joint (SIJ) fusion/stabilization). Domains include activity restrictions, wound care, and patient education. Standardized guidance reduces complications such as infection or lead migration while supporting safe recovery. Adapted from Lo Bianco et al,[125] Garcia et al,[128] and Tekmyster et al.[129]

guidance. For opioid-naïve patients, only short courses of immediate-release opioids are recommended, while chronic opioid users may need temporary peri-procedural adjustments under a clear tapering plan. These approaches align with national guidelines that stress prioritizing non-opioid modalities and minimizing opioid exposure.[62,130,131]

By incorporating multimodal strategies, monitoring early recovery, and addressing complications promptly, APPs bridge the procedural and medical aspects of care, ensuring safe transitions into the longer-term medication management framework described in the next section.

## 9. Medication Management

Medication management is a cornerstone of interventional pain practice, spanning the pre-, peri-, and post-procedural continuum. APPs play a central role in medication reconciliation, patient education, and the integration of multimodal strategies that prioritize non-opioid and adjuvant therapies while ensuring appropriate opioid prescribing and monitoring. In this capacity, APPs bridge interventional and medical approaches, optimizing outcomes through safe prescribing practices, risk mitigation, and ongoing follow-up.

## Prescription and Monitoring of Medications Related to Spine Interventions

Medication management must be delivered within a multimodal framework that integrates conservative therapies, psychosocial support, pharmacologic treatments, and interventional procedures. Non-opioid options (eg, NSAIDs, neuropathic agents, and muscle relaxants) should be prioritized. Opioids may be considered when clinically necessary but must be prescribed within evidence-based guidelines and regulatory requirements. Table 10 [61,62,131] summarizes APP responsibilities in reconciliation, prescribing, monitoring, counseling, and collaboration within interventional spine practice.

## National Guidelines and the Opioid Epidemic

The unregulated prescribing of opioids for acute and chronic non-cancer pain in the United States over the past two decades fueled the opioid epidemic, prompting regulatory oversight and national guidelines. The DEA and CDC play complementary roles, issuing evidence-based recommendations and enforcing standards to reduce misuse.[61,62]

Interventional pain management emphasizes multimodal strategies to limit opioid reliance. When opioids are deemed necessary, APPs should apply CDC guidance regarding initiation, dosing, duration, and risk assessment. Non-opioid and

**Table 10** Key Responsibilities of APPs in Medication Management

| Responsibility | Description |
|---|---|
| **Medication Reconciliation** | Review prescription, over-the-counter, and supplement use at each visit. |
| **Initiation and Titration** | Prescribe and adjust non-opioid therapies (NSAIDs, neuropathic agents, muscle relaxants). |
| **Opioid Prescribing** | Prescribe opioids within collaborative frameworks, adhering to CDC, DEA, and state-specific guidelines. |
| **Risk Mitigation** | Incorporate PDMP checks, urine drug screening, and opioid agreements into practice. |
| **Monitoring and Follow-Up** | Assess efficacy, safety, adherence, and side effects of prescribed medications. |
| **Patient Counseling** | Educate patients on benefits, risks, safe storage, and disposal of medications. |
| **Collaboration** | Coordinate care with pharmacy, behavioral health, and primary care for complex or high-risk patients. |

**Notes**: Key responsibilities of APPs in medication management, including reconciliation, prescribing, monitoring, patient education, and collaboration across multidisciplinary teams. Adapted from national guideline and regulatory standards, including the DEA *Controlled Substances* Act;[61] the CDC *Clinical Practice Guideline for Prescribing Opioids for Pain — United States*, 2022;[62] and Howard et al's 2023 evidence-based opioid prescribing recommendations.[131]

non-pharmacologic therapies should be attempted first, and patients counseled on risks, benefits, and functional goals before opioid initiation.[62]

## Initiation and Monitoring of Opioid Therapy

When opioids are indicated, they should begin with immediate-release formulations at the lowest effective dose and shortest duration. CMS aligns with CDC guidance, recommending that initial prescriptions for acute pain be limited to seven days or fewer. Clinicians should reassess benefit versus risk when daily doses exceed 50 MME and generally avoid prescribing >90 MME/day. APPs should consider co-prescribing naloxone for patients at elevated risk (eg, prior overdose, substance use disorder, concurrent benzodiazepine use, or daily opioid doses ≥50 MME). Co-prescribing opioids and benzodiazepines should be avoided whenever possible.[62,132,133]

## Adherence to Regulatory Guidelines

DEA and CDC guidelines form the foundation for safe prescribing of controlled substances. The DEA registers prescribers and supports Prescription Drug Monitoring Programs (PDMPs), while CMS adds oversight by flagging unsafe prescribing patterns. State medical boards further define jurisdiction-specific requirements.[61,62]

APPs who prescribe opioids must maintain an active DEA license and PDMP account, review PDMP data before prescribing, and incorporate structured risk stratification and monitoring. Safeguards include baseline and annual urine drug testing (UDT), with frequency adjusted by risk level, and co-prescription of naloxone where appropriate. Documentation should include history, exam findings, treatment plan, risk assessments, and monitoring. Completion of DEA-mandated medication-assisted treatment (MAT) training is also required for prescribers of controlled substances.[61]

## Risk Stratification: Opioid Risk Tool (ORT)

The Opioid Risk Tool (ORT) is a validated screening instrument used to stratify patients by risk of opioid misuse before initiating therapy. Scores of ≤3 indicate low risk (with up to two urine drug tests annually), 4–7 indicate moderate risk (two tests every 6 months), and ≥8 indicate high risk (up to three tests every 90 days). These thresholds guide the intensity of monitoring and reinforce individualized prescribing decisions (Table 11).[134,135]

## Future Directions

Ongoing innovation in interventional pain management will require parallel progress in APP education, credentialing, and research. The emergence of advanced neuromodulation technologies, including closed-loop spinal cord stimulation, dorsal root ganglion stimulation (DRG-S), and peripheral nerve stimulation, underscores the need for APPs to pursue specialized

**Table 11** Opioid Risk Tool (ORT) Documentation Template

| Mark Each Box that Applies | Female | Male |
|---|---|---|
| **Family history of substance use** | | |
| Alcohol | 1 | 3 |
| Illegal drugs | 2 | 3 |
| Rx drugs | 4 | 4 |
| **Personal history of substance abuse** | | |
| Alcohol | 3 | 3 |
| Illegal drugs | 4 | 4 |
| Rx drugs | 5 | 5 |
| **Age between 16–45 years old** | 1 | 1 |
| **History of preadolescent sexual abuse** | 3 | 0 |
| **Psychological disease** | | |
| ADD, OCD, bipolar, schizophrenia | 2 | 2 |
| Depression | 1 | 1 |
| **Scoring totals** | | |

**Notes**: The Opioid Risk Tool (ORT) is a validated screening instrument for stratifying patients by risk of opioid misuse prior to therapy initiation. Scores of ≤3 indicate low risk, 4–7 moderate risk, and ≥8 high risk, guiding the frequency of urine drug testing and monitoring intensity. Adapted from Webster and Webster[134] and Cheatle et al.[135]

training and continuing education.[136–139] Expanding telehealth, remote device programming, and artificial intelligence–driven monitoring may further enhance APP roles, particularly in improving access for rural and underserved populations.[140–142]

Research is also critical to advancing APP integration. Studies evaluating patient satisfaction, cost-effectiveness, and clinical outcomes in practices with and without APP involvement are needed to provide quantitative justification for expanding APP roles.[14] Establishing structured postgraduate fellowship programs in pain medicine would standardize training, improve consistency in practice, and strengthen workforce readiness. Credentialing and certification initiatives led by professional societies such as ASPN could formally recognize APP expertise in interventional pain management and reassure institutions, payers, and patients of their qualifications. Dedicated educational tracks at professional conferences (eg, NANS, AAPM, ASPN) and greater inclusion of APPs in research and guideline development will further advance the field.

## Limitations

These consensus guidelines outline a comprehensive set of recommendations for integrating APPs into interventional pain management, but several limitations must be acknowledged. Currently, no standardized postgraduate fellowship programs exist for APPs in interventional pain management, leading to variability in training and procedural competencies across institutions. State regulations and payer policies create further heterogeneity in APP scope of practice, which limits the ability to establish uniform national standards. Evidence specific to APP outcomes also remains limited, as most available studies are physician-driven or focused on broader multidisciplinary teams, leaving gaps in knowledge about APP-led care. Institutional and cultural barriers persist, since resistance from some physicians or administrators can restrict APP integration despite supportive evidence. Finally, although these guidelines were developed in the United States, their applicability to international practice is limited by differences in training, licensure, and healthcare delivery systems.

## Conclusion

Integrating APPs into interventional pain management can be achieved by emphasizing interdisciplinary collaboration and efficient workflows. This model allows physicians to focus on advanced and complex interventions while APPs expand patient access, continuity of care, and overall quality. APPs are uniquely positioned to conduct pre-procedural assessment, reinforce informed consent and patient education, monitor for complications, and manage peri- and post-procedural care.

Looking forward, structured APP fellowships, ASPN-led credentialing initiatives, and outcome-based research will be essential to fully realizing the value of APPs in interventional spine and pain practices. By addressing training gaps, reducing regulatory variability, and strengthening collaboration across disciplines, the field can optimize APP contributions and improve patient care while expanding system capacity to meet the rising demand for pain management services.

## Acknowledgments

The authors gratefully acknowledge the following individuals as members of the multidisciplinary panel assembled by ASPN, and for their valuable contributions to concept development, background research, and/or manuscript review: Karen Trutnau, NP; Hannah Sisti, PA; Cynthia Konrath, PA; Nicole Busch, CNS; Victoria Flower, NP; Ashley Wheeler, NP; Jill Study, NP; Robert Thomas, PA; Mackenzie Tiderington, PA; Alhashmin Murji, PA; Collin Duffy, PA; Alexa Moreira, MD; and Jenna Abeloe, NP. Additionally, we recognize Nomen Azeem, MD (ORCID: 0000-0002-6609-5976); Jonathan Silverman, MD; Jonathan Hagedorn, MD (ORCID: 0000-0003-1039-8166); Kenneth Chapman, MD (ORCID: 0000-0002-1799-3411); Pankaj Mehta, MD; and Dawood Sayed, MD (ORCID: 0000-0001-8867-2140) for their contributions to the manuscript and their roles within the panel.

## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

## Disclosure

Ms Casey Grillo is a consultant for Abbott, Nalu, and Painteq, outside the submitted work. Dr Alaa Abd-Elsayed is a consultant for Medtronic, Curonix, Avanos and Averitas. Mrs Brittney Misercola reports personal fees from Abott, personal fees from Auroua, personal fees from Boston Reliviant, outside the submitted work. Dr. Tariq Yousef has nothing to declare. Ms Zohra Hussaini reports consulting fees from Nevro, Averitas, Spr, and Vertos, outside the submitted work. Dr Morteza Rabii is a consultant for Abbott, SI-BONE, Spinal Simplicity, and Informed Consent, outside the submitted work. Mrs Kristen Durkin reports she is a Consultant / speaker for Boston Scientific, Nevro / Globus med, Stryker, Mainstay medical, Corner loc, Abbott, and Spinal simplicity, outside the submitted work. Mr Patrick McGinn reports personal fees from Biotronik Neuro, personal fees from Saluda Medical, personal fees from Carwin Pharmaceutical, personal fees from SPR Therapeutics, personal fees from CornerLoc, personal fees from Stryker, and personal fees from Spinal Simplicity, outside the submitted work. Dr Timothy Deer reports personal fees from Abbott, personal fees from SpineThera, personal fees from Saluda Medical, personal fees from Cornerloc, personal fees from Boston Scientific, personal fees from Pain Teq, personal fees from Spinal Simplicity, personal fees from Biotronik, personal fees from Aurora, personal fees from Nervonik, outside the submitted work; In addition, Dr Timothy Deer has a patent pending with Abbott. This guideline report did not receive external funding. The authors declare no conflicts of interest related to this project.

## References

1. Laguardia S, Piccioni A, Alonso Vera JE, et al. A comprehensive review of the role of the latest minimally invasive neurosurgery techniques and outcomes for brain and spinal surgeries. *Cureus*. 2025;17(5). doi:10.7759/CUREUS.84682

2. Hamric AB, Hanson CM, Tracy MF, O'Grady ET. *Hamric and Hanson's Advanced Practice Nursing: An Integrative Approach*. 7th ed. St Louis, MO: Elsevier; 2021.
3. Goldie CL, Prodan-Bhalla N, Mackay M. Nurse practitioners in postoperative cardiac surgery: are they effective? *Can J Cardiovasc Nurs*. 2012;22(4):8–15.
4. Dinh M, Walker A, Parameswaran A, Enright N. Evaluating the quality of care delivered by an emergency department fast track unit with both nurse practitioners and doctors. *Australas Emerg Nurs J*. 2012;15(4):188–194. doi:10.1016/j.aenj.2012.09.001
5. Patel MR, McDonough RP, Ramasamy A, Caballero J. Impact of nurse practitioner scope of practice on health care access: a systematic review. *West J Nurs Res*. 2019;41(7):995–1011. doi:10.1177/0193945918795168
6. Norton L, Tsiperfal A, Cook K, et al. Effectiveness and safety of an independently run nurse practitioner outpatient cardioversion program (2009–2014). *Am J Cardiol*. 2016;118(12):1842–1846. doi:10.1016/j.amjcard.2016.08.074
7. Gilani N, Patel N, Gerkin RD, Ramirez FC, Tharalson EE, Patel K. The safety and feasibility of large-volume paracentesis performed by an experienced nurse practitioner. *Ann Hepatol*. 2009;8(4):359–363. [PMID:20009136]. doi:10.1016/S1665-2681(19)31750-8
8. Kim N, Herbert T, Marranca S, et al. The acceptability of a novel procedure service run by physician assistants and nurse practitioners. *JAAPA*. 2021;34(12):49–53. doi:10.1097/01.JAA.0000794988.39630.38
9. Lockwood A, Kable A, Hunter S. An evaluation of a nurse-led venous thromboembolism (VTE) prevention program for patients following Hip and knee arthroplasty. *J Clin Nurs*. 2018;27(3–4):e553–e561. doi:10.1111/jocn.14141
10. Ndosi M, Lewis M, Hale C, et al. The outcome and cost-effectiveness of nurse-led care in people with rheumatoid arthritis: a multicentre randomized controlled trial. *Ann Rheum Dis*. 2014;73(11):1975–1982. doi:10.1136/annrheumdis-2013-203403
11. Resnick CM, Daniels KM, Flath-Sporn SJ, Doyle M, Heald R, Padwa BL. Physician assistants improve efficiency and decrease costs in outpatient oral and maxillofacial surgery. *J Oral Maxillofac Surg*. 2016;74(11):2128–2135. doi:10.1016/j.joms.2016.06.195
12. Chao AH, Yaney A, Skoracki RJ, Kearns PN. The impact of physician assistants on a breast reconstruction practice: outcomes and cost analysis. *Ann Plast Surg*. 2017;79(3):249–252. doi:10.1097/SAP.0000000000001087
13. Paz M, Galdi R, Staller K, Thurler A, Vélez C. The role of the advanced practice provider in a subspecialty practice: satisfaction and professionalism, including COVID-19 impacts. *Gastroenterol Nurs*. 2023;46(3):232–242. doi:10.1097/SGA.0000000000000713
14. Hoffmann C, Schatman ME. Advanced practice providers – effectively bridging the gap in interventional pain management. *J Pain Res*. 2023;16:527–528. doi:10.2147/JPR.S405404
15. American Association of Nurse Practitioners. State practice environment. Available from: https://www.aanp.org/advocacy/state/state-practice-environment. Accessed September 24, 2025.
16. American Medical Association. State law chart – physician assistants' scope of practice. 2018. Available from: https://www.ama-assn.org/sites/ama-assn.org/files/corp/media-browser/public/arc-public/state-law-physician-assistant-scope-practice.pdf. Accessed May 11, 2024.
17. National Commission on Certification of Physician Assistants. Competencies for the PA profession. Available from: https://www.nccpa.net/resources/competencies-for-the-physician-assistant-profession/. Accessed September 24, 2025.
18. American Association of Critical-Care Nurses. Clinical nurse specialist (CNS) scope of practice framework. 2024. Available from: https://www.aacn.org. Accessed April 2025.
19. American Nurses Credentialing Center. Certification information and guidelines. 2024. Available from: https://www.nursingworld.org/ancc. Accessed April 2025.
20. Brennan C. Tracing the history of the nurse practitioner profession in 2020, the year of the nurse. *J Pediatr Health Care*. 2020;34(2):83–84. doi:10.1016/j.pedhc.2019.12.005
21. American Association of Nurse Practitioners. NP facts | NP week. Available from: https://npweek.aanp.org/np-facts. Accessed April 25, 2025.
22. Feeney A. Nurse practitioner practice authority: a state-by-state guide. *NurseJournal*. 2024. Available from: https://nursejournal.org/nurse-practitioner/np-practice-authority-by-state/. Accessed April 28, 2024.
23. Kippenbrock T, Emory J, Lee P, Odell E, Buron B, Morrison B. A national survey of nurse practitioners' patient satisfaction outcomes. *Nurs Outlook*. 2019;67(6):707–712. doi:10.1016/j.outlook.2019.06.009
24. American Academy of Physician Associates. What is a PA? 2024. Available from: https://www.aapa.org/about/what-is-a-pa/. Accessed April 6, 2024.
25. American Academy of Physician Associates. History of AAPA. 2024. Available from: https://www.aapa.org/about/history/. Accessed April 6, 2024.
26. National Association of Clinical Nurse Specialists. What is a CNS? 2024. Available from: https://nacns.org/about-us/what-is-a-cns/. Accessed April 13, 2024.
27. Whitehead P. Florence Nightingale: the first clinical nurse specialist. *Clin Nurse Spec*. 2020;34(5):191–193. doi:10.1097/NUR.0000000000000537
28. Matthews JH, Whitehead PB, Ward C, Kyner M, Crowder T. Florence Nightingale: visionary for the role of clinical nurse specialist. *OJIN Online J Issues Nurs*. 2020;25(2):Manuscript1. doi:10.3912/OJIN.Vol25No02Man01
29. American Association of Critical-Care Nurses. Clinical nurse specialist core competencies. 2022. Available from: https://www.aacn.org. Accessed April 2025.
30. American Association of Critical-Care Nurses. CNS certification renewal handbook. 2023. Available from: https://www.aacn.org. Accessed April 2025.
31. American Academy of Nurse Practitioners Certification Board. Home page. Available from: https://www.aanpcert.org/. Accessed September 24, 2025.
32. American Nurses Credentialing Center. Nursing certification renewal. Available from: https://www.nursingworld.org/certification/renewals/. Accessed September 24, 2025.
33. National Commission on Certification of Physician Assistants. Maintain certification. Available from: https://www.nccpa.net/maintain-certification/#1652371545507-55b6dbdb-a566. Accessed September 24, 2025.
34. Fishman SM, Ballantyne JC, Rathmell JP. *Bonica's Management of Pain*. 5th ed. Philadelphia, PA: Wolters Kluwer; 2019.
35. Deer TR, Huntoon MA, Pope JE, et al. Best practices for interventional pain medicine fellowship training: guidance from the American Society of Interventional Pain Physicians (ASIPP). *Pain Physician*. 2014;17(3):E291–E317.
36. Cohen SP, Bhatia A, Buvanendran A, et al. Consensus guidelines on the training and education for interventional pain physicians: joint recommendations from ASRA, ESRA, AAPM, INS, Spine Intervention Society, and NANS. *Reg Anesth Pain Med*. 2021;46(11):892–923. doi:10.1136/rapm-2021-102803

37. Sayed D, Grider J, Strand N, et al. The American Society of Pain and Neuroscience (ASPN) evidence-based clinical guideline of interventional treatments for low back pain. *J Pain Res*. 2022;15:3729–3832. doi:10.2147/JPR.S386879
38. Manchikanti L, Singh V, Falco FJE, Soin A, Kaye AD, Hirsch JA. *Essentials of Interventional Techniques in Managing Chronic Pain*. 2nd ed. Cham, Switzerland: Springer Nature; 2024.
39. Manchikanti L, Knezevic NN, Navani A, et al. Epidural interventions in the management of chronic spinal pain: American Society of Interventional Pain Physicians (ASIPP) comprehensive evidence-based guidelines. *Pain Physician*. 2021;24(S1):S27–S208.
40. Manchikanti L, Kaye AD, Soin A, et al. Comprehensive evidence-based guidelines for facet joint interventions in the management of chronic spinal pain: American Society of Interventional Pain Physicians (ASIPP) guidelines. *Pain Physician*. 2020;23(3S):S1–S127.
41. Cohen SP, Bhaskar A, Bhatia A, et al. Consensus practice guidelines on interventions for lumbar facet joint pain. *Reg Anesth Pain Med*. 2020;45 (6):424–467. doi:10.1136/rapm-2019-101243
42. Sayed D, Deer TR, Tieppo Francio V, et al. American Society of Pain and Neuroscience best practice (ASPN) guideline for the treatment of sacroiliac disorders. *J Pain Res*. 2024;17:1601–1638. doi:10.2147/JPR.S464393
43. Lee DW, Pritzlaff S, Jung MJ, et al. Latest evidence-based application for radiofrequency neurotomy (LEARN): best practice guidelines from the American Society of Pain and Neuroscience (ASPN). *J Pain Res*. 2021;14:2807–2831. doi:10.2147/JPR.S325665
44. Sayed D, Naidu RK, Patel KV, et al. Best practice guidelines on the diagnosis and treatment of vertebrogenic pain with basivertebral nerve ablation from the American Society of Pain and Neuroscience. *J Pain Res*. 2022;15:2801–2819. doi:10.2147/JPR.S378544
45. Abd-Elsayed A, Chitneni A. Basivertebral nerve ablation. In: *Vertebral Augmentation Techniques*. Philadelphia, PA: Elsevier;2023:83–88. doi:10.1016/B978-0-323-88226-2.00018-5
46. Fischgrund JS, Rhyne A, Franke J, et al. Intraosseous basivertebral nerve ablation for the treatment of chronic low back pain: a prospective randomized double-blind sham-controlled multi-center study. *Eur Spine J*. 2018;27(5):1146–1156. doi:10.1007/s00586-018-5496-1
47. Kaye AD, Edinoff AN, Temple SN, et al. A comprehensive review of novel interventional techniques for chronic pain: spinal stenosis and degenerative disc disease—MILD percutaneous image guided lumbar decompression, Vertiflex interspinous spacer, MinuteMan G3 interspinous-interlaminar fusion. *Adv Ther*. 2021;38(9):4628–4645. doi:10.1007/s12325-021-01875-8
48. Gill B, Tidwell C, Hagedorn JM, et al. Consensus guidelines from the American Society of Pain and Neuroscience for the use of 60-day peripheral nerve stimulation therapy: a NEURON living guideline project. *J Pain Res*. 2025;18:3117–3139. doi:10.2147/JPR.S521788
49. Kalia H, Abd-Elsayed A, Malinowski M, et al. Educational curriculum for peripheral nerve stimulation developed by the North American Neuromodulation Society. *Neuromodulation*. 2023;26(3):483–489. doi:10.1016/j.neurom.2022.09.015
50. Deer TR, Hayek SM, Grider JS, et al. The Polyanalgesic Consensus Conference (PACC)®: intrathecal drug delivery guidance on safety and therapy optimization when treating chronic noncancer pain. *Neuromodulation*. 2024;27(7):1107–1139. doi:10.1016/j.neurom.2024.03.003
51. Hagedorn JM, Misercola B, Comer A, et al. The team approach to spinal cord and dorsal root ganglion stimulation: a guide for the advanced practice provider. *Mayo Clin Proc Innov Qual Outcomes*. 2021;5(3):663–669. doi:10.1016/j.mayocpiqo.2021.05.002
52. Deer TR, Russo MA, Grider JS, et al. The Neurostimulation Appropriateness Consensus Committee (NACC): recommendations for surgical technique for spinal cord stimulation. *Neuromodulation*. 2022;25(1):1–34. doi:10.1016/j.neurom.2021.10.015
53. Deer TR, Russo MA, Sayed D, et al. The Neurostimulation Appropriateness Consensus Committee (NACC)®: recommendations for the mitigation of complications of neurostimulation. *Neuromodulation*. 2024;27(6):977–1007. doi:10.1016/j.neurom.2024.04.004
54. Deer TR, Mekhail N, Provenzano D, et al. The appropriate use of neurostimulation of the spinal cord and peripheral nervous system for the treatment of chronic pain and ischemic diseases: the Neuromodulation Appropriateness Consensus Committee. *Neuromodulation*. 2014;17 (6):515–550. doi:10.1111/ner.12208
55. Narouze S, Benzon HT, Provenzano D, et al. Interventional spine and pain procedures in patients on antiplatelet and anticoagulant medications (second edition): guidelines from the American Society of Regional Anesthesia and Pain Medicine, the European Society of Regional Anaesthesia and Pain Therapy, the American Academy of Pain Medicine, the International Neuromodulation Society, the North American Neuromodulation Society, and the World Institute of Pain. *Reg Anesth Pain Med*. 2018;43(3):225–262. doi:10.1097/AAP.0000000000000700
56. APRN Consensus Work Group, National Council of State Boards of Nursing APRN Advisory Committee. Consensus model for APRN regulation: licensure, accreditation, certification & education. Chicago, IL: National Council of State Boards of Nursing; 2008. Available from: https://www.ncsbn.org/public-files/Consensus_Model_Report.pdf. Accessed April 2025.
57. American Medical Association. State law chart: nurse practitioner prescriptive authority. 2017. Available from: https://www.ama-assn.org/sites/ama-assn.org/files/corp/media-browser/specialty%20group/arc/ama-chart-np-prescriptive-authority.pdf. Accessed April 24, 2024.
58. National Commission on Certification of Physician Assistants. Available from: https://www.nccpa.net/. Accessed April 12, 2024.
59. American Academy of Physician Associates. Available from: https://www.aapa.org/. Accessed April 12, 2024.
60. Federation of State Medical Boards. Available from: https://www.fsmb.org/. Accessed September 30, 2024.
61. US Department of Justice, Drug Enforcement Administration. *Practitioner's manual: an informational outline of the Controlled Substances Act*. DEA; 2022. Available from: https://www.deadiversion.usdoj.gov/. Accessed April 12, 2025.
62. Dowell D, Ragan KR, Jones CM, Baldwin GT, Chou R. CDC clinical practice guideline for prescribing opioids for pain—United States, 2022. *MMWR Recomm Rep*. 2022;71(3):1–95. doi:10.15585/mmwr.rr7103a1
63. Centers for Medicare & Medicaid Services. *Medicare benefit policy manual, chapter 15: covered medical and other health services*. CMS; 2023. Available fom: https://www.cms.gov/. Accessed April 12, 2025.
64. US Department of Health and Human Services. Pain management best practices inter-agency task force report. 2019. Available from: https://www.hhs.gov/opioids/prevention/pain-management-options/index.html. Accessed September 22, 2025.
65. American Association of Nurse Practitioners. Issues at a glance: full practice authority. 2023. Available from: https://www.aanp.org/advocacy/advocacy-resource/position-statements/issues-at-a-glance-full-practice-authority. Accessed April 12, 2025.
66. American Academy of Physician Associates. PA state practice environment. 2022. Available from: https://www.aapa.org/advocacy-central/state-advocacy/state-maps/pa-state-practice-environment/. Accessed April 12, 2024.
67. Naidu RK, Chaturvedi R, Engle AM, et al. Interventional spine and pain procedure credentialing: guidelines from the American Society of Pain & Neuroscience. *J Pain Res*. 2021;14:2777–2791. doi:10.2147/JPR.S309705
68. American Academy of Physician Associates. Wyoming landmark legislation a victory for PAs and patients. 2022. Available from: https://www.aapa.org/news-central/2021/04/wyoming-landmark-legislation-a-victory-for-pas-and-patients/. Accessed April 12, 2025.

69. Patterson D, Chang J, Lee D, et al. Establishing a standardized fellowship curriculum for advanced minimally invasive spine interventions: a multidisciplinary approach to training and competency. *Neurospine*. 2025;22(2):332–334. doi:10.14245/NS.2550730.365
70. Moss E, Seifert PC, O'Sullivan A. Registered nurses as interprofessional collaborative partners: creating value-based outcomes. *Online J Issues Nurs*. 2016;21(3):4. doi:10.3912/OJIN.Vol21No03Man04
71. Sanchez N, Hermis K. Interprofessional collaboration to improve and sustain patient experience outcomes in an ambulatory setting. *Patient Exp J*. 2019;6(1):149–153. doi:10.35680/2372-0247.1313
72. Institute of Medicine (US) Committee on the Robert Wood Johnson Foundation Initiative on the Future of Nursing, at the Institute of Medicine. *The Future of Nursing: Leading Change, Advancing Health*. Washington, DC: National Academies Press; 2011.
73. Perloff J, DeRoaches CM, Beurhaus P. Comparing the cost of care provided to medicare beneficiaries assigned to primary care nurse practitioners and physicians. *Health Serv Res*. 2016;51(4):1407–1409. doi:10.1111/1475-6773.12425
74. Pope JE, Deer TR. *Year One of Practice Transition: The Necessary Guide to Success*. 1st ed. Cambridge, MA: Academic Press; 2021.
75. Nancarrow SA, Booth A, Ariss S, Smith T, Enderby P, Roots A. Ten principles of good interdisciplinary team work. *Hum Resour Health*. 2013;11:19. doi:10.1186/1478-4491-11-19
76. Xyrichis A, Lowton K. What fosters or prevents interprofessional teamworking in primary and community care? A literature review. *Int J Nurs Stud*. 2008;45(1):140–153. doi:10.1016/j.ijnurstu.2007.01.015
77. Fewster-Thuente L, Velsor-Friedrich B. Interdisciplinary collaboration for healthcare professionals. *Nurs Adm Q*. 2008;32(1):40–48. doi:10.1097/01.NAQ.0000305946.31193.61
78. Starmer AJ, Spector ND, Srivastava R, et al. Changes in medical errors after implementation of a handoff program. *N Engl J Med*. 2014;371(19):1803–1812. doi:10.1056/NEJMsa1405556
79. Weaver SJ, Dy SM, Rosen MA. Team-training in healthcare: a narrative synthesis of the literature. *BMJ Qual Saf*. 2014;23(5):359–372. doi:10.1136/bmjqs-2013-001848
80. Leonard M, Graham S, Bonacum D. The human factor: the critical importance of effective teamwork and communication in providing safe care. *Qual Saf Health Care*. 2004;13(Suppl 1):i85–i90. doi:10.1136/qhc.13.suppl_1.i85
81. Rosen MA, DiazGranados D, Dietz AS, et al. Teamwork in healthcare: key discoveries enabling safer, high-quality care. *Am Psychol*. 2018;73(4):433–450. doi:10.1037/amp0000298
82. Buljac-Samardzic M, Doekhie KD, van Wijngaarden JDH. Interventions to improve team effectiveness within health care: a systematic review of the past decade. *Hum Resour Health*. 2020;18(1):2. doi:10.1186/s12960-019-0411-3
83. Burks S, Yang M. The neurological examination part I: cranial. In: Wang MY, Strayer AL, Harris OA, Rosenberg CM, Mummaneni PV, editors. *Handbook of Neurosurgery, Neurology, and Spinal Medicine for Nurses and Advanced Practice Health Professionals*. 1st ed. New York, NY: Thieme; 2018:63–69.
84. Patchen S, Perez R. The neurological examination part II: spine. In: Wang MY, Strayer AL, Harris OA, Rosenberg CM, Mummaneni PV, editors. *Handbook of Neurosurgery, Neurology, and Spinal Medicine for Nurses and Advanced Practice Health Professionals*. 1st ed. New York, NY: Thieme; 2018:71–74.
85. Esquenazi Y, Kim D. The neurological examination part III: peripheral nervous system. In: Wang MY, Strayer AL, Harris OA, Rosenberg CM, Mummaneni PV, editors. *Handbook of Neurosurgery, Neurology, and Spinal Medicine for Nurses and Advanced Practice Health Professionals*. 1st ed. New York, NY: Thieme; 2018:76–83.
86. Berkman ND, Sheridan SL, Donahue KE, et al. Health literacy interventions and outcomes: an updated systematic review. *Ann Intern Med*. 2011;155(2):97–107. doi:10.7326/0003-4819-155-2-201107190-00005
87. Mackey LM, Doody C, Werner EL, Fullen BM. Self-management skills in chronic disease management: what role does health literacy have? *Med Decis Making*. 2016;36(6):741–759. doi:10.1177/0272989X16638330
88. Smith SG, Curtis LM, O'Conor R, et al. Low health literacy predicts decline in physical function among older adults: findings from the LitCog cohort study. *J Epidemiol Community Health*. 2015;69(5):474–480. doi:10.1136/jech-2014-204915
89. Hersh L, Salzman B, Snyderman D. Health literacy in primary care practice. *Am Fam Physician*. 2015;92(2):118–124.
90. Sheridan SL, Halpern DJ, Viera AJ, Berkman ND, Donahue KE, Crotty K. Interventions for individuals with low health literacy: a systematic review. *J Health Commun*. 2011;16(suppl 3):30–54. doi:10.1080/10810730.2011.604391
91. Joshi GP, Chung F, Vann MA, et al. Society for ambulatory anesthesia consensus statement on perioperative blood glucose management in diabetic patients undergoing ambulatory surgery. *Anesth Analg*. 2010;111(6):1378–1387. doi:10.1213/ANE.0b013e3181f9c288
92. Maitra S, Mikhail C, Cho SK, Daubs MD. Preoperative maximization to reduce complications in spinal surgery. *Global Spine J*. 2020;10(1 Suppl):45S–52S. doi:10.1177/2192568219882349
93. Doan LV, Blitz J. Preoperative assessment and management of patients with pain and anxiety disorders. *Curr Anesthesiol Rep*. 2020;10(1):28–34. doi:10.1007/s40140-020-00367-9
94. Practice advisory for the prevention, diagnosis, and management of infectious complications associated with neuraxial techniques: an updated report by the American Society of Anesthesiologists Task Force on Infectious Complications Associated with Neuraxial Techniques and the American Society of Regional Anesthesia and Pain Medicine. *Anesthesiology*. 2017;126(4):585–601. doi:10.1097/ALN.0000000000001521
95. Lau JSY, Kiss C, Roberts E, et al. Surveillance of life-long antibiotics: a review of antibiotic prescribing patients in an Australian healthcare network. *Ann Clin Microbiol Antimicrob*. 2017;16(3):3. doi:10.1186/s12941-017-0180-6
96. Zheng P, Hao D, Christolias G, et al. Factfinders for patient safety; delaying epidural steroid injections: infection and safe platelet cutoff. *Interv Pain Med*. 2024;3(1):100091.
97. Even JL, Crosby CG, Song Y, McGirt MJ, Devin CJ. Effects of epidural steroid injections on blood glucose levels in patients with diabetes mellitus. *Spine*. 2012;37(1):46–50. doi:10.1097/BRS.0b013e31821fd21f
98. BE E Jr, Orr SP, Antonetti J, Thomas SB, Theiss SM. Factors impacting press ganey patient satisfaction scores in orthopedic surgery spine clinic. *Spine J*. 2016;16(11):1285–1289. doi:10.1016/j.spinee.2016.04.007
99. Bleicher J, Esplin J, Blumling AN, et al. Expectation-setting and patient education about pain control in the perioperative setting: a qualitative study. *J Opioid Manag*. 2021;17(6):455–464. doi:10.5055/jom.2021.0680
100. Egbert LD, Battit GE, Welch CE, Bartlett MK. Reduction of postoperative pain by encouragement and instruction of patients: a study of doctor-patient rapport. *N Engl J Med*. 1964;270(15):825–827. doi:10.1056/NEJM196404092701505

101. Wilkenfeld DA, Campbell G. Improving informed consent by enhancing the role of nurses. *Nurs Ethics*. 2021;28(4):575–584. doi:10.1177/0969733020956375
102. Farmer L, Lundy A. Informed consent: ethical and legal considerations for advanced practice nurses. *J Nurse Pract*. 2017;13(2):124–130. doi:10.1016/j.nurpra.2016.08.011
103. Deer T, Patel AA, Sayed D, et al. Informed consent for spine procedures: best practice guideline from the American Society of Pain and Neuroscience (ASPN). *J Pain Res*. 2023;16:3559–3568. doi:10.2147/JPR.S418261
104. Perrenoud B, Velonaki VS, Bodenmann P, Ramelet AS. The effectiveness of health literacy interventions on the informed consent process of health care users: a systematic review protocol. *JBI Database System Rev Implement Rep*. 2015;13(10):82–94. doi:10.11124/jbisrir-2015-2304
105. Sahai A, Kucheria R, Challacombe B, Dasgupta P. Video consent: a pilot study of informed consent in laparoscopic urology and its impact on patient satisfaction. *JSLS*. 2006;10(1):21–25.
106. Farrell EH, Whistance RN, Phillips K, et al. Systematic review and meta-analysis of audio-visual information aids for informed consent for invasive healthcare procedures in clinical practice. *Patient Educ Couns*. 2014;94(1):20–32. doi:10.1016/j.pec.2013.08.019
107. Glaser J, Nouri S, Fernandez A, et al. Interventions to improve patient comprehension in informed consent for medical and surgical procedures: an updated systematic review. *Med Decis Making*. 2020;40(2):119–143. doi:10.1177/0272989X19896348
108. Martin JG, Shekhani H, Becker L, et al. Quality improvement project to increase patients' knowledge about their impending procedures during the consent process. *J Am Coll Radiol*. 2018;15(4):652–654. doi:10.1016/j.jacr.2017.10.033
109. Mawhinney G, Thakar C, Williamson V, Rothenfluh DA, Reynolds J. Oxford Video Informed Consent Tool (OxVIC): a pilot study of informed video consent in spinal surgery and preoperative patient satisfaction. *BMJ Open*. 2019;9(7):e027712. doi:10.1136/bmjopen-2018-027712
110. Rowbotham MC, Astin J, Greene K, Cummings SR. Interactive informed consent: randomized comparison with paper consents. *PLoS One*. 2013;8(3):e58603. doi:10.1371/journal.pone.0058603
111. American Medical Association. Informed consent. Available from: https://code-medical-ethics.ama-assn.org/ethics-opinions/informed-consent. Accessed September 24, 2025.
112. The Joint Commission. *Comprehensive Accreditation Manual for Hospitals (CAMH): Rights and Responsibilities of the Individual, Standard RI.01.03.01 (Informed Consent)*. Oakbrook Terrace, IL: The Joint Commission; 2024.
113. Commonwealth of Pennsylvania. *Medical Care Availability and Reduction of Error (MCARE) Act, 40 P.S. § 1303.504*. Harrisburg, PA: Pennsylvania General Assembly; 2002.
114. Bohm ER, Dunbar M, Pitman D, Rhule C, Araneta J. Experience with physician assistants in a Canadian arthroplasty program. *Can J Surg*. 2010;53(2):103–108.
115. Althausen PL, Shannon S, Owens B, et al. Impact of hospital-employed physician assistants on a level II community-based orthopaedic trauma system. *J Orthop Trauma*. 2013;27(2):e87–e91. doi:10.1097/BOT.0b013e3182647f29
116. Deer TR, Provenzano DA, Hanes M, et al. The Neurostimulation Appropriateness Consensus Committee (NACC) recommendations for infection prevention and management. *Neuromodulation*. 2017;20(1):31–50. doi:10.1111/ner.12565
117. Tan T, Lee H, Huang MS. Prophylactic post-operative measures to minimize surgical site infections in spine surgery: systematic review and evidence summary. *Spine J*. 2020;20(3):435–447.
118. Ning J, Wang J, Zhang S, Sha X. Nasal colonization of Staphylococcus aureus and the risk of surgical site infection after spine surgery: a meta-analysis. *Spine J*. 2020;20(3):448–456.
119. Deer TR, Narouze S, Provenzano DA, et al. The Neurostimulation Appropriateness Consensus Committee (NACC): recommendations on bleeding and coagulation management in neurostimulation devices. *Neuromodulation*. 2017;20(1):51–62. doi:10.1111/ner.12542
120. Dombovy-Johnson ML, D'Souza RS, Thuc Ha C, Hagedorn JM. Incidence and risk factors for spinal cord stimulator lead migration with or without loss of efficacy: a retrospective review of 91 consecutive thoracic lead implants. *Neuromodulation*. 2022;25(5):731–737. doi:10.1111/ner.13487
121. Garg I, Wang D. Complications of spinal cord stimulator trials and implants: a review. *Curr Pain Headache Rep*. 2023;27(12):837–842. doi:10.1007/s11916-023-01190-7
122. Koushik SS, Raghavan J, Saranathan S, Slinchenkova K, Viswanath O, Shaparin N. Complications of spinal cord stimulators: a comprehensive review article. *Curr Pain Headache Rep*. 2024;28(1):1–9. doi:10.1007/s11916-023-01178-3
123. Deer TR, Lamer TJ, Pope JE, et al. The Neurostimulation Appropriateness Consensus Committee (NACC) safety guidelines for the reduction of severe neurological injury. *Neuromodulation*. 2017;20(1):15–30. doi:10.1111/ner.12564
124. Lo Bianco G, Tinnirello A, Papa A, et al. Interventional pain procedures: a narrative review focusing on safety and complications. Part 1: injections for spinal pain. *J Pain Res*. 2023;16:1637–1646. doi:10.2147/JPR.S402798
125. Lo Bianco G, Tinnirello A, Papa A, et al. Interventional pain procedures: a narrative review focusing on safety and complications. Part 2: interventional procedures for back pain. *J Pain Res*. 2023;16:761–772. doi:10.2147/JPR.S396215
126. Hynes JP, Fhlatharta MN, Ryan JW, et al. Complications in image-guided musculoskeletal injections. *Skeletal Radiol*. 2021;50(2):343–349. doi:10.1007/s00256-020-03565-y
127. Wray JK, Dixon B, Przkora R. Radiofrequency ablation. In: *StatPearls*. Treasure Island (FL): StatPearls Publishing; 2025.
128. Garcia K, Wray JK, Kumar S. Spinal cord stimulation. In: *StatPearls*. Treasure Island (FL): StatPearls Publishing; 2025.
129. Tekmyster G, Jonely H, Lee DW, et al. Physical therapy considerations and recommendations for patients following spinal cord stimulator implant surgery. *Neuromodulation*. 2023;26(1):260–269. doi:10.1111/ner.13391
130. Overton HN, Hanna MN, Bruhn WE, et al. Opioid-prescribing guidelines for common surgical procedures: an expert panel consensus. *J Am Coll Surg*. 2018;227(4):411–418. doi:10.1016/j.jamcollsurg.2018.07.659
131. Howard R, Gunaseelan V, Lee JS, et al. Evidence-based opioid prescribing guidelines and new persistent opioid use after surgery. *Ann Surg*. 2023;278(2):216–221. doi:10.1097/SLA.0000000000005680
132. Centers for Medicare & Medicaid Services. Medicare Part D opioid policies: information for prescribers. 2025. Available from: https://www.cms.gov/files/document/part-d-opioid-policies-information-prescribers-eff-202501.pdf. Accessed February 20, 2025.
133. Centers for Medicare & Medicaid Services. A prescriber's guide to Medicare prescription drug (Part D) opioid policies (MLN Fact Sheet). 2025. Available from: https://www.cms.gov/files/document/mln2886155-prescribers-guide-medicare-prescription-drug-part-d-opioid-policies.pdf. Accessed February 20, 2025.

134. Webster LR, Webster RM. Predicting aberrant behaviors in opioid-treated patients: preliminary validation of the Opioid Risk Tool. *Pain Med*. 2005;6(6):432–442. doi:10.1111/j.1526-4637.2005.00072.x
135. Cheatle MD, Compton PA, Dhingra L, Wasser TE, O'Brien CP. Development of the revised opioid risk tool to predict opioid use disorder in patients with chronic nonmalignant pain. *J Pain*. 2019;20(7):842–851. doi:10.1016/j.jpain.2019.01.011
136. Malhotra N, Joshi M, Dey S, Sahoo R, Verma S, Asish K. Recent trends in chronic pain medicine. *Indian J Anaesth*. 2023;67(1):123–129. doi:10.4103/ija.ija_31_23
137. Lam CM, Latif U, Sack A, et al. Advances in spinal cord stimulation. *Bioengineering*. 2023;10(2):185. doi:10.3390/bioengineering10020185
138. Strand N, Tieppo Francio V, Gulati A, et al. Advances in pain medicine: a review of new technologies. *Curr Pain Headache Rep*. 2022;26(8):605–616. doi:10.1007/s11916-022-01062-6
139. Chapman KB, Deer TR, Provenzano D, et al. Best practices for dorsal root ganglion stimulation: a consensus document. *J Pain Res*. 2023;16:2625–2641. doi:10.2147/JPR.S364370
140. El-Tallawy SN, Pergolizzi JV, Vasiliu-Feltes I, et al. Innovative applications of telemedicine and other digital health solutions in pain management: a literature review. *Pain Ther*. 2024;13(4):791–812. doi:10.1007/s40122-024-00620-7
141. Perez J, Niburski K, Stoopler M, Ingelmo P. Telehealth and chronic pain management: from rapid adaptation to long-term implementation in pain medicine. *Pain Rep*. 2021;6(1):e912. doi:10.1097/PR9.0000000000000912
142. Cooke A, Castellanos S, Enriquez C, et al. Telehealth for management of chronic non-cancer pain and opioid use disorder in safety net primary care. *BMC Health Serv Res*. 2023;23(1):325. doi:10.1186/s12913-023-09330-w