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ORTHOSES – LOWER EXTREMITIES

PEER-REVIEWED EXCELLENCE IN NURSE LIFE CARE PLANNING SINCE 2006

American Association of Nurse Lifecare Planners

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DEPARTMENTS

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A Message from the President

Dear AANLCP Members and Friends,

As autumn arrives, I'm reminded how change and renewal often go hand in hand. This season offers a moment to reflect on our accomplishments and set our sights on the opportunities ahead.

Your continued engagement has kept our association strong and moving forward. Together, we've advanced our goals, garnered new professional connections, strengthened existing ones, and shared knowledge that benefits us all. I'm deeply grateful for your participation, whether through events, committees, or everyday support of one another.

In the months ahead, we'll continue building momentum with educational offerings and initiatives shaped by your feedback. I encourage you to stay involved, share your ideas, and help us keep this vibrant community growing. AANLCP is about you…our members.

Here's wishing you a productive and inspiring autumn and holiday season, filled with connection, purpose, and gratitude.

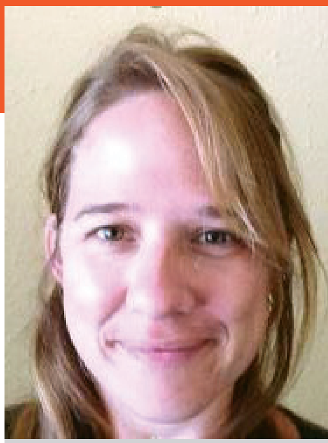
As always, your Executive Board is focused on supporting you and always welcomes your feedback.

Warm regards,

Craig
President, AANLCP

Craig Felty, RN, BSN, MBA, FACHE, FIG LCP-C, FIG MCP-C
President, AANLCP 2025 | president@aanlcp.org

From the Editor



Vanessa Richie
JNLCP Editor
journal@aanlcp.org

With the changing leaves, cooler temperatures, and the holidays around the corner, it's easy to either settle into a sense of quiet contentment or a sense of looming anxiety. One way or another, over the next few months, the routine that we've fallen into since summer is going out the window. The shorter days make it feel like we are getting less done, while simultaneously making it easier to sleep and feel like we have more downtime.

It's a nearly perfect dichotomy as we approach the end of the year because it reminds us that the holidays are quickly approaching, and we need to start wrapping up the tasks that we can. It's also a great time to start thinking about how we want to approach 2026. If there isn't enough time to meet goals or resolutions for this year, you can start making plans for next year.

This issue may help you to feel a bit more productive without having to leave home. Most of the articles focus on lower limb orthotics and the considerations that must be made for different types of orthotic users and different types of devices. Our partnered article with the AALNC includes case studies and considerations for both legal nurse consultants and life care planners. This issue also includes an article about AI, giving you a bit more much-needed information about a tool that is rapidly gaining in popularity but needs to be used with caution.

Have a safe and peaceful autumn as we move into the holidays.

Vanessa Richie, Editor

Information for Authors

Information for Authors

AANLCP® invites interested nurses and allied professionals to submit article queries or manuscripts that educate and inform the Nurse Life Care Planner about current clinical practice methods, professional development, and the promotion of Nurse Life Care Planning. Submitted material must be original. Manuscripts and queries may be addressed to the Editor. Authors should use the following guidelines for articles to be considered for publication.

Text

- Manuscript length: 1500-3000 words
- Use Word© format (.doc, .docx) or Pages (.pages)
- Submit only original manuscript not under consideration by other publications
- Put the title and page number in a header on each page (using the Header feature in Word)
- Place author name, contact information, and article title on a separate title page
- Use APA style (Publication Manual of the American Psychological Assoc. current edition)

Art, Figures, Links

- All photos, figures, and artwork must be in JPG or PDF format (JPG preferred for photos).
- Line art must have a minimum resolution of 1000 dpi, halftone art (photos) a minimum of 300 dpi, and combination art (line/tone) a minimum of 500 dpi.
- Each table, figure, photo, or art must be submitted as a separate file, labeled to match its reference in text, with credits if needed (e.g., Table 1, Common nursing diagnoses in SCI; Figure 3, Time to endpoints by intervention, American Cancer Society, 2019). Graphic elements embedded in a word processing document cannot be used.
- Live links are encouraged. Please include the full URL for each.

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Manuscript Review Process

Submitted articles are peer reviewed by Nurse Life Care Planners with diverse backgrounds in life care planning, case management, rehabilitation, and nursing. Acceptance is based on manuscript content, originality, suitability for the intended audience, relevance to Nurse Life Care Planning, and quality of the submitted material. If you would like to review articles for this journal, please contact the Editor.

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Contributors to this Issue

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Phil Stevens, MEd, CPO, is the Vice President of Clinical Affairs for Hanger. He is a graduate of the University of Washington's Prosthetics and Orthotics Program and earned his Master's Degree in Allied Health Education and Administration from the University of Houston. He currently holds an Adjunct Faculty Position within the University of Utah's Division of Physical Medicine and Rehabilitation. He was a co-editor on the 4th and 5th editions of the Atlas of Amputations and Limb Deficiencies. He served as the President of the American Academy of Orthotists and Prosthetists from 2014-2015 currently sits on the Editorial Board of the Journal of Prosthetics and Orthotics. He is a regular presenter at National and International Continuing Education Conferences within his field of prosthetics and orthotics. He has contributed to more than 60 peer-reviewed publications and 10 textbook chapters and has authored over 100 columns for the industry publication O&P Edge.

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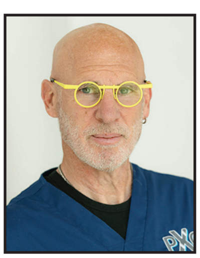
Kendall Brice, MS, CPO, graduated from Baylor College of Medicine's Orthotics and Prosthetics Program and has her BA in Kinesiology, Sports Medicine, from Rice University. In her clinical time, Kendall provided a broad spectrum of care from lower-limb prosthetics to scoliosis and craniosynostosis care, and she has consistently emphasized advanced lower-limb orthotic care in her practice.

Curt Bertram, CPO, FAAOP

Curt Bertram is the Sr. Manager of Clinical Affairs at O & P Insight, LLC. Curt is a certified orthotist/prosthetist and a Fellow of AAOP with over 35 years of experience. He earned his undergraduate degree in Mechanical Engineering from Northern Arizona University, post-graduate certificates in orthotics and prosthetics from Northwestern University and the University of Hartford, respectively, and a graduate certificate in O&P management from the University of Hartford. Curt had a brief career as an aerospace engineer for General Dynamics before finding his way to O&P. Curt is a past president of the ABC and is the current prosthetics CPM examiner and a member of AOPA's Coding and Reimbursement Committee. He is the recipient of the Sam Hammontree Award for Best Business Presentation at the AOPA National Assembly in 2025. He has held a number of positions in O&P, from technician to COO, to business owner. He has traveled the US and world teaching pediatric orthotics, coding & documentation, and compliance.

Curt grew up as an Army brat, has lived in Europe and the US. Currently, he lives in Hartland, WI with his wife Jennifer, daughter Meghan, and Ruby the precocious puppy.



Dale Berry, CP, FAAOP, LP

Dale Berry, CP, FAAOP, LP is the owner of Prosthetic Xpert Consultation, LLC. He is certified by the American Board for Certification in Orthotics and Prosthetics; is a Fellow of the American Association of Orthotists and Prosthetists; and is licensed to practice in Texas, Minnesota, and Illinois. With over 45 years of clinical care and operational experience, Dale consults with prosthetic providers nationwide for patient assessment and treatment, clinical standards of care, and regulatory compliance.

Contributors to this Issue

Karen Vacca, BSN, RN

Originally from the suburbs of Chicago, Karen Vacca earned her Bachelor of Science in Nursing in 2012. While in nursing school, she began her career as a CNA on a medical-surgical oncology unit in Chicago. After obtaining her nursing license, she became an RN on the same unit. In 2014, she moved to Reno, Nevada, to start her career as an OR nurse at a level II trauma hospital. There, she gained experience in various specialties, including open-heart surgery, TAVR and TMVR procedures, neurosurgery, orthopedics, vascular surgery, robotic surgery, urology, plastic surgery, trauma surgery, and general surgery. She is part of the heart and neuro teams within the department. When new hires are trained in the OR, she precepts them during their neurosurgery rotation.

In 2023, Karen completed her LNC course and founded Vacca Consulting, LLC. In 2024, she attended her first forum through AALNC and began working as an expert witness and subcontractor for other LNCs. Since then, she has actively participated in both the national organization and local chapters. Karen has also integrated her expert witness experience into her hospital practice. Management fully supports her business, and she has spoken to her department about how documentation impacts legal outcomes.

Her biggest supporter is her husband, Brandon, to whom she has been married for 10 years. They have two children: Charlotte, 2.5 years old, and Leo, 9 months old. They also have two cats, Nalla and Simba, along with three dogs: Dixie, Kayla, and Roger. This family is passionate about the Chicago Bears and Notre Dame football.

Richard Bays, JD, MBA, EA, RN, LNCC, LCP-C, MCP-C, MSA-C

Richard Bays has served in numerous capacities in the healthcare industry ranging from clinical services and operations, healthcare billing and policy analysis, medical- legal consulting for healthcare attorney groups and oversight of accreditation, licensure and regulatory compliance programs. He specializes in economic aspects of healthcare litigation such as Life Care Plans, Future Medical Cost Projections, Medicare Set-Asides, accounting and tax considerations, as well as reimbursement issues.

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Kristin Clarkson is a Rehabilitation Medicine Nurse Practitioner and holds certification as a Certified Nurse Life Care Planner and Certified Rehabilitation Registered Nurse. She earned her Doctor of Nursing Practice degree from the University of Pittsburgh, a Master of Science in Nursing from the University of Pennsylvania, and a Bachelor of Science in Nursing from Seton Hall University.

Her clinical and academic work focuses on improving function and quality of life for children and adults with neurodevelopmental and complex medical conditions. She has authored several peer-reviewed publications and frequently presents on rehabilitation care across the life span.

Contributors to this Issue

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Victoria Powell is a registered nurse with 30 years of professional nursing experience. Her background has primarily been focused on catastrophic injury care with an emphasis on amputation injury, having worked with her first limb loss individual while working as a work comp case manager.

Ms. Powell is an active member of multiple professional organizations, including the American Association of Nurse Life Care Planners, the Case Management Society of America, the International Academy of Rehab Professionals, and the International Society for Prosthetics and Orthotics (US-ISPO), among others. She also currently serves on the Amputee Coalition's Science and Medical Advisory Council and currently sits on the Osteointegration Task Force, Wrist Disarticulation Task Force, and the Limb Loss Education Task Force. She is a board member of Enhancing Skills for Life, a 501c non-profit organization focused on education and support for those with bilateral upper limb loss and more. Powell has presented and published on a variety of subjects surrounding catastrophic injury.

Victoria Powell is the founder and President of VP Medical Consulting, located in Central Arkansas. She can be contacted at victoria@vp-medical.com or by calling (501) 778-3378.

Steven Boal

Steven Boal is a seasoned technology and mobility executive with a strong track record of innovation and leadership. He is the CEO and Chairman of the Board of Matia Mobility, a manufacturer of robotic standing mobility devices.

Steven previously founded Quotient Technology Inc. (NYSE: QUOT) and served as its CEO and Chairman, and he also founded CashStar, later acquired by Blackhawk Network Holdings. Earlier in his career, he held senior roles at Integral Development Corporation and J.P. Morgan.

A guest lecturer at Stanford Graduate School of Business, Steven has also served on numerous nonprofit boards. His career is defined by leveraging technology to create impact, drive engagement, and improve quality of life.

Olivia Stock

Olivia Stock is a videographer, photographer, and social media marketing specialist with a passion for storytelling. At Matia Mobility, she creates photo and video content that shares the company's mission to improve the lives of people with walking disabilities through innovative standing mobility technology.

Before joining Matia Mobility, she worked as a freelance creative, producing photo, video, and graphic design projects for brands, small businesses, and clients. Her work included photographing and filming weddings and engagements, as well as designing, photographing, and publishing a 100+ page cookbook for a client.

Across every project, Olivia brings a creative eye, attention to detail, and a genuine love for telling stories that provide connection and inspiration.

THE LOWER LIMB ORTHOSIS USER

By: Phil Stevens, MEd, CPO, VP of Clinical Affairs for Hanger and Kendall Brice, MS, CPO

Keywords: 1. Lower Limb Orthoses, 2. Gait, 3. Mobility, 4. Pain, 5. Falls

NURSING DIAGNOSES TO CONSIDER
NANDA-I 2024-2026

Impaired Physical Mobility; Risk for Adult Falls; Chronic Pain

Introduction

Lower limb orthoses (LLO) are mechanical devices worn on the lower extremity to mediate biomechanical deficits frequently due to neurologic or orthopedic injury. Lower limb orthosis users (LLOU) represent a diverse group across a spectrum of clinical diagnoses and presentations who, because of limb weakness, joint instability, poor motor control, and other causative factors, are characterized by their common reliance upon the mechanical assistance of LLO to facilitate safe and efficient standing and ambulation.

The use and benefits of LLO have been reported among several diverse clinical populations. These include individuals with a previous cerebral vascular accident (CVA) (Daryabor et al., 2018; Daryabor et al., 2022; Ferreira et al., 2013; Padilla et al, 2014; Tyson et al., 2013) and those with multiple sclerosis (MS) (Byrnes-Blanco et al., 2023), spinal cord injury (SCI) (Abarghuei and Karimi, 2022), and Charcot-Marie Tooth (CMT) (Kim et al., 2024). However, while these populations are frequently identified with LLO, even in aggregate, they represent less than 40% of LLO (Balkman et al., 2023).

The larger cohort of LLOU has only recently been reported upon. In their development of a population-specific patient-reported outcome measure of mobility among LLOU, Balkman et al. (2024) collected surveys from 1,036 adults with chronic lower limb impairments who used LLO. They compared the general health profiles of LLOU against those of the general US population utilizing the Patient-Reported Outcome Measure Information System 29-item short form version 2.0 (PROMIS-29) (Hinchcliff et al., 2011). The PROMIS-29 is a composite measure from the larger suite of PROMIS patient report instruments consisting of 29 questions assessing the healthcare domains of anxiety, sleep disturbance, fatigue, depression, pain interference, ability to participate in social roles and activities, and physical function. PROMIS-29 measures are indexed to the population of the

United States, allowing ready comparisons between the population of study and national trends. This effort identified several health constructs where LLOU profiles diverged unfavorably from national population averages.

Among these, the most striking was the mean T-score for Physical Function among LLOU, reported at 38.43. This is more than one standard deviation below the US population mean and consistent with the 13th percentile of that population (Balkman et al., 2024), suggesting the severe extent of the deficits in physical function observed among this population.

Also significant was the mean T-score for LLOU for Pain Interference, reported at 56.34 and consistent with the 74th percentile of the larger US population. This implies that the average LLOU experiences pain interference levels greater than three-quarters of the population. In a separate analysis, Stevens et al. (2025), reporting upon a cohort of nearly 1,300 individuals that had been prescribed LLO, observed that 91% of their surveyed population reported Pain Interference values greater than the US average, with 67% of the population reporting Pain Interference values more than 1 standard deviation above the mean US value. Thus, Pain Interference represents a second construct of common and significant concern in this population.

Citing the previously reported relationships between both physical function and pain interference on fall rates in other clinical populations, Stevens et al. (2005) examined the prevalence of injurious falls among individuals who had been prescribed LLO. They observed a 6-month injurious fall rate of 18.6%. This rate exceeded the 12.7% 6-month injurious fall rate observed among lower limb prosthesis users (Miller et al, 2023) and the 10.7% 12-month injurious fall rate observed among elderly adults (Bergen et al., 2021).

Considered collectively, LLOU are best viewed as a heterogeneous population comprised of numerous diverse clinical subpopulations that are characterized by significantly compromised physical function, elevated rates of pain interference during the day-to-day activities, and high rates of injurious falls. Because of the heterogeneity of this population, they present with a complex array of biomechanical deficits and associated gait deviations, the most common of which will be explained below. However, in considering the biomechanical deficits of an individual prescribed LLO, the life care planner must retain an awareness of the impacts of these discrete deficits upon the considerable global health burdens borne by the average LLOU.

Common Phenotypes of Gait Deficits

As identified, the LLOU population is highly heterogeneous with an array of diagnoses, prognoses, and particular needs. Common treatment targets include abnormal and suboptimal biomechanical patterns in ambulation (LeCursi et al, 2024; Whyte, 2014) and can be directly addressed by an orthosis. Some of the more commonly addressed gait deficits among LLOU are described below.

Crouch Gait

Crouch gait is a walking pattern where the knees stay bent throughout the stance phase of gait (Ries & Schwartz, 2019; Rosenberg & Steele, 2017). When the calf muscles (plantar flexors) are too weak to control the forward motion of the shin, the knee extensors must work hard to restrain the knees as they collapse into progressive flexion. In addition to the associated fatigue, this creates less efficient walking and can create additional orthopedic problems (Stout et al., 2008). Crouch gait is often seen in people with low lumbar or sacral level myelomeningocele (Duffy et al., 1996) and in those with cerebral palsy (Ries & Schwartz, 2019; Rosenberg & Steele, 2017).

Genu Recurvatum

Genu recurvatum is the exaggerated hyperextension of the knee in stance phase (Kobayashi et al., 2016; Appasamy et al., 2015). Typically, when the foot comes into contact with the ground, the knee bends forward slightly to absorb impact and allow smooth weight transfer. However, with excessive fixed plantarflexion at the ankle or paired plantar flexor and quadricep weakness, this knee flexion is disrupted. The former presentation creates a mechanical block that prevents the knee from progressing forward, eventually even pushing it backwards. The latter presentation poses a hazardous situation that increases the risk of falling as the weakened knee is prone to buckling forward. To prevent this buckling event, individuals can move the weight of the upper body in front of the knee joint, causing the knee to move to a mechanically secure position of hyperextension. Over time, this posturing can progress from a mild hyperextension to a more visible, destructive, and painful genu recurvatum. Genu recurvatum is commonly observed in stroke and polio survivors (Appasamy et al., 2015; Dean et al., 2020).

Foot Drop and Steppage Gait

Foot drop refers to the lack of ability to raise the toes while advancing the leg through the air in swing phase and is often due to a deficit of the Tibialis Anterior muscle (Carolus et al., 2019). As a result, the toes may drag on the ground, increasing the risk of trips and falls. To prevent this, oftentimes, compensatory strategies are used, such as lifting the limb higher by flexing the hip and knee more than typical – a strategy referred to as "steppage gait." Foot drop is commonly linked to conditions causing flaccid paralysis of the dorsiflexors, like injury to the peripheral nervous system, including compression to the nerves, trauma, or lesions (Carolus et al., 2019; Stewart, 2008).

Equinus

Equinus gait is another deviation observed at the ankle in the swing phase of gait. In contrast with the weakened dorsiflexors associated with foot drop, equinus results from a fixed plantarflexion contracture. With equinus, no matter the strength of the dorsiflexors, the ankle cannot be moved, and the toes stay pointed downwards (Robinson & Mielke, 2024). Because of the rigidity of the ankle, equinus gait affects gait during both swing and stance. Plantar flexor spasticity may also be an associated cause, as the calf muscles are stretched in stance phase and respond by contracting suddenly, causing the foot to point downwards through swing phase (Robinson and Mielke, 2024). Like foot drop, equinus gait makes walking less safe and less efficient, while increasing fall risk. It is often associated with diagnoses affecting the central nervous system, including cerebral palsy and traumatic brain injury (Fock et al., 2004; Robinson and Mielke, 2024).

Antalgic Gait

Antalgic, or "pain-avoidant," gait borrows a multitude of compensatory strategies from other, more pointed classifications (DeLisa, 1998). Nonetheless, it is important to recognize this deviation independently, as LLOU often experience some level of pain that interferes with daily life. For example, after a traumatic ankle injury, arthritis may develop in the ankle joint (Coetzee et al., 2020). As a result, the person may take shorter steps to avoid the pain. They might also shift their trunk quickly to the opposite side, reducing the time spent putting weight on the painful ankle (DeLisa, 1998). These changes are often subconscious ways to avoid discomfort but can make walking less efficient and harder over time, potentially also risking overuse injuries in other joints and tissues.

Remediation through Lower Limb Orthoses

LLO are conventionally referred to according to the joint segments that they cross. Thus, the most frequently encountered device, the ankle-foot-orthosis (AFO) represents an orthosis that crosses the joints of the ankle and foot. When more proximal stabilization is required, the device may extend past more proximal joints, such as might be seen with a knee-ankle-foot orthosis (KAFO). These devices can be manufactured across a range of materials according to the needed performance characteristics of the device.

In considering how to approach the treatment targets identified above, the clinical orthotist must consider the stiffness and alignment of their eventual design (Kobayashi et al., 2019; LeCursi et al., 2024; Owen, 2010). This allows an orthotist to create an individualized device design with appropriate mechanical properties to address the particular treatment target, or biomechanical deviation, with the forefront goal being to improve the global health profile of the patient.

An orthosis necessarily controls motion or position of a segment of the lower extremity by exerting a force to the anatomical segment (Ramachandran et al., 2018). The degree of control, or degree to which the device permits or limits motion, can be generally referred to as its stiffness. Such stiffness can vary from open, unresisted motion to the complete blockage of motion. Dynamic elements, like carbon fiber struts, variably compressed springs, and bumpers with graded durometers, facilitate considerable variation in this area. Determining the desired stiffness for a given case varies with the person and their particular biomechanical goals. For instance, a stiffer device is required to control the smooth movement of an individual's body weight over a dorsiflexing ankle and crouching knee, while a much less stiff device is needed to lift the weight of a flail foot during swing phase (Waterval et al., 2019; Waterval et al., 2020; Waterval et al., 2025). Implementing various stiffness levels within the orthosis takes many forms from simply selecting the degree of flexibility in the thermoplastic construction by changing thickness or material to the selection of additional joint elements.

While mechanical joint stiffness has historically been fixed throughout the gait cycle, the introduction of microprocessors now enables the mechanical joints of LLO to dynamically alter the stiffness properties throughout the gait cycle. For example, the knee joints of microprocessor KAFOs cycle between extremely stiff during stance, when a patient's weight is born through the affected limb, to open during swing, to allow the anatomical knee joint to flex and extend as the toes clear the floor and the leg prepares for the next step (Ruetz et al., 2024).

Joint alignment also ensures that the device promotes optimal biomechanics given a patient's presentation (Brown et al., 2017; Kobayashi et al., 2019; Owen, 2010; Owen, 2019; Owen, 2020). In the absence of anatomical restrictions to joint mobility, proper alignment is relatively easy to obtain. In instances of restricted joint mobility, deformity, or pain, alignment can be more challenging to obtain. For example, a patient who presents with a plantarflexion contracture will require an orthosis that accommodates this position, but may require additional elements, such as an external heel wedge, to align proximal joint segments for optimal ambulation.

Applications in Life Care Planning

An influential variable to consider during the creation of a life care plan is the anticipated duration of LLO need. Mild injuries to peripheral nerves and joint instabilities due to soft tissue laxity will often recover with time. Significant neurological insult or biomechanical deficits due to chronic presentations are unlikely to exhibit meaningful recovery. While the former may only require a single LLO to supplement gait until recovery, the latter often requires periodic replacement of LLO. While generalities must be approached with caution, replacement of custom devices tends to occur every 3 to 5 years due to mechanical wear and degradation of the device. Such replacements tend to require two clinic visits with costs commonly ranging between $700 and $1,500. Individuals who experience a significant change in their presentation, including both improvements and worsening of symptoms, may require earlier replacement of their LLO.

A second consideration is the complexity of the biomechanical deficits. Deficits that are confined to a single plane of motion (i.e., sagittal or coronal) can sometimes be managed by comparatively simple, non-custom LLO. Those deficits that impact movement in two or more planes are generally managed by custom LLO capable of controlling these more complex movement patterns.

Consultation with a certified orthotist who has evaluated a prospective LLOU will allow the life care planner to determine whether a given case will require a single or multiple LLO, the anticipated frequency of replacement, the need for custom versus non-custom LLO solutions, and the complexity of design with associated cost projections. Where measures of general health and pain are not administered by the treating orthotist, the life care planner might choose to administer such assessments for a fuller holistic assessment of the patient's condition.

Case Study

JD presented to his orthotist with a primary diagnosis of an undiagnosed peripheral motor neuropathy and a prescription for bilateral KAFOs. Protracted weakness of the major joint segments of his lower limb caused him to walk with several pronounced gait deficits. In swing phase, weakness of his dorsiflexors precluded his ability to lift his toes to avoid catching them against the floor, predisposing him to stumbles and falls. JD attempted to compensate for this deficit via bilateral steppage gait with exaggerated hip and knee joint flexion (Image 1).

Image 1: Patient ambulating prior to orthotic intervention displays excessive hip and knee flexion in swing to avoid the toes from catching the floor as he walks – a compensatory strategy employed to reduce fall risk.

In stance phase, weakness of his knee extensors precluded his ability to walk without them buckling with concomitant falls, especially in unfamiliar or non-level walking environments. JD attempted to compensate for this deficit by hyperextending his knees and keeping his body weight anterior to the joint to create passive stability.

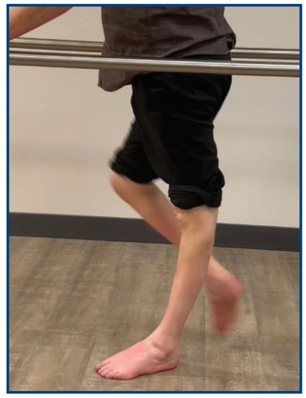

Image 2: Patient employs significant genu recurvatum in stance phase to maintain the knee in an extended position as the plantar flexor and knee extensor groups are insufficient to control knee flexion.

The aggregated impact of these biomechanical deficits, gait deviations, and associated compensations on JD's mobility was assessed using the Orthotic Patient Reported Outcome – Mobility (OPRO-M) (Balkman et al., 2023). This patient-reported outcome measure was developed using item-response theory and is indexed to T-scores among the target population of LLOU. This permits ready comparison of an individual's score to the LLOU population mean. It has demonstrated known group validity among LLOU according to paresis type, the extent of LLO use (unilateral versus bilateral involvement and AFOs versus more proximal orthoses), and positive versus negative fall history (Balkman et al., 2023). Concurrent validity has been established against both performance and patient-report outcomes measures (Balkman et al., 2025). The instrument invites subjects to rate the relative difficulty they associate with 12 common mobility items across a 5-item Likert scale:

- Without any difficulty
- With a little difficulty
- With some difficulty
- With much difficulty
- Unable to do.

Activities are listed in progressive difficulty, beginning with "Are you able to walk a short distance in your home," and concluding with "Are you able to run on level ground?"

JD's OPRO-M T-score at his baseline presentation was 37.9. This placed him in the 11th percentile for mobility among all LLOU. Tasks that JD identified as associated "with much difficulty" included taking two steps backwards, sweeping the floor, stepping up and down curbs, walking over grass, walking over gravel, keeping up with others, and managing stairs.

The impact of pain and pain interference on JD's daily existence was measured using the 4-item short form of the PROMIS Pain Interference (P-PI). In this instrument, participants are invited to consider the past 7 days, rating how much pain interfered with their day-to-day activities, their work around the home, their ability to participate in social activities, and their household chores. Responses were made across a 5-item Likert scale:

- Not at all
- A little bit
- Somewhat
- Quite a bit
- Very much.

JD's P-PI T-score was 68, placing him in the 96th percentile for pain interference relative to the US population. When asked to rate his satisfaction with how things have worked out with his health over the past 4 weeks on a 10-point Likert scale, JD responded with a 4. When asked to rate his quality of life over the past 4 weeks on a 10-point Likert scale, JD responded with a 4.

JD was subsequently fit with bilateral KAFOs with microprocessor-regulated knee joints that blocked his hyperextension and provided mechanical knee joint stability in stance across a range of walking environments. The ankle joints of the KAFO provided mechanical dorsiflexion assist in swing phase, assisting in toe-clearance. Following receipt of the orthoses, JD attended several sessions of physical therapy to maximize his walking potential in the new devices. Sagittal video of JD's gait was obtained during his baseline assessment and 4 months later at the conclusion of his physical therapy. Kinovea analytic software facilitated a biomechanical analysis of the observed differences. This included reduced knee flexion as his steppage gait compensation was no longer required to clear his toes above the floor during swing phase, the elimination of hyperextension as the KAFO's blocked this motion during stance phase, and increased walking cadence as JD adopted greater walking velocities (Figure 1).

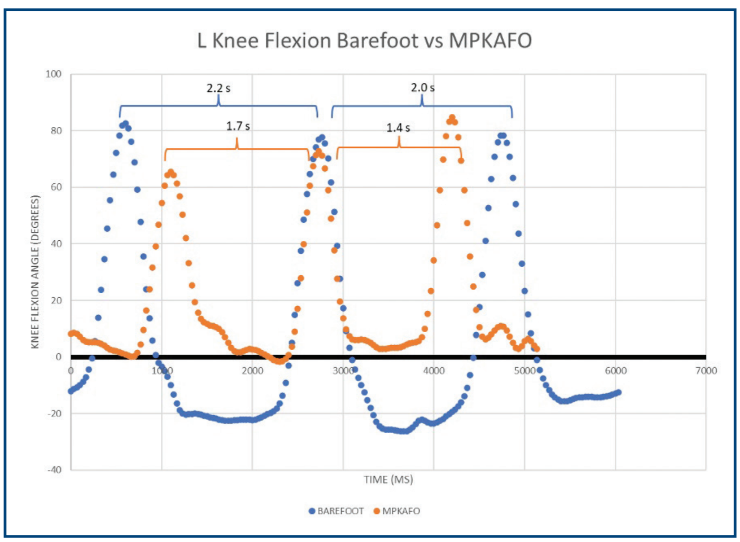

Figure 1: Knee kinematics observed at baseline (blue) and with bilateral MPKAFOs (orange), indicating reduced knee flexion in swing, reduced hyperextension in stance, and increased cadence.

The impact of these biomechanical improvements was captured with the OPRO-M and P-PI. JD's mobility improved from the baseline T-score of 37.9 to 52.9, consistent with improvement from the 11th to the 61st percentile of his LLOU peers. Tasks that improved from "with much difficulty" to "with a little difficulty" included taking two steps backwards, walking over loose gravel, walking on even grass, and keeping up with others (Figure 2). The impact of the intervention upon JD's pain interference was observed as the P-PI T-score reduced from 68 to 50, moving him from the 96th percentile to the 50th percentile, approximating the average pain interference of the US population. Concomitant with these improvements in mobility and pain interference, JD's satisfaction and quality of life scores improved from 4/10 to 9/10 for both assessments.

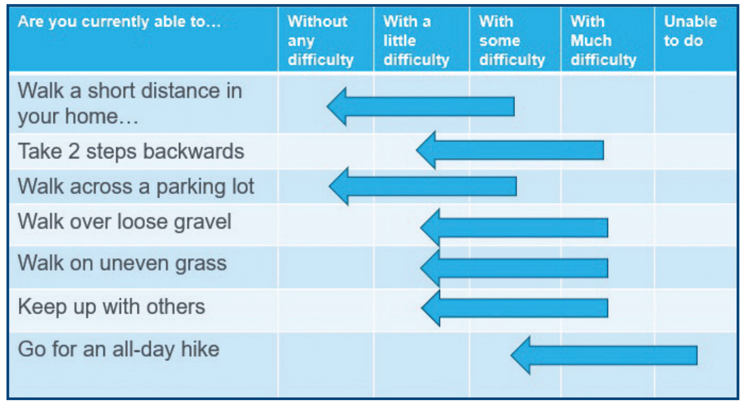

Figure 2: Reductions in the difficulty associated with a series of mobility tasks following successful rehabilitation with an appropriate lower limb orthosis

Conclusion

LLOU represent a diverse group of patients and patient populations with a variety of mechanical deficits necessitating external support of the lower limbs. While this population has historically been understudied, the extent of their global health burden is now better understood. This includes significant compromise to their physical function, high levels of pain and pain interference, and high rates of injurious falls. The biomechanical phenotypes associated with these health burdens and their associated remediation lie within the purview of the clinical orthotist. Successful management of LLOU should address both the observed biomechanical deficits and the associated global health burdens. Successful provision of LLOs is contingent upon successful collaboration amongst the related healthcare providers, as a prescription for the device is required for provision. As a nurse of life care planning, awareness of a patient's potential lifelong need for an orthosis and its potential replacement can be pivotal to the patient's continued access to devices that promote and enhance the improvement of their mobility and global health.

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Life Care Planning Considerations for LOWER LIMB ORTHOTIC INTERVENTION

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Keywords: 1. Lower Limb Orthoses, 2. Microprocessor-controlled Knee Ankle Foot Orthotic, 3. Orthotics, 4. AFO

NURSING DIAGNOSES TO CONSIDER
NANDA-I 2024-2026

Impaired Walking Ability, Risk for Adult Falls, Risk for Excessive Sedentary Behaviors, Risk for Disuse Syndrome

An orthosis, by definition, is an exoskeletal medical device to improve function and support the body due to weakness and/or deformity. Lower limb orthoses are applied by the orthotic clinician to provide benefits to the individual that can include assisting gait, reducing pain, offloading weight, controlling movement, and minimizing the progression of a deformity. Because different types of orthoses have different indications, contraindications, features, and user preferences, the appropriate long-term orthosis should be selected based on the status of the individual's unmet long-term needs (Choo, 2020).

As lower limb orthotics relate to life care planning, immediately after injury and during the rehabilitation process, the specific benefits and features of the orthosis, as needed by the injured person, may change over time due to long-term functional and support needs. Therefore, when developing a life care plan involving lower limb orthotics, the individual's orthotic clinical and billing history during rehabilitation is not necessarily the optimal or medically necessary orthotic intervention and option for future long-term care.

Orthoses Classifications

Lower limb orthoses are defined and classified based upon the specific lower limb joints that have been affected and need support, functional assistance, and/or pain relief. The common nomenclature for lower limb orthoses is defined by applying first letter of each joint the orthosis crosses, from proximal to distal. For example, the following are some of the most frequently used nomenclature:

- FO = Foot Orthosis
- AFO = Ankle Foot Orthosis
- KO = Knee Orthosis
- KAFO = Knee Ankle Foot Orthosis and
- PPE = Personal Powered Exoskeleton.

Within each category of orthosis, there are two distinct orthotic categories, with the determination of which category is medically necessary for the individual dependent upon specific functional, physical, and psychological needs of the individual (CMS, 2025). The two categories that define orthoses are prefabricated and custom fabricated. The prefabricated orthoses are manufactured in various sizes and may come as a kit to be assembled. In this prefabricated category of orthoses, there are two subcategories: off-the-shelf (OTS) and custom fitted. These subcategories are only differentiated by what is performed at the time of delivery. The OTS orthoses are supplied to the individual with minimal self-adjustment (42 CFR §414.402); this is defined as the individual, or caregiver, having the ability to adjust the orthosis and does not require a trained individual, such as a licensed or certified orthotist (CGS JC 2025). The custom-fitted orthoses require substantial adjustments that must be performed by a certified or licensed orthotist, as these adjustments are beyond minimal self-adjustment. The limitations of prefabricated orthoses are that they are generic in shape and configuration and therefore may not accommodate unique individual shapes and sizes, and thus do not always provide optimal function, pain relief, support, or joint control. Prefabricated orthoses can also be made from lower-quality materials and are typically not intended for long-term use.

The primary benefits of OTS orthoses are that they are affordable and readily accessible. These orthoses can be delivered through an orthotist with a degree of efficiency due to being mass-produced by various manufacturers. OTS orthoses can be provided by a wide range of health care suppliers, including certified and licensed orthotists, physical and occupational therapists, nurses, and physicians who have a durable medical equipment (DME) license. Custom-fitted orthoses require the expertise of a certified orthotist, as defined as an individual who is certified by the American Board for Certification in Orthotics and Prosthetics, Inc., or by the Board for Orthotist/Prosthetist Certification (LCD, 2025).

The second category for orthoses is custom fabricated, which, as the name indicates, is custom fabricated to the specific individual's size, shape, and condition. This category will only fit or function for the individual for whom the orthosis was designed. This type of fabricated device is based on clinically derived and rectified castings, tracings, and measurements, and it requires the expertise of a certified or licensed orthotist.

The published regulatory standards to determine if a custom-fabricated orthosis is medically necessary are where there is clinical documentation to verify that the individual meets at least one of the following criteria (LCD, 2025):

a) Could not be fit with an OTS or custom-fitted orthosis

b) The condition necessitating the orthosis is expected to be permanent or of longstanding duration

c) There is a need to control the knee, ankle, or foot in more than one plane or there is documented neurological, circulatory

d) Orthopedic status that requires custom fabrication to prevent tissue injury

e) The individual has a healing fracture that lacks normal anatomical integrity or anthropometric proportions.

Reasonable Useful Life

An orthosis (CFR, §414.202) is classified by Medicare as durable medical equipment, prosthetics and orthotics, and supplies (DMEPOS) (CFR §424.57). Government regulatory standards for the replacement of orthotic devices stipulate that an orthotic that has been in continuous use (CFR, §414.230) has a reasonable useful lifetime (RUL) of not less than 5 years (CFR §414.210).

The RUL of an orthotic can be negatively affected by, but not limited to, the following:

- A change in the physiological condition of the individual
- Irreparable damage of the device rendering it non usable
- Loss of the device.

When calculating the RUL of an orthosis over the individual's lifetime, it is appropriate to use a replacement cycle of 5 years while realizing that extenuating circumstances can reduce or extend the life of the specific orthosis.

Coding and Pricing

An orthosis can be comprised of numerous components, parts, and services. The industry standard is to describe each component of the device using the "L Code" system, in which each component, part, and service is allocated a specific four-digit L-code. A typical orthosis can be coded using from 1 up to +10 L-codes depending upon the type and complexity of the prosthesis. The price of the orthosis is calculated as the sum total of all the line-item L-Codes.

With regard to the specific line-item price for each L-Code, discount and contract rates heavily influence the orthotic industry, and the price of L-Code and subsequent style orthosis varies depending on individual location and payor source. There are three pricing profiles: Medicare Rate, Contract Rate, and Fair Market Value, which is commonly referred to as Retail or Usual & Customary Rate. Medicare rates are publicly available with specific rate dependent upon the individuals zip code (DMEPOS).

Contract rates with commercial insurance are typically confidential and are not published; however, they can be identified by reviewing individual billing records.

For the Fair Market Value, there are three publicly available sources to obtain these rates:

a) Office of Worker's Compensation Programs Fee Schedule (WC RATE)

b) US Department of Veterans Administration Reasonable Charges (VA RATE)

c) Medicare DMEPOS Fee Schedule Files (MC Rates)

Fair Market Value is calculated at 1.265% of the average Medicare Reimbursement (Berry, 2020).

Lower Limb Orthoses Designs

A custom orthosis can be made from a variety of materials, often in combinations to balance strength, flexibility, and comfort.

Material	Properties & Benefits
Thermoplastics	Moldable, rigid, or semi-rigid, commonly used for custom fitted
Carbon Fiber	Lightweight, high strength offers energy return during gait
Metal	Durable, used in older or heavy-duty designs
Leather	Comfortable, breathable, used in hybrid designs

The most common lower limb orthoses are AFOs. The number of permutations for a custom AFO is too numerous to mention; however, they can be classified in a few broader categories: static, dynamic articulating, and dynamic response.

Image 1

The static AFOs are used to limit the range of motion in the foot or ankle and can provide strong ground reaction forces (Image 1). Limiting motion is most associated with healing fractures, bracing post-surgical fixation, or stabilizing the foot/ankle from soft tissue derangement. These injuries often occur from trauma due to injuries suffered from falls, impact, or abnormal gait deviations from slipping or tripping. The solid AFO works well with work boots and occupation-type footwear due to its low profile and adjustability.

Image 2

The dynamic articulating AFOs allow motion in the foot or ankle and are less restrictive. This grants the wearer a more natural gait and is better for stairs and slopes (Image 2). Allowing ankle motion is indicated when the range of motion can be tolerated. The articulated AFO does have additional components at the ankle, allowing for ankle motion to be controlled to the degree of freedom appropriate for the diagnosis. The articulated AFO works well with peroneal nerve injuries associated with drop foot, muscle weakness contributing to abnormal movement of the leg in stance or swing. The nerve and muscle injuries are often associated with crushing of soft tissues and bone, lacerations, and blunt force trauma. The articulating AFO has more bulk to its design and has limitations in footwear (e.g., work boots are impractical to wear with an articulating AFO).

Image 3

The Dynamic Response AFO (e.g., IDEO, ExoSym Image 3) is fabricated from carbon composites that provide energy storing and return promoting dynamic responses during the gait cycle. This provides a guided motion with the ability to replace lost muscle function. This is typically used in highly active individuals. These AFOs can also offload the foot and ankle while maintaining the dynamic response movements. The dynamic response AFO can restore lower limb function from injuries similar to those mentioned for the solid or articulating AFOs. Due to the unique design, carbon composite materials, and stiffness, the Dynamic Response AFO replaces lost muscle function, offloads to reduce pressures/pain, and stores and returns energy during the gait cycle. The individuals utilizing this AFO would be highly-active individuals returning to a vocation that requires a lot of standing/walking, similar to a K4 level amputee.

When the need to control knee motion exists, a KAFO is required. The KAFO has the additional complexity of introducing more proximal leg control using knee joints and a thigh cuff extending the orthosis just distal to the premium. As with AFOs, the number of permutations for a custom KAFO is too numerous to mention; however, they can be classified in a few broader categories: static, dynamic or articulating, stance control (SCO), and microprocessor-controlled (MPKAFO).

Image 4

The static KAFO is one where the knee is locked during stance and is manually unlocked for sitting (Image 4). This is a mechanical process in which the individual initiates the unlocking of the knee at the appropriate time for sitting. It should be noted that it is well documented that a locked knee KAFO creates unwanted gait deviations that lead to long-term compensatory comorbidities for the individual.

Image 5

The dynamic articulating KAFO allows motion in the knee and is less restrictive (Image 5). The knee can be stabilized in stance using specific knee joints and alignment. This allows for a more natural gait. Similar to an articulating AFO, the articulating KAFO allows for knee motion in flexing and extending and offers side-to-side control due to instabilities associated with knee derangement. The mechanisms for these knee injuries occur from falls, abnormal knee movement from uneven ground, carrying heavy loads, or steps/stairs. The articulating KAFO normalizes the sagittal motion of the knee, enabling a more natural gait while alleviating the negative gait abnormalities of the locked knee KAFO. The SCO KAFO is a specific design allowing for an automatic locking knee joint during stance and a free motion knee joint during swing (Image 6). This alleviates the unwanted side effects of a locked knee KAFO during swing while providing stance phase stability. The SCO KAFO allows the best of both worlds from the locked knee KAFO in stance and the articulating KAFO in swing. These individuals suffer from quadriceps weakness due to nerve injury, muscle, or knee derangement.

Image 6

Image 7

An MPKAFO uses intelligent sensor technology to assist individuals with lower limb paralysis or weakness (Image 7). Unlike traditional KAFOs that rely on mechanical locking mechanisms, MPKAFOs dynamically respond to the user's movement in real time, providing resistance and motion throughout the gait cycle—making walking safer, smoother, and more energy-efficient. Traditionally, individuals who require the use of an orthosis due to a condition that results in weakness or paresis of the lower extremity have been prescribed and fitted with other types of orthoses, such as a LKAFO or an SCO. The MPKAFO provides stability and dynamic movement improvements to leg orthosis-dependent individuals. The MPKAFO, which uses signal-processing algorithms, supports walking with a wide variety of different gait velocities. This type of orthosis may be appropriate for individuals who meet specific criteria for fitness, health, and daily utilization expectations. The individuals utilizing this MPKAFO would be highly-active individuals returning to a vocation that requires a lot of standing/walking, similar to a K3/K4 level amputee.

Image 8

In recent years, the PPE mobility device (e.g., ReWalk, Ekso Indego) has come to market (Image 8). The PPE is a wearable robotic system designed to help individuals with spinal cord injuries (SCI T3-L5) walk again—independently and upright. The PPE provides health benefits that have been shown to improve trunk control and posture, reduce spasticity, improve bowel and bladder function, and improve quality of life (Juszczak, et al., 2018; Gorman, et al., 2021).

Supplies and Maintenance

There are predictable supplies and maintenance for an orthosis. A common shortcut approach to calculate supplies and maintenance is to apply a yearly amount based on a percentage of the total cost of the device (MacKenzie et al., 2007). It is imperative to establish that there is no clinical, scientific, medical, or published peer-reviewed evidence to support or validate this for any configuration of orthosis. Supplies and maintenance can be estimated accurately for key orthotic components. Consumable items and their life cycle can be clearly identified and priced. It is reasonable to include 2 to 3 hours of clinical support for maintenance and follow-up for miscellaneous services and care. There is no need for supplies and maintenance for the years that a new orthosis is being provided. A 5-year cycle for an orthosis will therefore include one orthosis and four incidents for supplies and maintenance

Conclusion

In a life care plan for an individual that requires long-term lower limb orthotic care, costs will typically be a significant line item. Although historical and current orthotic records contain valuable information to establish the style, type, and cost of orthosis the individual has had in the past or is currently wearing, these records cannot be solely relied upon to produce accurate future cost projections. It is important to note that access to optimal medically necessary orthosis may have been restricted due to the individual's insurance benefit limitations. It is beneficial to coordinate with an independent Certified Orthotist with no financial interest in the individual's current or future care to provide insight as to future medically necessary orthotic care.

The nurse life care planner must consider key factors related to current orthotic clinical practice guidelines, coding, billing practices, and regulatory standards to develop a life care plan for an individual requiring long-term lower limb orthotic intervention.

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AALNC

LEGAL NURSE VOICE:
Insights from a Legal Nurse Consultant

Recognizing Peroneal Nerve Injuries and Foot Drop

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Keywords: 1. Peroneal Nerve Injury, 2. Foot Drop, 3. AORN Positioning Standard of Care

NURSING DIAGNOSES TO CONSIDER
NANDA-I 2024-2026

Impaired Physical Mobility, Risk for Falls, Chronic Pain

Introduction

Peripheral nerve injuries are uncommon but can be devastating in surgical patients. Among them, the common peroneal nerve (CPN) is especially vulnerable. When injured, it can lead to foot drop, a life-altering complication that affects mobility, independence, and quality of life.

For the perioperative nurse, preventing positioning-related nerve injuries is a daily responsibility. For the legal nurse consultant (LNC), these same injuries often become the focus of malpractice claims, where charting gaps, missed assessments, and deviations from standards of care take center stage. For nurse life care planners (LCPs), these injuries may necessitate adjustments to existing life care plans, as well as additional considerations to address gaps in long-term care.

This article condenses the clinical essentials of peroneal nerve injury and connects them directly to what LNCs and LCPs should flag when reviewing surgical records.

Anatomy and Why It Matters Legally

The common peroneal nerve originates from the posterior divisions of the L4–S2 spinal nerve roots. It branches off from the sciatic nerve proximal to the popliteal fossa and travels laterally around the fibular neck, where it runs superficially beneath the skin. At this location, it has very little protective soft tissue. This makes the nerve especially prone to external compression from surgical positioning, tourniquet use, or even leg crossing.

Clinical translation: An injury here causes weakness in ankle dorsiflexion ("foot drop"), loss of toe extension, sensory deficits along the dorsum of the foot and lateral shin, and compensatory gait changes. Patients may stumble, fatigue easily, and require ankle-foot orthotics.

Legal translation: Because its location and vulnerability are well established in perioperative nursing and surgical standards, the OR team is expected to pad, position, and monitor the fibular head with diligence. If documentation is vague or absent, it becomes significantly more challenging to demonstrate whether the standard of care was met.

Common Mechanisms of Injury

There are several things to look for that could cause the injury or are signs that a client is suffering from the condition.

- **Trauma:** Tibial plateau or fibular head fracture, knee dislocation, or crush injury.

- Iatrogenic/surgical: Tourniquet ischemia, traction during orthopedic or vascular procedures, excessive manipulation during spine surgery.
- Positioning: Prolonged lithotomy, leg crossing, external rotation without padding, or immobility in lengthy surgeries.

Why it matters for LNCs:

Each of these mechanisms can (and should) be tied to a documentable event. Questions to ask to help determine if a client suffers or could be suffering from the condition include the following:

- Was a baseline neurovascular exam documented preoperatively?
- Was padding over the fibular head specifically described?
- Were tourniquet times, pressures, and breaks charted?
- Did intraoperative notes show position checks?
- Were postoperative neurovascular assessments completed at defined intervals?

The absence of these elements can shift liability toward the surgical or nursing team, whereas the presence of these would need consideration for life care plans.

Clinical Presentation in the Chart

When foot drop develops, chart patterns often reveal one or more of the following:

- New weakness in ankle dorsiflexion or toe extension.
- Steppage gait (a high-stepping walking pattern), in which the foot hangs with the toes pointing down, causing the toes to scrape the ground while walking. This requires the person to lift their leg higher than usual, which is noted by a physical therapist (PT) or occupational therapist (OT).
- Sensory loss in the lateral leg and dorsum of the foot.
- Neuropathic pain or paresthesia.

LNC application: Delayed recognition is common. A patient may first complain of “numb toes” or “heaviness in the leg” in the post-anesthesia care unit (PACU), but if the concern isn’t documented or escalated, it can become a major litigation point.

LCP application: Documenting a patient’s ongoing medical care, including any necessary adaptations to their daily life, can help attorneys show damages. The plan should outline the patient’s need for durable medical equipment, physical therapy for gait training, and occupational therapy to adjust activities of daily living, with regular reassessments. It’s also essential to follow up with specialists like neurology, orthopedics, pain management, and podiatry, among others.

Case Illustrations: What the Records Reveal

There are many situations where peroneal nerve injuries could result in foot drop. The following are a few case studies that illustrate real-world situations where clients suffered injuries that required orthotic care and therapy as part of their long-term care.

Case 1: Tibial Plateau Fracture

Scenario: A 60-year-old sustained an open tibial plateau fracture after being pinned between a trailer hitch (a device attached to a vehicle for towing) and a trailer at work. He was rushed to the operating room emergently for fracture stabilization and soft tissue repair. Despite successful fracture repair, the peroneal nerve had been crushed and never fully recovered. Unfortunately, he became permanently dependent on ankle-foot orthoses and therapy (Dickens, 2025).

- *Clinical reality:* The nerve was crushed at the time of trauma.
- *Legal takeaway*: Documented pre-op deficits protected the surgical team. If that baseline had not been noted, permanent disability could have been misattributed to intraoperative negligence.
- *Life care planning considerations:* The patient’s functional loss was permanent, ongoing, and costly over their remaining lifespan.

Case 2: Vascular Bypass Surgery

Scenario: A 55-year-old male underwent a scheduled femoropopliteal bypass to improve circulation to his lower limb. The case was lengthy and required the patient to remain in the supine position with one leg externally rotated for surgical access. About six months after the procedure, he reported burning leg pain and developed foot drop, impairing his mobility. The patient was referred to neurosurgery to rule out lumbar pathology. MRI imaging ruled out spinal causes; the injury was most likely caused by intraoperative compression. The patient underwent a peroneal decompression surgery, but deficits persisted (Canner-Peterson, 2025).

- *Clinical reality:* Likely compression from positioning.
- *Legal takeaway:* No documentation of padding at the fibular head. Even if padding was used, the omission in the record created exposure. For LNCs, this is a red flag: absence of documentation often carries the same legal weight as absence of care.
- *Life care planning considerations:* The goal is to capture not only the medical and rehab needs, but also the economic, vocational, and psychosocial impact over his lifetime.

Case 3: Bilateral Foot Drop After Spine Surgery

Scenario: A 50-year-old ranger presented with claudication symptoms due to lumbar stenosis. He underwent a lumbar decompression surgery to alleviate nerve root compression. During the procedure, significant manipulation of the lumbar spine occurred around the L5 nerve roots. Following surgery, the patient developed bilateral foot drop, with profound weakness in ankle dorsiflexion. Electromyography (EMG) confirmed severe bilateral L5 radiculopathy, likely caused by excessive nerve root compression during surgery. Despite physical therapy, the patient never fully recovered. He now wears bilateral ankle-foot orthoses (AFOs) and struggles with the physical demands of his work activities (Moore, 2025).

- *Clinical reality:* Findings consistent with central L5 radiculopathy.
- *Legal takeaway:* This case highlights the nuance of causation. Expert testimony focused on whether intraoperative traction was excessive and whether neuromonitoring was properly used and charted. For the LNC, these records must be reviewed for neuromonitoring reports, anesthesia notes, and intraoperative neurocheck documentation.
- *Life care planning considerations:* A devastation in both physical and vocational aspects, mainly when the job relies on mobility, agility, and endurance. This was not just an injury, but a lifetime of braces, therapy, fall risks, and career loss.

Case 4: Delayed Recognition After Microdiscectomy

Scenario: A patient underwent a microdiscectomy in another state. The surgery lasted longer than expected. Postoperatively, the patient reported pain, weakness, numbness, and atrophy in the thigh. However, follow-up was inconsistent. By the time he sought a second opinion, more than 6 months later, EMG studies showed significant nerve root compression injury that had not been recognized earlier. His function never returned to baseline (Moore, 2025).

- *Clinical reality:* Post-op complaints were vague and poorly documented.
- *Legal takeaway:* Missed opportunities for early detection contributed to a worsened outcome. For the LNC, the red flag is the lack of clear escalation protocols, inconsistent follow-up visits, and incomplete patient education documentation.
- *Life care planning considerations:* The key considerations revolve around permanent neurologic impairment, chronic pain, delayed intervention, and long-term functional loss.

Medical Assessment:

Linking Peroneal Nerve Injury to Long-Term Outcomes and Legal Implications

Peroneal nerve injury is a unique complication in surgery because it bridges three domains: anatomy, functional outcome, and medico-legal responsibility. A thorough assessment requires looking beyond the immediate intraoperative events to understand the cascade of clinical and legal consequences that follow.

Clinical Assessment of Injury

The common peroneal nerve's superficial path around the fibular head leaves it highly vulnerable to compression, traction, or laceration. A medical assessment begins with a careful baseline neurovascular exam that documents motor strength (ankle dorsiflexion, toe extension, and eversion) and sensory distribution (dorsum of the foot and lateral shin). Failure to capture this baseline blurs the line between pre-existing deficits and iatrogenic injury (Vacca, 2025).

Once injury occurs, the clinical picture usually unfolds in stages (Keller, 2025):

1. Acute Phase (hours to days): Patients may report paresthesia, numbness, or weakness in the affected limb. PACU documentation should capture whether these symptoms were present immediately postoperatively or developed later.
2. Subacute Phase (days to weeks): Foot drop becomes more apparent, particularly when patients attempt to ambulate. Physical therapy often identifies a high-steppage gait, compensatory hip hiking, or frequent tripping.
3. Chronic Phase (months to years): Muscle atrophy, contractures, and persistent sensory loss set in. Patients may require AFOs, mobility aids, or surgical decompression.

From a medical standpoint, EMG/NCS studies provide objective confirmation of the site and severity of nerve damage; however, they must be interpreted within the surgical timeline. A nerve conduction block due to compression is treated very differently from root compression at L5.

Long-Term Medical Consequences

The long-term consequences of peroneal nerve injury are significant and often permanent:

- Functional Loss: Patients struggle with uneven terrain, stairs, and endurance activities. Even with orthoses, walking becomes energy-intensive and fatiguing.
- Secondary Injuries: Falls and musculoskeletal strain are common due to compensatory gait.
- Chronic Pain: Neuropathic pain and dysesthesia can persist long after the initial insult.
- Psychosocial Impact: Loss of independence, reduced employability, and depression are not uncommon, especially in younger or working-age patients.

These sequelae are rarely fully captured in operative or nursing documentation but become central to damage calculations in litigation.

For LCPs, the litigation focuses on damages, and the measurable lifelong condition with quantifiable costs can support settlements.

- Functional Loss: As mentioned earlier, the inability to walk normally due to the patient's own gait and struggling through uneven terrain increases the risk of falls. This, in turn, reduces independence for daily living and may impact the ability to work.
- Secondary Injuries: Besides musculoskeletal strain, skin breakdown can occur from the use of braces.
- Chronic pain: In addition to neuropathic pain, there is a risk of hip, knee, and back issues due to compensation.
- Psychosocial Impact: Jobs such as nursing, construction, warehouse work, or driving can render the ability to work impossible. Emotional and psychological harm can include depression, anxiety, social withdrawal, and frustration from the loss of independence.

Translating to the Medico-Legal Realm

From the legal perspective, the clinical assessment translates into three key questions.

1. Causation: Is the injury anatomically and temporally consistent with intraoperative events, positioning, or pre-existing trauma?
   - Example: A patient with baseline numbness pre-op is less likely to attribute deficits to intraoperative negligence if this was documented.
2. Standard of Care: Were accepted perioperative measures documented, such as padding of the fibular head, tourniquet monitoring, and neurovascular checks?
   - The absence of documentation, even if care was performed, creates exposure. In litigation, "not charted" is often interpreted as "not done."
3. Damages: Did the injury result in long-term disability or impairment?
   - The presence of an AFO prescription, extended PT/OT records, home modifications like grab bars, and occupational restrictions are powerful evidence of lasting damages.

Integrating Case Lessons

- Case 1 illustrates the importance of baseline documentation. Pre-op charting protected the team from liability. For life care planning, this case highlights lifelong bracing, rehab, equipment replacement, pain management, home/work modifications, and vocational loss. Even though the fracture was repaired, the permanent peroneal nerve injury ensures ongoing damage that must be accounted for.
- Case 2 shows how the omission of padding notes, despite likely application, weakened the defense. For life care planning, this case accounts for lifelong bracing, therapy, medical follow-up, pain management, home and vehicle modifications, vocational rehabilitation, psychological care, and projected complications.
- Case 3 highlights the complexity of differentiating peripheral from central etiologies, a key role for expert witnesses. In life care planning, addressing bilateral foot drop is much more disabling, visible, and costly. It involves lifelong use of braces, medical follow-up, rehab, pain management, home and vehicle modifications, psychological care, and vocational support over time.
- Case 4 demonstrates how poor follow-up documentation can be as damaging legally as intraoperative errors. Early recognition and action could have minimized the damage; however, the delay led to permanent deficits. For life care planning, it is important to document how weakness, pain, and disability affect daily life, especially considering permanent neurologic damage, chronic pain, delayed treatments, and long-term loss of function.

Summary

A detailed medical assessment of peroneal nerve injury ties anatomy to outcome. For clinicians, prevention hinges on vigilance and documentation. For LNCs, every gap in that documentation is an opportunity or liability. Long-term consequences such as foot drop, chronic pain, and loss of independence amplify the damage side of the equation, making these cases high-stakes in the medico-legal arena and as an important consideration when drafting and updating life care plans.

OR Nurse Perspective: Prevention and Recognition

Positioning Responsibilities

AORN emphasizes that all team members share responsibility for patient positioning. The goals include maintaining circulation, preventing compression, and protecting nerves and bony prominences.

- Supine: Use pillows under knees to prevent hyperextension. Avoid straps directly over the fibular head/knees.
- Lithotomy: Avoid excessive hip flexion (>90°) or abduction (>45°). Prevent legs from resting against stirrup posts. Limit duration to reduce neuropathy risk.
- Lateral: Pad dependent extremities. Protect the fibular head from compression against the OR bed.

- Reverse Trendelenburg: Use a padded footboard to prevent sliding and nerve traction.

Tourniquet Safety

- Select the appropriate cuff size.
- Minimize inflation time.
- Communicate the inflation time every 15 minutes after the first hour.
- Document inflation/deflation and postoperative skin/nerve assessment.

Intraoperative Monitoring

- Reassess positioning regularly during lengthy procedures (>2 to 4 hours).
- Ensure no equipment rests on the extremities.
- Monitor vital signs for systemic hypotension, which worsens ischemia.

Documentation

Meticulous documentation strengthens both patient safety and legal defense:

- Preoperative baseline neurovascular exam.
- Positioning method, devices used, and padding applied.
- Tourniquet times and notifications to the surgeon.
- Postoperative neurovascular checks and interventions.

What LNCs Should Scrutinize

Risk Factors:

- Diabetes, obesity, peripheral neuropathy, malnutrition.
- Prolonged or complex orthopedic, vascular, or spine procedures.

Documentation Gaps:

- Missing or incomplete neurovascular baseline exams.
- Lack of specificity: "patient padded" vs. "pillow placed under knees."
- Missing tourniquet data (pressure, duration, breaks).
- No position reassessment noted in long cases.
- Vague or absent postoperative neuro checks.

Causation Questions:

- Does the timing of deficits align with surgical positioning or trauma?
- Could deficits be explained by central pathology (spinal nerve injury) rather than peripheral compression?
- Did a delay in recognition directly worsen outcomes?

Standards of Care:

- Padding over bony prominences.
- Tourniquet documentation and monitoring.
- Position reassessment every 2 to 4 hours.
- Prompt escalation of new neuro complaints.

Damages and Impact in Litigation

Peroneal nerve injuries carry lifelong implications. Patients may require braces, mobility aids, or adjustments to their careers. Economic damages include lost wages, vocational retraining, and lifelong medical care. Non-economic damages include chronic pain, psychological impact, and reduced independence.

Why it matters for LNCs: Linking the medical record to these damages strengthens causation arguments for plaintiff attorneys and highlights areas of defensibility for defense attorneys. A well-prepared LNC can articulate how gaps in documentation translate into long-term patient harm and financial impact.

Why it matters for LCPs: The ripple effects in a person's life can help an LCP prepare to organize and show how the impairment directly impacts the patient's quality of life and job prospects. The ongoing medical needs also help broaden the scope of damages beyond the initial nerve injury.

Practical Checklists

For OR Nurses:

- Document baseline neuro exam.
- Apply and chart padding at the fibular head.
- Reassess position in surgeries >2 to 4 hours.
- Communicate and document tourniquet times.
- Perform and document post-op neuro checks.

For LNCs Reviewing Records:

- Compare pre- and post-op neuro exams line by line.
- Review padding and positioning notes for clarity and specificity.
- Verify tourniquet pressures, times, and breaks.
- Track escalation of neuro complaints (or lack thereof).
- Differentiate peripheral vs. central etiologies in causation analysis.

For LCPs Reviewing Records:

- Medical management and follow-up
- Rehabilitation and therapy
- Durable medical equipment

- Assistive technology and home modifications
- Vocational and daily living support

Conclusion

Peroneal nerve injuries and foot drop are rare, but their impact is profound. Clinically, they demand vigilance in positioning, padding, and monitoring. Legally, they demand a sharp eye for what was done, what was charted, and what was omitted.

For the perioperative nurse, prevention protects the patient. For the LNC, understanding the anatomy, mechanisms, and red flags turns complex records into clear narratives. For the LCP, proving functional loss and the requirement of ongoing medical care, equipment replacement, and adaptations for the patient's entire lifetime is necessary. These narratives often determine whether care is successfully defended or deemed negligent.

Ultimately, awareness, prevention, and meticulous documentation remain the strongest safeguards both in the OR and in the courtroom.

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The Dual Role of Artificial Intelligence in Life Care Planning: OPPORTUNITIES AND LEGAL RISKS

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Introduction

Life care planners (LCPs) develop long-term care plans for individuals with catastrophic injuries, chronic illnesses, or disabilities often for use in litigation. These plans must be evidence-based, objective, and legally defensible. With artificial intelligence (AI) now embedded in everything from electronic health records (EHRs) to predictive analytics, LCPs must navigate how to responsibly use these tools without compromising the integrity of their work. As legal challenges involving AI rise, understanding its utility and limitations is essential for risk mitigation.

Advantages of AI for Life Care Planners

There are numerous AI tools available that can streamline or simplify drafting a life care plan. However, there are three that stand out for the benefits they offer when used correctly.

1. Automated Chart Review and Documentation

AI-powered Natural Language Processing (NLP) tools can extract relevant clinical data from thousands of pages of records in minutes. This allows LCPs to identify diagnostic patterns, missed interventions, or care timelines more efficiently.

Application: NLP tools like Amazon Comprehend Medical or IBM Watson can flag instances of medication errors, prior falls, or inconsistent pain documentation, improving the precision of care needs listed in a life care plan (Rajkomar et al., 2019).

The following are some additional advantages for LCPs.

Time Efficiency

- Rapid Data Extraction – AI can scan thousands of pages of medical records in seconds, identifying relevant diagnoses, procedures, and care needs. This also eliminates the risk of human error when identifying and pulling data.

- Automated Summarization – Key information (medications, surgeries, imaging, therapy notes) can be compiled into concise summaries, reducing manual review time. This provides a high-level look for quick assessments, as needed, and provide a way of identifying what other areas need further review.

Improved Accuracy and Consistency

- Error Reduction – Some AI programs minimize the risk of missing important records, misreading handwriting, or overlooking small but significant details.

- Standardized Documentation – Consistent presentation of data ensures life care plans follow a consistent format aligned with legal and medical standards. It provides a reliable template that streamlines the review process.

Comprehensive Data Analysis

- Pattern Recognition – AI can identify trends in medical history, such as recurring complications or progressive conditions.

- Cost Projections Integration – AI can automatically link clinical findings to appropriate CPT® codes and cost databases for accurate future care projections.

Enhanced Clinical Decision Support

- Evidence-Based Recommendations – AI can reference guidelines (e.g., CMS, AHRQ, ODG) to support care recommendations. This should not be relied upon as comprehensive, but with verification, it can help to focus on justifications for the recommendations.

- Risk Flagging – Part of the recommendation process can include alerting LCPs to potential gaps in treatment or emerging health risks requiring further evaluation.

Legal and Compliance Benefits

- Audit-Ready Documentation – AI-generated summaries can include timestamps, source citations, and version control for legal defensibility. It does require verification before approval or submission.

- HIPAA-Compliant Processing – Advanced platforms can ensure patient privacy through encrypted, secure data handling. There are a number of available security features (depending on the software) that both comply with HIPAA and enhance data protection.

Increased Productivity and Scalability

- Handling Larger Caseloads – LCPs can manage more cases without compromising quality.

- More Time for Expert Analysis – AI use can reduce time spent on clerical tasks, allowing focus on complex clinical judgment, professional assessments, and expert testimony preparation.

Integration with Life Care Planning Tools

- Seamless Workflow – AI can feed extracted data directly into life care planning software for cost projections, care schedules, and plan narratives. It provides a great starting point that can be refined and enhanced during the assessment process.

- Real-Time Updates – AI enables faster revisions when new medical information becomes available. This provides a way of seeing just the recent changes without all of the data LCPs have already reviewed.

2. Predictive Modeling for Cost Forecasting

AI-based actuarial and clinical models can predict long-term care needs and costs based on diagnosis, comorbidities, and local healthcare trends. With proper, specific prompts, this can provide a predictive model to ensure that all of the patient's needs are met in the life care plan.

Application: LCPs can use predictive analytics platforms (e.g., Milliman or CMS tools) to adjust cost projections based on updated risk stratification models. Prior to using AI with these platforms, you will need to verify that they are compatible and have been tested to ensure they provide an accurate representation of the data.

The following are some additional advantages for LCPs.

- Adjustment for Patient-Specific Factors – Forecasts can account for age, comorbidities, expected disease progression, and care utilization patterns.
- Scenario Testing – Allows LCPs to model multiple care pathways (e.g., conservative vs. aggressive treatment) and compare projected costs.
- Insurance and Reimbursement Patterns – Incorporates payer trends and policy changes to project realistic future out-of-pocket and insurer-covered expenses.
- Automated Calculation – Reduces manual research and calculations, freeing LCPs to focus on interpretation and expert testimony preparation.
- Error Reduction – Minimizes arithmetic and data entry errors that could weaken legal credibility.
- Forecasting Over Decades – AI models can account for disease progression, potential complications, and long-term care needs extending over the patient's lifetime.

- Early Risk Identification – Predictive analytics highlight likely future interventions (e.g., surgeries, equipment replacements) to ensure costs are included.

3. Decision Support for Treatment Planning

AI can suggest evidence-based interventions, such as new therapies or care pathways, which may be more effective or cost-efficient. How you develop the query and what needs to be included varies based on the platform. It provides additional research support in a fraction of the time it would take to look into other options.

Application: AI recommends early initiation of neuromodulation in spinal cord injury cases, potentially reducing years of ineffective conservative care. Since it is difficult to anticipate what problems will present later, this can help anticipate them.

The following are some additional advantages for LCPs.

Early Identification of Care Gaps

- Proactive Risk Assessment – AI can flag missing interventions, underutilized therapies, or potential complications requiring additional care planning. For spinal injuries, this is essential for ensuring that contingent plans are in place for the many different health issue scenarios that can arise over time.
- Prevention-Focused Recommendations – AI suggests early interventions to reduce future costs and complications. This can minimize or prevent larger issues, improving the client's quality of life.

Disadvantages of AI for LCPs

AI is just a tool, similar to your smartphone assistant or an app on your phone. This means that it is entirely limited, both based on the user and the source where it pulls the data.

1. Overreliance on AI Outputs

AI algorithms may seem authoritative but are often trained on biased, incomplete, or non-contextualized data. This means that it may not recognize when there are gaps, leaving issues entirely unaddressed or taken into account for the overall client care. In the worst cases, AI may try to fill in information with no support of the data it supplies for those gaps. LCPs who adopt AI outputs without clinical judgment may be vulnerable to cross-examination or professional liability.

The following are some possible disadvantages for LCPs.

Risk of Inaccurate or Incomplete Data

- Garbage In, Garbage Out – AI accuracy depends on the quality and completeness of input data. Missing or misclassified records may lead to flawed projection data.
- Limited Contextual Understanding – AI may misinterpret nuances in clinical notes, handwritten entries, or non-standard documentation.

Lack of Clinical Judgment

- AI Cannot Replace Human Expertise – AI can provide recommendations but cannot fully account for patient-specific nuances, psychosocial factors, or ethical considerations.
- Over-Reliance Risk – LCPs may unintentionally defer to AI outputs rather than applying professional reasoning and experience.

Cost and Training Barriers

- Implementation Costs – High-quality AI tools often require significant investment in software, data integration, and ongoing updates.
- Learning Curve – LCPs need training to interpret AI outputs accurately and recognize limitations.

Legal Case: In *Doe v. TechHealth Corp.* (2022), a nurse used an AI-based cost projection tool to estimate future care needs in a spinal cord injury case. During deposition, it was revealed that the tool didn't account for the patient's psychosocial limitations, leading to an underestimated care plan. The court ruled the plan "not sufficiently individualized," reducing its evidentiary weight.

2. Algorithmic Bias and Inequity

AI tools may embed racial, gender, or socioeconomic biases. If these tools guide care planning, the result may disadvantage vulnerable populations. This perpetuates current issues in data that have more gaps for minority populations, so it is not just a problem with AI. However, it is a significant reason for why AI results need to be verified.

The following are some possible disadvantages for LCPs.

Multifaceted General Bias in AI Models

- Historical Data Bias – AI trained on incomplete or skewed datasets may perpetuate disparities in care recommendations or cost forecasting by misinterpreting past patient history.
- Limited Adaptability – Algorithms may not perform well for rare conditions or atypical patient profiles. Since there is considerably less data for rare ailments, AI will be incredibly limited in what recommendations it returns.
- Skewed Cost Forecasting – Costs derived from biased datasets may underestimate or overestimate needs for patients of different socioeconomic, racial, or geographic backgrounds.

Hidden Bias in Predictive Models

- Opaque Algorithms – Many AI systems function as "black boxes," making it difficult for planners to detect whether recommendations are influenced by bias.
- False Sense of Objectivity – AI outputs may appear neutral and evidence-based, masking underlying inequities in data sources.

Impact on Patient Advocacy

- Reduced Individualization – Over-reliance on biased algorithms may limit the ability of LCPs to advocate for patient-specific needs.
- Erosion of Trust – Patients and attorneys may lose confidence if AI-driven plans consistently disadvantage certain groups.

Study Example: Obermeyer et al. (2019) found a widely used hospital algorithm underestimated the healthcare needs of black patients by nearly 50%, due to using healthcare spending as a proxy for illness severity.

Legal Risk: An LCP using such a tool could inadvertently produce a discriminatory care plan, risking bias allegations.

3. Transparency and Admissibility Issues

Most AI algorithms are proprietary and "black-box" in nature meaning users cannot see how conclusions are generated. This poses challenges for court admissibility under Daubert or Frye standards, which require that methods be testable, peer-reviewed, and accepted by the scientific community.

The following are some possible disadvantages for LCPs.

Black Box Algorithms

- Opaque Decision-Making – Many AI models do not clearly show how conclusions are reached, making it difficult to explain recommendations in testimony (Casey & Niblett, 2020).
- Lack of Traceability – Without a clear audit trail, it may become challenging to verify which data points influenced projections or treatment recommendations.

Limited Admissibility in Court

- Challenges in Expert Testimony – AI cannot explain the methodology behind cost forecasts or treatment plans in a court setting.
- Insufficient Validation Standards – Without industry-wide protocols for validating AI tools, opposing counsel may argue that AI-generated outputs are unreliable or inadmissible.

Documentation Gaps

- Incomplete Justification of Findings – AI may provide numerical outputs or recommendations without the clinical rationale needed for legal defensibility.
- Difficulty in Cross-Examination – If AI logic cannot be explained in human terms, it may weaken a planner's credibility during deposition or trial.

Ethical and Professional Liability

- Responsibility Still Rests with the Planner – Even when AI assists with the work product, the LCP must ensure all findings are clinically sound, evidence-based, and defensible.

Regulatory Uncertainty

- Evolving Standards – Courts and regulatory bodies are still developing guidelines for AI use in medical-legal documentation, creating uncertainty for admissibility.

Legal Case: In Smith v. GenCare Health AI, Inc. (2023), an opposing attorney challenged the admissibility of a life care plan citing AI-generated estimates. The court excluded the evidence due to lack of transparency about the algorithm's methodology.

Recommendations for Life Care Planners

RECOMMENDATION	RATIONALE
Use AI as a tool, not stand alone	Always combine AI outputs with professional clinical judgment
Disclose AI use in documentation	Transparency builds credibility and avoids surprises in court
Validate with peer-reviewed sources	Supports the scientific basis of the life care plan
Understand data sources and limitations	Avoid overgeneralizations or biased conclusions
Ensure compliance with admissibility standards	Check if AI-generated insights meet Daubert or Frye criteria

Legal Standards Affecting AI Use in Life Care Planning

Daubert Standard (U.S. Federal[1] and most States):

The purpose of the 1993 Daubert Standard is threefold:

1. Gatekeeping Function: Trial judges must evaluate expert testimony to ensure it is based on sound scientific principles and methods.

2. Reliability: The core of the Daubert standard is ensuring the scientific foundation of the testimony is reliable, not just the conclusions.

3. Relevance: The testimony must also be relevant to the facts of the case to be helpful to the jury.

The Daubert standard requires that expert testimony must be based on "scientific knowledge" that is testable, peer-reviewed, has a known error rate, and is widely accepted.

This legal standard requires expert testimony to be:

- Based on reliable methodology
- Peer-reviewed
- Have a known error rate
- Standards controlling the technique's operation
- Generally accepted in the field (Daubert v. Merrell Dow, 1993)

Frye Standard (Some State Courts[2]):

Established in the 1923 case Frye v. United States, the "general acceptance" test was designed to ensure that new scientific techniques were broadly recognized before being presented to a jury. While still used in some states, many federal courts and other states have replaced the Frye Standard with the Daubert Standard, which offers a more flexible framework for assessing scientific evidence.

This legal standard bases admissibility on whether the method is "generally accepted" by the relevant scientific community.

Application: If an LCP's use of AI cannot meet these standards, the entire life care plan could be excluded from evidence.

SUMMARY OF ADVANTAGES AND DISADVANTAGES

ADVANTAGES OF AI	DISADVANTAGES OF AI
Faster chart review – Automates review of large medical records, reducing time and error risk.	Over-reliance risk – May cause planners to depend too heavily on AI outputs without applying clinical judgment.
Accurate cost forecasting – Uses CPT®/ICD codes and regional/national databases for long-term cost projections.	Algorithmic bias – Models may be skewed if training data lacks diversity, potentially creating inequities
Decision support – Synthesizes clinical guidelines and research to justify interventions.	Transparency issues – AI's reasoning can be a "black box," making it harder to explain in legal settings.
Improved documentation – Drafts structured, professional life care plans with consistent formatting.	Admissibility concerns – Courts and attorneys may challenge AI-generated outputs as lacking reliability.
Efficiency and productivity – Automate repetitive tasks, allowing LCPs to manage more cases effectively.	Quality variation – Output depends on the quality of data and algorithms; errors in input can misguide results
Evidence-based defense – Provides data-driven rationale to withstand cross-examination in litigation.	Ethical concerns – Use of AI in sensitive patient planning raises confidentiality and privacy challenges.
Trend and risk analysis – Identifies patterns, predicts complications, and enhances proactive planning.	Cost and training barriers – Access to advanced AI tools may be expensive and require new skill sets.

Conclusion

AI can empower LCPs by increasing efficiency, clinical accuracy, and predictive power. However, it also introduces new legal vulnerabilities, particularly regarding transparency, admissibility, and bias. LCPs who use AI responsibly, balancing its benefits with critical human oversight, will be better prepared to create accurate and legally defensible care plans in an evolving medicolegal landscape.

FOOTNOTES

1 Rule 702. Testimony by Expert Witnesses - A witness who is qualified as an expert by knowledge, skill, experience, training, or education may testify in the form of an opinion or otherwise if the proponent demonstrates to the court that it is more likely than not that: (a) the expert's scientific, technical, or other specialized knowledge will help the trier of fact to understand the evidence or to determine a fact in issue; (b) the testimony is based on sufficient facts or data; (c) the testimony is the product of reliable principles and methods; and (d) the expert's opinion reflects a reliable application of the principles and methods to the facts of the case.

2 California employs the Kelly-Frye standard, which combines the original Frye standard with the California Supreme Court's interpretation in People v. Kelly.

Illinois follows the Frye standard for expert testimony admissibility, as established in Donaldson v. Central Illinois Public Service Co.

Maryland previously utilized the Frye standard, it has transitioned to a modified Daubert approach, but still maintains some elements of the Frye standard.

New York courts adhere to the Frye standard, as seen in cases like Frye v. United States.

New Jersey courts generally apply the Frye standard, focusing on general acceptance within the relevant scientific community.

Pennsylvania courts rely on the Frye standard to determine the admissibility of expert testimony.

Washington state courts apply the Frye standard, as established in Frye v. United States.

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SUPPORTING FUNCTION AND MOBILITY: PEDIATRIC ORTHOSES

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Keywords: 1. Pediatric Orthoses, 2. Support Devices, 3. Function

NURSING DIAGNOSES TO CONSIDER
NANDA-I 2024-2026

Impaired Physical Mobility, Risk for Impaired Skin Integrity, Risk for Disuse Syndrome

Orthoses are supportive devices that can enhance mobility, function, and quality of life. For children, this can translate to developmental gains, access to the school and home environment, and immersion into adaptive recreation. Orthoses are typically prescribed by pediatric rehabilitation medicine providers and orthopedic surgeons as a part of the rehabilitation process. Orthotists assist in the design process, fabrication, and delivery of orthoses. Physical and occupational therapists are also valuable members of the rehabilitation team who can assist in decision-making and orthosis acceptance.

Neuromuscular conditions that children may benefit from an orthosis include cerebral palsy, spinal cord injury, myelomeningocele, muscular dystrophy, traumatic brain injury, hypotonia, and club foot. Orthoses may also be considered after a traumatic injury or after a surgical intervention for immobilization (Uustal & Ho, 2024). Orthoses in children can be prescribed for the upper extremity, lower extremity, spine, and head. Similar to other aspects of rehabilitation care, the clinician should explore the patient's and family's goals, how the device will improve function, and what supports can meet the child's needs. Other factors to consider with orthoses include prior devices, functional goals, anatomical considerations, future growth, and duration of need.

Upper Extremity Orthoses

The upper extremity's function is to grasp, reach, and hold objects. Orthoses can be used to support weakness, prevent deformity, or stabilize a joint. The patient's function is of the utmost importance. Sometimes, upper extremity orthoses can provide support but inhibit function, and an orthosis may be deferred during waking hours. Orthoses are named based on the joints they support. Common upper extremity orthoses prescribed include a wrist hand orthosis, wrist hand finger orthosis, elbow orthosis, and thumb abduction splint. Thermoplastic orthoses can be custom molded to immobilize and prevent contractures. Neoprene orthoses are commonly used to maintain a neutral alignment. Wear of neoprene orthoses can occur more quickly than thermoplastic orthoses due to a weaker supporting material. The skin of the hand is also less tolerant to pressure than the lower extremity, and close monitoring of skin is required for patients with contractures and spasticity (Uustal, 2024).

Lower Extremity Orthoses

Lower extremity orthoses are commonly prescribed to minimize gait deviations, provide support, inhibit spasticity, or compensate for weakness (Ward et al, 2021). Foot orthoses support the arch of the foot or accommodate a midfoot deformity. For increased support for the ankle and midfoot, a supramalleolar orthosis can be prescribed. When there are gait deviations at the knee or there is increased spasticity or foot drop, an ankle foot orthosis is typically recommended. When more proximal support is required, a knee ankle foot orthosis or knee foot orthosis can be prescribed to assist with support in hip flexion and knee extension. The higher the brace, the more bulky and challenging it can be to don.

When donning a lower extremity orthosis, shoes are always recommended. An orthotic accommodating shoe should have a wide toe box and is commonly ½ – 1 shoe size larger than the child's foot. Specific knit socks are also available that have breathable material for improved tolerance. Footwear can be deferred if an anti-slip tread is posted on the orthosis.

Spinal Orthoses

Spinal orthoses may be prescribed after injury, for seating balance, and for patients living with scoliosis. Cervical orthoses can be used for immobilization or for support in maintaining neutral alignment. Thoracic lumbar sacral orthoses (TLSOs) are also utilized to stabilize the spine after a traumatic injury or surgery. This can protect a fracture or surgical repair. TLSOs are also commonly prescribed for children with neuromuscular impairments to improve postural control. There is a lack of research to support that bracing can decrease the progression of a scoliotic curve, and the goal of bracing is optimal seating and standing alignment. Improved truncal posture can also positively affect a child's respiratory status. For children with hypotonia, neoprene vests can provide truncal compression and prevent a kyphotic rounded posture.

Pediatric Considerations

When an orthosis is prescribed, the family should be provided with a break in the schedule to evaluate tolerance. Children may not be able to verbalize discomfort with the orthosis, and close monitoring is essential. If a child develops redness that lasts more than 15 minutes or develops a pressure injury, the orthosis should be evaluated by an orthotist to see if modifications should be made or if fabrication of a new orthosis is needed.

Replacement considerations depend on the frequency of use, wear, function, and fit. In a growing child, a daytime orthosis is likely to be replaced at a minimum on an annual basis. Once a child has reached skeletal maturity, the replacement frequency decreases.

Life Care Plan Considerations

When preparing to include orthoses in the pediatric life care plan, the life care planner should review the child's current devices and explore what the child will likely benefit from in the future. When including orthoses, the life care plan should allocate the device, explore if the device is prefabricated or custom molded, quantity (1 or 2), daytime versus nighttime orthoses, and likely replacement intervals.

CPT codes that can be billed by skilled therapists during therapy sessions include 97760, 97763, and 97761. Orthoses are classified by HCPCS codes with L codes and depend on the orthosis, material, and whether custom-molded or prefabricated. Additional codes can be added if extra support is added, such as a heel posting/tone inhibiting modification (L2999), varus/vagus correction (L2275), limited ankle motion (L2220), soft interface for molded plastic (L2820), molded inner boot (L2280), heel lift (L3310), and casting supplies (A4580).

Pediatric orthoses are integral to supporting mobility, function, and participation for children. Their use extends beyond the clinical setting, influencing a child's access to education, recreation, and community life. For nurse life care planners, thoughtful inclusion of orthoses in a life care plan requires balancing clinical evidence, family goals, device functionality, and accurate costing. Anticipating growth, replacement schedules, and the potential need for multiple devices ensures accuracy in planning and advocacy for resources. As technology continues to advance, orthoses are becoming more customizable and responsive, which underscores the importance of ongoing education and collaboration across disciplines.

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PLANNING FOR LONG-TERM ORTHOSES

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Keywords: 1. Orthotics, 2. DME Costing, 3. Pedorthists, 4. Orthotist, 5. Prosthetist

NURSING DIAGNOSES TO CONSIDER
NANDA-I 2024-2026

Impaired Pysical Mobility, Delayed Child Development, Impaired Standing, Impaired Walking, Delayed Child Development, Disturbed Body Image, Risk for Delayed Surgical Recovery, Risk for Impaired Tissue Integrity

In life care planning, meticulously charting an individual's long-term rehabilitation and recovery is essential. Orthotics (including braces, splints, and supports) play a critical role in providing stability and support for those recovering from catastrophic injuries such as spinal cord injuries (SCI), traumatic brain injuries (TBI), or amputations. Far from just holding things in place, these tools promote movement, ease pain, and aid healing. For life care planners recommending durable medical equipment (DME), a solid grasp of orthotics involves separating short-term fixes from ongoing needs, following regulatory guidelines, and estimating costs based on practical realities. This article aims to clarify the options, from ready-made devices to fully customized ones, helping planners build strategies that genuinely support future well-being.

Orthotics, broadly defined, are external devices designed to apply targeted forces to the body, helping to correct, support, or enhance function. Short-term orthotics might stabilize a sprain during acute recovery, but primary long-term orthoses—think custom ankle-foot orthoses (AFOs) for persistent foot drop or thoracolumbosacral orthoses (TLSOs) for spinal instability—are the backbone of plans for catastrophic injuries. These devices help prevent deformities, control spasticity, and build independence, all of which improve quality of life and reduce risks, like pressure sores or falls. In life care planning, orthotics are not just add-ons; they are essential recommendations that shape rehabilitation timelines and even home modifications.

Orthotics Expertise

The practitioners in this space are made up of pedorthists, orthotists, and prosthetists. The roles of these three types of providers form a vital triad of care, each honing in on distinct anatomical territories with specific skills. Pedorthists, for example, are foot-focused practitioners who craft and fit custom foot orthoses, shoes, and inserts to redistribute pressure and prevent ulcers in patients. They draw from their training in podiatric mechanics and should hold ABC/BOC certification.

Orthotists are broader body brace specialists who design and adjust supportive devices from the ankle-up, such as ankle foot orthoses (AFOs) for foot drop in SCI or TLSOs for spinal stability, using casts, 3D scans, and biomechanical expertise to restrict motion, ease pain, and promote healing.

Prosthetists, meanwhile, step in for those who have lost limbs. They fabricate and fit prosthetic sockets, components, and interfaces such as myoelectric arms for upper-extremity amputees, to restore function and gait, emphasizing alignment and energy return in devices that evolve with the patient's residual limb changes. Together, these professionals collaborate in life care plans, ensuring seamless transitions from foot-specific relief to full-body mobility, while clear boundaries avoid unnecessary costs or gaps in care.

Different Classifications and Certifications

Understanding Medicare's classification and coverage guidelines for orthotics is crucial, even when Medicare is not the payer. These standards serve as a benchmark for private insurers and influence reimbursement policies, documentation requirements, and care planning across the healthcare industry. Familiarity with Medicare's framework ensures life care planners can align treatment plans with widely accepted standards, facilitating consistent and comprehensive care for patients regardless of the funding source.

Medicare covers orthoses only if they're "reasonable and necessary," meaning they must demonstrably restrict motion to decrease pain, accelerate healing, or support a weakened joint/spine. In the intricate ecosystem of durable medical equipment (DME), prosthetics, orthotics, and supplies collectively known as DMEPOS, there are two key players: Pricing, Data Analysis, and Coding (PDAC) and the Durable Medical Equipment Coding System (DMECS) database.

The PDAC contractor run by Palmetto GBA, acts as Medicare's gatekeeper or overseer and is tasked with scrutinizing orthotic devices like AFOs, knee braces, and TLSOs to assign precise HCPCS codes that dictate coverage. Think of PADC as a referee. Manufacturers submit their products, and PDAC verifies if they meet "reasonable and necessary" criteria, such as alleviating pain through motion restriction or bolstering a weakened spine post-SCI, while also flagging mandatory categories to prevent claim denials.

A device that is PDAC certified means the device was evaluated by the contractor to verify the HCPCS code is appropriate for that particular device. It is mandatory for certain categories of orthotic and prosthetic devices, such as spinal orthoses, knee braces, AFOs, knee-ankle-foot orthoses (KAFOs), upper limb orthoses, and lower and upper limb prosthetic components. The PDAC identifies products requiring verification through the HCPCS coding system and publishes its decisions online in the DMECS database. It is crucial for product manufacturers and distributors to submit their products to the PDAC for verification to ensure compliance with Medical and other healthcare plan requirements.

PADC verifies everything from spinal orthoses to prosthetic components and publishes their rulings in DMECS. DMECS is PDAC's practical online tool, allowing providers, suppliers, and life care planners to quickly categorize DMEPOS items by combining product details, clinical info, and coding rules for easy submissions to Medicare Administrative Contractors (MACs). Together, they ensure that a custom orthotic device is not just fabricated but also funded.

The orthotics and prosthetics (O&P) field has seen significant shifts in the last decade. In the practitioner's mind, every item should be custom because all human bodies are different. But corporations want faster, cheaper products and do not necessarily see the difference in a custom device and a prefabricated device outside of the cost. Insurance companies are making it very hard for the orthotist, which in turn has cut profit margins. Practitioners must spend more time on documentation. Vague notes won't cut it. Documentation must include how the device addresses the patient's unique pathology and should be backed by clinical evidence from sources like the American Academy of Orthotists and Prosthetists.

Choosing the Right Orthotic Device

Not all orthotics are created equally. The choice of orthotic device hinges on the injury's complexity, the patient's anatomy, and, unfortunately, budget realities. Here's a breakdown to guide your recommendations, including how they're used, Medicare nuances, and replacement cycles.

Prefabricated Orthoses

Prefabricated (Off-the-Shelf) Orthoses are mass-produced devices that come in standard sizes, ready to grab from medical supply stores or online vendors (such as AliMed, Sammons Preston, Rehabmart) or in local or national orthotic and prosthetic clinics (like Snell, Hanger Clinic, or Ottobock Patient Care Centers). These off-the-shelf devices are ideal for less severe or temporary needs. An example of conditions for which a prefabricated orthosis is appropriate might be a minor sprain, mild foot drop in early TBI recovery, or stabilizing anatomy during initial rehabilitation, such as following a procedure. These are less likely to be recommended in a life care plan unless the plan includes future surgery.

These prefabricated devices typically include adjustable straps that allow the device to be slipped on, and the straps adjusted for fit and immediate support. A basic wrist-hand orthosis (WHO) might steady a tremor, while a sling prevents movement following shoulder surgery. One rule of thumb is a knee brace can be prefab until it extends six inches above or below the knee, which then necessitates a custom or custom-fit orthosis.

Pricing for these prefabricated devices typically ranges from $50 to $500, making them a cost-effective entry point. Warranties typically last 1 year. One advantage of prefabricated orthotics is their immediate availability, which is helpful for urgent needs, but the one-size-fits-most fit can cause skin irritation or slip in active patients. They are not intended for complex deformities and should be reserved for when a custom option is not yet justified.

Custom-Fit Orthoses

A custom-fit orthosis is the middle ground. These orthoses bridge the prefab device and the custom option. Orthoses start as an off-the-shelf product but get orthotist-modified. Modifications might be bending, trimming, or adding padding or hinges. These custom-fit options provide better alignment than prefab without the full custom price tag, but are limited for multi-plane deformities (e.g., severe body habitus requiring adjustments in rotation and flexion). They are ideal transitional tools, especially as insurance squeezes margins, pushing providers toward "custom-fit" over pure prefab.

They are perfect for moderate needs, like adjusting an AFO for a patient's slight leg length discrepancy or customizing a knee brace. These custom-fit devices are used when the need is too complex for standard prefabricated devices but does not require custom fabrication. They are common in cases with moderate anatomical variations and can be a transitional solution for stable conditions requiring minor modifications. A custom-fit knee orthosis might have added hinges for better motion control or additional padding to ensure a more intimate fit.

The costs for custom-fit orthoses typically range from $200 to $2,000. Adjustments typically take a couple of days to a week. They offer better alignment and comfort than prefabricated devices. Durability varies depending on the base device, what modifications were done, and device usage, but typically lasts between 2 and 4 years. The life care planner should include the costs for the base device, as well as professional fitting fees and periodic adjustments.

Custom Orthoses

When anatomy is irregular, fully custom orthoses are non-negotiable. Custom orthoses are individually designed and fabricated for a specific patient based on detailed measurements, casts, or digital scans of their anatomy. They are built from scratch by orthotists to address unique functional or anatomical needs. Custom orthoses are used for complex or severe conditions requiring precise fit and function (e.g., high-level SCI, progressive neurological conditions, or severe contractures). They are ideal for patients with irregular anatomy, significant deformities, or specific functional goals (e.g., weight-bearing or gait correction).

Some examples might be a KAFO custom-built for a patient with quadriceps paralysis or severe lower limb weakness, a thoracolumbosacral orthosis (TLSOs that has been custom-molded for spinal deformities), or a myoelectric upper limb orthosis for complex upper limb support in cases of paralysis.

These custom orthoses, fabricated from scratch using casts, measurements, or digital scans, are molded by orthotists to the patient's exact contours for a precise fit that conforms exactly to the patient's anatomy. They are designed to meet specific biomechanical needs, such as improving mobility or stability. They are often made from quality materials, such as carbon fiber or thermoplastics, that allow the devices to last longer than prefabricated options. If the custom device requires use for greater than six months, it tends to qualify for long-term coverage.

Costs associated with custom orthoses are dependent upon the material used and the complexity of the need.

The fabrication time is much longer (expect 2 to 6 weeks) and typically requires multiple fittings and adjustments. Maintenance is also increased. Periodic adjustments or repairs are likely due to wear or changes in the client's condition. The life care planner should factor in initial fabrication costs, plus ongoing adjustments (e.g., every 6 months or annually) with replacements every 3 to 5 years. In the pediatric client, consider growth changes or worsening spasticity, which may necessitate new custom devices earlier than in the adult population.

Custom orthotics are unmatched in fit that enhances mobility and comfort, but for fabrication and multiple follow-ups. In an era of shrinking profits, insurers scrutinize these, so documentation must outline the reason for the custom device, the deficits it is expected to improve, and how it is to be used. For example, HCPCS codes like L1900 for custom AFOs demand PDAC approval. Coverage requires proof of medical necessity, like prefab inadequacy. Prices soar to $1,000 to $10,000+ (carbon fiber boosts durability), with warranties up to 3 years. Overall, DME cycles stretch from 5 to 7 years, but components like batteries or liners need to be swapped every 1 to 3 years.

Take a cranial helmet for pediatric plagiocephaly as an example. These helmets used to be available in a custom fit design, but now they are custom, consisting of 3D-printed inner shells (~$5,000 each) that adapt to growth. They have a hard outer shell that is a more standard orthosis.

Projecting in a Life Care Plan

When projecting orthotics, it is best for the life care planner to collaborate with an experienced vendor who employes certified professionals. An orthotist with credentials like Certified Orthotist (CO) or Certified Prosthetist-Orthotist (CPO) from the American Board for Certification in Orthotics, Prosthetics, & Pedorthics (ABC) or Board of Certification/Accreditation (BOC) can best manage the fit and selection. These certifications require rigorous education, training, and candidates must sit for a national exam. The orthotist should also hold a valid license in states that require it (e.g., Texas, Florida). Also, look for practitioners who hold additional certifications or training in specific areas such as neurorehabilitation, pediatric orthotics, or advanced materials like carbon fiber. Pedorthists focus on footbeds for plantar support, while orthotists tackle ankle-up issues. Ask for the practitioner's experience with conditions like SCI, TBI, or amputations. Verify if the vendor has in-house lab capabilities for custom orthoses, which often ensure better quality control. Ask if they utilize advanced tools such as 3D scanning, CAD/CAM design, or pressure mapping for custom devices.

ORTHOSIS TYPE	BEST FOR	COST RANGE	REPLACEMENT CYCLE	MEDICARE NOTES
Prefabricated	Mild/temporary needs (e.g., early foot drop)	$50 – $500	1 – 3 years	PDAC via DMECS; quick claims
Custom-Fit	Moderate variations (e.g., adjusted knee brace)	$200 – $2,000	2 – 4 years	Document mods; bundled codes are common
Custom	Severe/complex (e.g., SCI KAFO)	$1,000 – $10,000+	3 – 5 years (adjust 6 – 12 mos.)	Casting required; strict necessity proof

Medicare's Local Coverage Determinations (LCDs) dictate replacement frequencies. Typically, a prefab device is replaced every 1 to 3 years for wear if periodic use is anticipated. Custom orthoses are replaced after 5 years if a documented need persists. However, you must check DMECS for HCPCS-specific pricing because some devices might cap at the allowable. For example, an L4360 custom AFO might cap at Medicare's allowable ($800 to $1,200 regionally). Warranties vary by vendor (Össur offers 2 to 3 years on carbon models). Other factors to consider are that pediatric growth requires resizing every 6 months, while adult spasticity might accelerate wear.

ORTHOTICS DME

DESCRIPTION	HCPCS CODE	MEDICARE ALLOWABLE (NOVITAS SOLUTIONS)	WARRANTY PERIOD	LE OF DEVICE	COMMENTS
Toe filler	L5000	$808.58	6 months	5 years	
Diabetic footwear	A5500	$88.85	6 months	6 months	Difficult reimbursement-must be accompanied by insert
Custom inserts	A5513	$54.08	6 months	3 each/year	Multi-layer insert that goes in the shoe
Shoulder sling w/o abductor pillow	L3670	$129.43	3 months	6 months	Plain
Shoulder sling with abductor pillow	L3674	$1,303.06	3 months	2 years	Includes fitting and adjustments
Cervical orthoses	L0130, L1040, L1050, L1060	$317.28	1 year	1 year	
Thoracic orthoses	L0450	$141.29	1 year	1 year	
Lumbar orthoses	L0628-L0651	$898.49	1 year	1 year	Custom or OTC
Scoliosis brace	L1007	$0	1 year	unknown	Includes all accessory pads, straps and interface; custom
Knee unloader brace	L1840, L1843, L1845, L1846	$1,184. -avg	1 year	2 years	Prefab or custom
Cranial helmets	S1040	$2331.08	6 months	"varies"	
Soft helmets	A8001, A8000	$214.00	3 months	2 years	Prefab
Soft helmets	A8002, A8003	$135.85	3 months	2 years	Custom hard or soft and includes accessories
Helmet inner shell	A8004	$75.75	3 months	2 years	Soft interface replacement only
Mastectomy bra	L8000	$45.00	none	4 per year	Bra without form
Mastectomy form	L8020, L8030, L8031	$215.83	2 years	3 years	Form insert
FES Functional Electrical Stimulation	E0764, E0770	$0	not covered	1 per lifetime	Integrated with orthotics to stimulate muscle contraction and improve gait
Wrist-hand orthoses (WHOs)	L3900-L3908	$500.75	6 months	1 year	Support weak or paralyzed hands/wrists
Elbow orthoses	L3764-L3702	$838.58-$1,496.80	6 months	2 years	Stabilize or limit elbow motion in cases of contractures or spasticity
Shoulder orthoses	L3973-L3971	$2,186.77	6 months	2 years	Prevent subluxation or support shoulder stability

NOTE: The Medicare allowable fees were used in association with Novitas Solutions, and cover AR, CO, LA, MS, NM, OK, TX, and Indian Health and Veterans Affairs. Pricing is given as a guideline, and usual, customary, and reasonable charges will be higher. This serves as a guideline for UCR charges, which are usually 30% higher on average.

Orthotics – An Empowering Device

In the ever-evolving landscape of life care planning, orthotics emerge not merely as equipment but as essential pillars in reclaiming autonomy after catastrophic injury, bridging the gap between vulnerability and vitality. From the swift accessibility of prefabricated braces for initial stabilization to the crafted precision of custom orthoses that adapt to one's unique anatomy, these devices—guided by the expertise of pedorthists, orthotists, and prosthetists—demand an understanding of Medicare's LCDs, PDAC verifications, and DMECS-driven coding to secure funding and functionality. As insurers tighten margins and documentation standards rise, life care planners hold the key to transformative plans by prioritizing certified providers, projecting realistic replacement cycles, and anticipating shifts like spasticity or growth that could necessitate upgrades. Ultimately, by weaving orthotics into holistic recommendations, the life care planner can empower an individual to navigate recovery with resilience, minimizing complications, and developing pathways of independence and newfound quality of life.

GLOSSARY

AAOP - American Academy of Orthotists and Prosthetists - A professional organization dedicated to advancing the field of orthotics and prosthetics in the United States. Membership: Includes certified practitioners (e.g., Certified Orthotist [CO], Certified Prosthetist-Orthotist [CPO]), educators, researchers, and technicians, as well as students and industry partners. Their mission is to promote excellence in patient care, education, and research in orthotics and prosthetics.

ABC - American Board for Certification in Orthotics, Prosthetics, and Pedorthics is a national certifying and accrediting organization focused on ensuring high standards in the practice of orthotics, prosthetics, and pedorthics. They set professional standards for practitioners and facilities. It is recognized as the leading authority in credentialing those who design, fit, and fabricate devices. They certify practitioners and accredit facilities.

DMECS - durable medical equipment coding system tool. An online search engine and database developed by Palmetto GBA to classify and code DMEPOS items for billing. The application provides HCPCS Level II coding assistance and national pricing information for DME, prosthetics, orthotics, and supplies. allows you to access an active HCPCS, modifier, current fee schedule, or rural zip code, view the PDAC Product Classification List details,

DMEPOS - the abbreviation for durable medical equipment, prosthetics, orthotics, and supplies. This is a broad classification of Medicare covered items used for home or mobility support which includes wheelchairs, hospital beds, and oxygen equipment among others. Items in this group are covered under Medicare Part B.

MAC Medicare Administrative Contractor – a private health care insurer that processes Medicare claims as well as DME claims for Medicare Fee for Service beneficiaries. They administer claims and perform activities such as verifying claims meet coverage requirements and meet Medicare coverage criteria. MACS play a role in ensuring timely and accurate reimbursement for DME providers and suppliers.

Medicare's Local Coverage Determinations (LCDs) - policy decisions issued by Medicare Administrative Contractors (MACs) - regional private insurers contracted by the Centers for Medicare & Medicaid Services (CMS)—to specify when and how Medicare will cover certain items or services in a defined geographic jurisdiction. Unlike National Coverage Determinations (NCDs), which apply nationwide and set broad standards (e.g., general criteria for DME coverage), LCDs allow for localized interpretations of medical necessity, evidence, and billing rules, tailored to regional healthcare practices and data.

NCOPE - National Commission on Orthotic and Prosthetic Education is a non-profit organization focused on advancing the education and training of professionals in orthotics and prosthetics. They are the primary accrediting body for educational programs. They accredit academic programs and residency training sites. Accredits master's degree programs in orthotics and prosthetics at universities, ensuring curricula cover clinical, technical, and professional skills (e.g., biomechanics, patient assessment, device fabrication). Examples of accredited programs include those at Northwestern University, University of Pittsburgh, and Eastern Michigan University. Develops and updates standards for orthotic and prosthetic education, incorporating advancements like 3D scanning, carbon fiber materials, and neurorehabilitation techniques.

PADC - Prosthetic Device Analysis Center, and more precisely, the Pricing, Data Analysis, and Coding Contractor. This is a Medicare-designated entity managed by Palmetto GBA, which is responsible for verifying and assigning correct HCPCS codes to DMEPOS.

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REFRAMING INDEPENDENCE: STANDING MOBILITY IN LONG-TERM REHABILITATION

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NURSING DIAGNOSES TO CONSIDER
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Impaired Physical Mobility, Impaired Standing Ability, Impaired Walking Ability

Introduction

Nurse life care planners and case managers are tasked with identifying equipment and services that support the long-term health, independence, and quality of life for individuals with catastrophic injuries. These injuries—often the result of motor vehicle accidents, workplace incidents, or medical negligence—can leave patients with permanent mobility impairments that require lifetime management. Selecting the right durable medical equipment (DME) is critical, not only for physical health but also for functional independence, psychosocial well-being, and vocational reintegration.

One category of DME that has gained increasing attention in recent years is standing mobility technology. Standing provides a range of physiological and psychological benefits, from improved bone density and bowel/bladder function to greater dignity and community participation. However, not all standing devices are designed to meet the daily needs of individuals living at home or working in community settings.

This article examines the wide range of standing mobility technologies available to patients today, from basic manual standing frames to sophisticated robotic devices that allow you to move around while upright. Each type plays a unique role within the continuum of care, addressing different levels of injury severity, independence, and accessibility. For life care planners, understanding how these devices compare in terms of cost, usability, and clinical application is critical to developing appropriate recommendations.

Vocational Reintegration and the Role of Standing Mobility

The impact of standing mobility on physical health and participation in daily life is evident in the experience of Dr. Ian Brown, a New Jersey anesthesiologist who pursued his medical career after experiencing a life-changing injury.

While serving in the military, Dr. Brown sustained a spinal cord injury that left him with significant lower mobility challenges. Following rehabilitation and medical training, he sought out the Tek RMD M1, a robotic standing mobility device, as a way to continue practicing medicine safely and effectively within the demanding environment of the operating room. Standing mobility offered him a new level of efficiency and comfort in the operating room, improving his ability to maneuver between patients and equipment and to access storage areas at varying heights—tasks that were more limited when using a traditional wheelchair.

Before returning to work, a simulation lab was created to determine whether the Tek RMD M1 could meet the physical and functional requirements of his job. During these assessments, Dr. Brown was able to demonstrate full access to the workspace — maneuvering through narrow areas, reaching surgical supplies, and communicating with surgical teams at eye level.

With the integration of this standing mobility device into his daily work, Dr. Brown was able to safely return to his duties as an anesthesiologist. Beyond Dr. Brown's case, other healthcare professionals and students pursuing medical careers have similarly utilized standing mobility devices to continue or complete their clinical training. These examples show how standing mobility can open the door to more than just physical access. It can help restore a sense of professional identity, build confidence, and support greater independence in the workplace.

Dr. Ian Brown at work, Operating Room Anesthesiologist

Advantages of Standing Mobility

Standing mobility devices—whether manual, powered, or robotic—provide both therapeutic and functional advantages that are important considerations in life care planning.

- Physiological Benefits: Standing promotes weight-bearing and gravity-assisted physiological functions, including improved bowel/bladder management, reduced risk of pressure injuries, improved circulation, decreased spasticity, and better preservation of bone mineral density.
- Psychosocial Benefits: Standing at eye level can reduce feelings of isolation, improve confidence, and enhance dignity. These benefits extend into social participation, family interaction, and mental health.
- Vocational Outcomes: Standing mobility devices can help individuals, like Dr. Ian Brown, return to work by restoring the ability to perform tasks in an upright position. In practice, this technology has enabled professionals in physically demanding fields, such as medicine, to resume hands-on roles that were once inaccessible after injury.
- Independent Sit-to-Stand Functionality: One of the key benefits of advanced standing mobility technology is the ability for users with little or no lower extremity function to transition safely from a seated to a supported standing position. Devices such as the Tek RMD M1 allow this process to be completed with a simple push of a lever, reducing caregiver dependence and encouraging greater personal autonomy.

Considerations and Limitations of Standing Mobility

While standing devices provide significant therapeutic and functional advantages, they also present several practical considerations for life care planners and users.

- Transfer Requirements: Most manual standing devices require a caregiver to help transfer in and out of the device. Powered and robotic standing mobility devices give you more freedom with transferring, but you still need adequate upper-body strength for safe transfers, or the assistance of a caregiver. This can limit independent use for individuals with high-level spinal cord injuries or limited upper extremity function.
- Learning Curve: Training is required for both patients and caregivers to safely use and integrate the devices into daily routines. While training is generally straightforward, it represents a short-term investment of time and resources.
- Indoor/Outdoor Limitations: Most standing mobility systems, even those with outdoor configurations, are best suited for indoor or level outdoor environments. They

are not designed for rugged terrain or extended outdoor travel, so users and planners should maintain realistic expectations for environmental use.

Cost: Robotic and powered standing mobility devices are considerably more expensive than non-robotic standers, which can present financial barriers. While insurance coverage is expanding, it remains variable across payers and jurisdictions, making funding an important factor in life care planning.

Understanding Different Types of Standing Devices

Manual / Non-Robotic Standing Frames

Typically used for therapeutic standing in clinical or home settings, these devices remain stationary and require caregiver assistance.

- Pros: Lower cost ($3,000 to $7,000) and simple mechanical design make these devices accessible and reliable. They provide therapeutic benefits of standing, and their less complex construction allows for longer durability, typically lasting 8 to 12 years.
- Cons: Lack of independent mobility significantly limits user autonomy, requiring frequent caregiver assistance for transfers and positioning. They have a large footprint in the home, taking up a lot of space.
- Examples: Devices such as EasyStand or Rifton are commonly used for therapeutic applications. They offer health benefits but no mobility or functional independence, which limits their practicality for everyday use.

Power Wheelchairs with Standing Features

These devices provide powered movement and standing support, functioning like a typical powered wheelchair when the user is seated.

- Pros: These power wheelchairs let users both drive and stand using the same device, offering flexibility for daily use. Many are covered by insurance, and their batteries usually last long enough for a full day of activity, or more.
- Cons: They're quite heavy—often over 400 pounds—and can be difficult to move or transport. Their price ranges from about $40,000 to $70,000, and when something breaks, repairs can be expensive, especially if the standing parts are affected, as the entire wheelchair may require replacement.
- Example: The Permobil F5 Corpus VS is one example of this category. While it offers both mobility and standing, its size and cost can be restrictive for many users.

Robotic Exoskeletons

Wearable powered devices that assist with walking through motorized joints and sensor-driven movement.

- Pros: Robotic exoskeletons allow users to practice walking and standing in rehabilitation or therapy settings. They can help build strength and coordination while promoting more natural movement patterns during recovery.
- Cons: Using these systems takes time and effort, often requiring 24 to 45 training sessions and a good amount of physical endurance. They're expensive—usually $75,000 or more—and not typically realistic for everyday mobility at home. Their batteries last only 6 to 8 hours, and the devices themselves typically need replacement after 4 to 5 years.
- Examples: Devices like the ReWalk and Ekso systems have shown strong therapeutic benefits but remain largely restricted to clinical use due to expense and accessibility challenges.

Robotic / Standing Mobility Device

This kind of device is designed for individuals who can benefit from both standing and upright mobility but need a compact, independent option suitable for home or work settings.

- Pros: These devices allow independent sit-to-stand transfers, powered upright movement, and compact maneuverability suited for indoor spaces, with some models also capable of outdoor use. They are increasingly covered by insurance, provide multiple days of use per charge, and have an average lifespan of 7 to 10 years.
- Cons: They are more expensive than manual standing frames, with a typical cost of around $29,999. Because users rely on their own upper-body strength to transfer into the device and maintain stability while operating it, setup and transfers may still require some assistance.
- Example: The Tek RMD M1 occupies a unique middle ground between stationary standers and robotic exoskeletons. It combines the therapeutic benefits of standing with the daily practicality of powered upright mobility. At a lower cost and with broader insurance coverage than many advanced robotic alternatives—including support from the VA and workers' compensation programs—it represents an important addition to the spectrum of standing mobility DME options.

Identifying Suitable Users

Robotic standing mobility devices are most appropriate for:

- Individuals with spinal cord injury (paraplegia), multiple sclerosis, cerebral palsy, muscular dystrophy, or other neuromuscular conditions affecting lower extremity function.

- Users with sufficient upper extremity strength to assist in transfers and operate the joystick.
- Individuals seeking independence in daily activities, improved health outcomes, and opportunities for vocational or community participation.
- Patients whose environments are compatible with compact maneuverability indoors and optional outdoor operation.

Contraindications

- Patients with severe osteoporosis or fragile bone health, which increases fracture risk during weight-bearing.
- Individuals with unstable cardiovascular conditions, where upright positioning may be unsafe.
- Patients with insufficient upper extremity function and no reliable caregiver assistance.
- Those who require frequent use on rugged outdoor terrain where the device is not designed to perform.

Conclusion

For nurse life care planners and case managers, standing mobility represents a practical, evidence-informed option for individuals with catastrophic injuries who seek greater independence and participation. By combining upright posture, powered mobility, and compact maneuverability, these devices extend standing benefits beyond the clinic into the home and community.

Despite higher initial costs, factors such as long service life, expanding insurance coverage, and reduced caregiver dependency strengthen its justification within individualized life care plans. The successful reintegration of professionals like Dr. Ian Brown underscores the broader impact of standing mobility in promoting autonomy, dignity, and quality of life for individuals living with catastrophic injury.

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