ETHICAL PROSTHETIC CARE

Understanding K-Levels, Access, Equity, and the Human Cost of Care Decisions

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Why This Matters

Case managers sit at the intersection of clinical need, insurance policy, and a patient's long-term quality of life. Small decisions ripple for decades.

33.9%

of people with limb loss experience clinically significant depression — nearly 5x the general population rate

Singh et al., 2024

44%

average prosthesis rejection rate across amputation levels in recent cohort data

Salminger et al., 2022

5.1 pp

national gap in prosthesis prescription rates between White and Black veterans

Miller et al., 2024

2.6x

increased odds of mortality for lower-limb amputees who never receive a prosthesis

Miller et al., 2023

What This Course Covers

Eight modules, each grounded in current research on prosthetic care and rehabilitation ethics.

1. **K-Levels & the Insurance Gatekeeping Problem**
2. **Device Abandonment: Why It Happens**
3. **Timing Is Not Neutral**
4. **Informed Consent as an Ongoing Conversation**
5. **The Psychological Weight of Limb Loss**
6. **Equity Gaps in Amputee Care**
7. **Emerging Technology & Ethical Foresight**
8. **The Case Manager's Ethical Role**

MODULE 1

K-Levels & the Gatekeeping Problem

Medicare's Functional Classification Level (K0–K4) system, created in 1995, determines what componentry insurance will cover — based on a clinician's prediction of future mobility, not just current ability.

K0	No ability/potential to ambulate or transfer safely
K1	Household ambulator — flat surfaces, fixed cadence
K2	Limited community ambulator — curbs, uneven terrain
K3	Community ambulator — variable cadence, most environments
K4	High-impact activity — sports, exercise beyond walking

The Documented Limitation

Only 47% of practitioners say they are the sole determinant of K-level; 43% call it a collaborative process — yet **most surveyed practitioners agreed the system has considerable limitations.**

A person's future mobility is under- or over-estimated more than half the time — meaning a documented K-level can lock a patient out of the very componentry that would help them progress.

Ethical takeaway: a K-level is a starting hypothesis, not a life sentence. Case managers should expect and support re-assessment as function changes.

Sources: Highsmith et al., 2016, Archives of Physical Medicine & Rehabilitation; O&P EDGE, 2026; CMS Lower Limb Prostheses Interagency Workgroup.

MODULE 1

Policy Is Starting to Respond

In 2024, CMS proposed reforms recognizing that rigid K-level cutoffs can block clinically appropriate care.

The 2024 Draft Local Coverage Determination

- Opens a pathway for K2 transfemoral amputees to access microprocessor and fluid/pneumatic knees historically reserved for K3 patients only
- Requires documentation of how the component will improve outcomes (fall reduction, injury prevention) and how lower-level options were considered and ruled out
- A long-time critique of K-levels has been that they prevent certain patient groups from receiving the technology that offers the best clinical solution

What This Means for You

When you see a denial based on K-level alone, ask: was mobility potential assessed with an objective outcome measure, or estimated from a brief clinical impression? Documentation quality — not just the K-level number — often decides the appeal.

Source: Ossur professional resources, 2024, summarizing CMS draft Local Coverage Determination (LCD).

MODULE 1

Activity-Specific Device Use

A K-level tells you a person's general mobility category. It doesn't tell you whether their daily-use foot will hold up on a construction site, a farm, or a track.

One Body, Multiple Devices

Research on running-specific prostheses (RSPs) shows they measurably reduce lower-limb muscle activity and joint loading compared to a daily-use prosthesis during running — the two devices are not interchangeable.

Most active prosthesis users need a daily-use device plus a separate activity-specific device (running blade, water leg, farm-duty leg) — each with its own cost and its own coverage fight.

Environment Can Break "the Right" Device

A qualitative study of 40 farmers and ranchers with amputations found durability and environment were the top-cited problems — bolts breaking under farm loads, and **sophisticated devices like myoelectric prostheses performing poorly in water, dirt, and dust.** Sometimes the most "advanced" componentry is the wrong ethical choice for someone's actual environment.

Minnesota's 2025 "So Every BODY Can Move" law now requires state-regulated plans and Medicaid to cover activity-specific prosthetic devices — recognition that a single device rarely covers a whole life.

Sources: Sepp et al., 2020, ScienceDirect (Clinical Biomechanics); Waldera, Heckathorne, Parker & Fatone, 2012, Disability and Rehabilitation: Assistive Technology; Team Tillges, 2026, on MN activity-specific coverage law.

MODULE 1

The Cost of a Fall vs. the Cost of a Knee

Microprocessor knees (MPKs) cost far more upfront than mechanical knees — but denying one on cost alone can ignore the cost of what it prevents.

$5K–$10K

cost of a mechanical (non-microprocessor) prosthetic knee

$30K–$100K

cost of a microprocessor-controlled knee (MPK)

79%

relative reduction in injurious falls for MPK users vs. mechanical-knee users

19 months

time for the average MPK to "pay for itself" in avoided Medicare fall-related claims

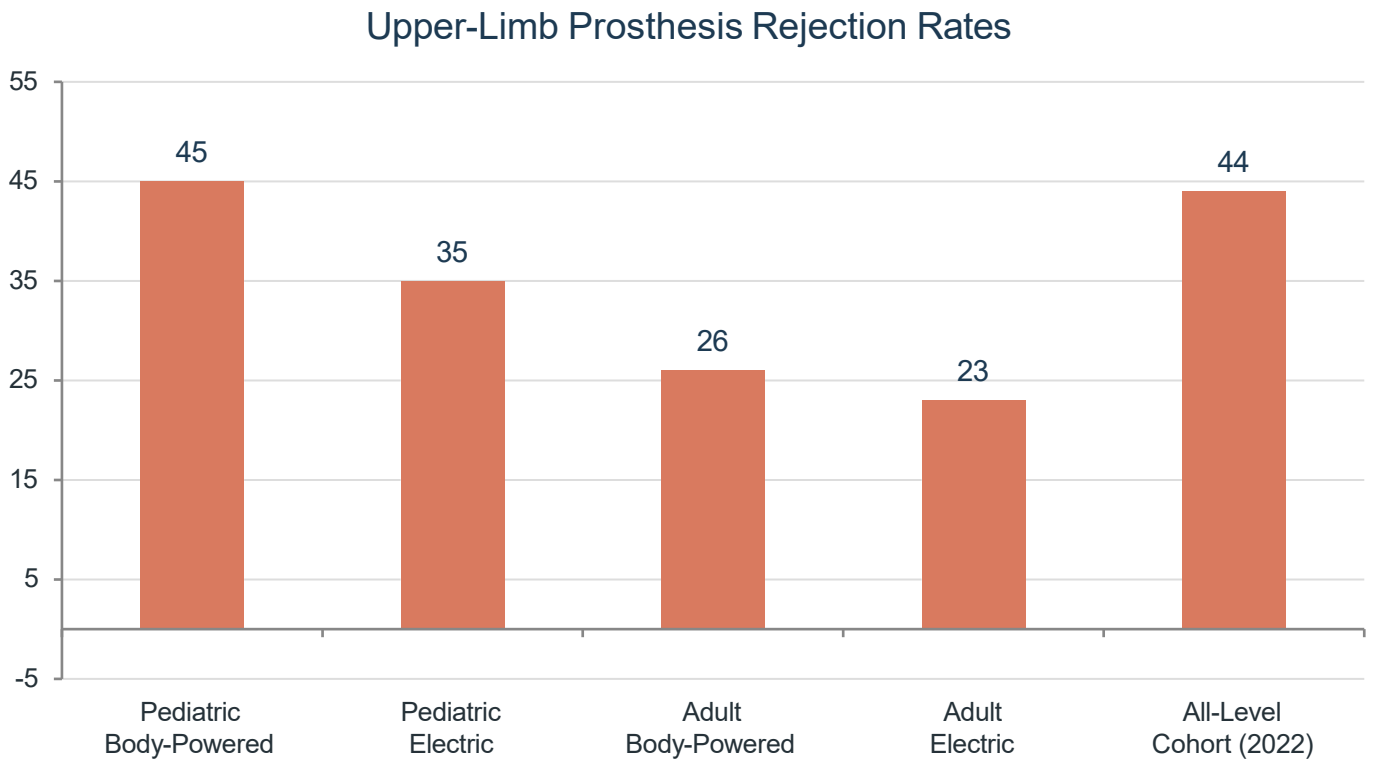
"This study quantifies the cost of falls that require medical attention — providing evidence that it may not be economical to withhold microprocessor knees from patients with moderate ambulatory capabilities." **— Kenton Kaufman, PhD, Mayo Clinic**

Sources: RAND Corp., 2017, Economic Value of Advanced Transfemoral Prosthetics (via Medscape, 2017); Mayo Clinic News Network, 2018; Living with Amplitude, 2025, summarizing Ottobock/Dobson|Davanzo Prosthetics & Orthotics International study.

MODULE 2

Device Abandonment: The Scope

Prosthetic abandonment is not rare, and it is not new. It persists even as devices get more advanced.



Reading the Numbers

Even in a 2022 cohort of amputees fitted with modern devices, **93% were prescribed the most advanced myoelectric technology available** — yet the overall rejection rate was 44%, unchanged from decades of prior data.

Better technology alone does not solve abandonment. The clinical and ethical lesson: fit the device to the person's actual life, not just their diagnosis.

Sources: Biddiss & Chau, 2007, Prosthetics & Orthotics International; Salminger et al., 2022, Disability & Rehabilitation; Gavette et al., 2024, Frontiers in Rehabilitation Sciences.

MODULE 2

Why Abandonment Happens — and What Helps

Discomfort & Fit

Excess weight, heat, sweating, and poor socket fit are consistently cited across decades of research.

Function Mismatch

Devices that don't match a person's actual job, hobbies, or home environment go unused, regardless of sophistication.

Insufficient Training

Advanced control schemes require real instruction; skipping training is strongly linked to rejection.

Low Involvement in Decisions

Patients excluded from the selection process are less likely to accept and continue using the device.

The strongest predictor of acceptance: well-structured, patient-tailored training combined with active involvement in the decision-making process.

Sources: Salminger et al., 2022, Disability & Rehabilitation; Gavette et al., 2024, Frontiers in Rehabilitation Sciences; Biddiss & Chau, 2007, Prosthetics & Orthotics International.

MODULE 2

The Impact of Home & Work Environments

A device that performs beautifully in a clinic gait lab can fail within a month on a factory floor, a farm, or a walk-up apartment. Environment is a prescription variable, not an afterthought.

Employment Predicts Prosthesis Success

3.6x — the increased odds of reaching higher prosthetic mobility for employed vs. unemployed users

48%–89% — civilian return-to-work range after amputation, falling below 30% in dysvascular populations without targeted vocational support

What This Looks Like on the Ground

- Stairs, flooring, and bathroom access at home shape which suspension and socket choices are realistic day to day
- Job tasks — kneeling, climbing ladders, exposure to water, dirt, or chemicals — determine durability needs a clinic visit won't reveal
- In a study of farmers and ranchers, workplace conditions caused mechanical failures and made high-tech componentry impractical

Sources: Prosthetic Limb Users' Survey of Mobility study on employment/geography (Archives of Physical Medicine and Rehabilitation); Darter et al. review via PMC, 2024; Waldera et al., 2012, Disability and Rehabilitation: Assistive Technology.

MODULE 3

Timing Is Not Neutral

Authorization delays are not a neutral administrative detail — they carry measurable clinical and psychological consequences.

53% → 92%

of amputees were fitted with a prosthesis by 4 months vs. 12 months post-surgery — the gap is where recovery momentum is won or lost

Resnik et al., 2020, JRRD

2.6x

increased odds of mortality among lower-limb amputees who never receive a prosthesis, compared with those who do

Miller et al., 2023, PM&R

21.4%

of inpatient rehabilitation days ended in an unsuccessful prosthetic fitting — often tied to cognitive or psychiatric comorbidities needing earlier attention

Physical Med. & Rehab. study, PMC

Ethical takeaway: paperwork speed is a clinical variable. Delayed authorizations compound muscle atrophy, residual-limb changes, and psychological disengagement from rehab.

MODULE 4

Informed Consent as an Ongoing Conversation

Prosthesis design involves dozens of appropriate options with little comparative-effectiveness evidence to guide a single 'best' choice — which makes the patient's values essential, not optional, information.

Four Themes from Shared Decision-Making Research

1. Acknowledging the complexity of communicating technical options in plain terms
2. Clarifying the patient's values before presenting device options
3. Recognizing that lived experience reshapes preferences over time
4. Understanding the prosthetic journey as a series of decisions, not one event

Practice Point

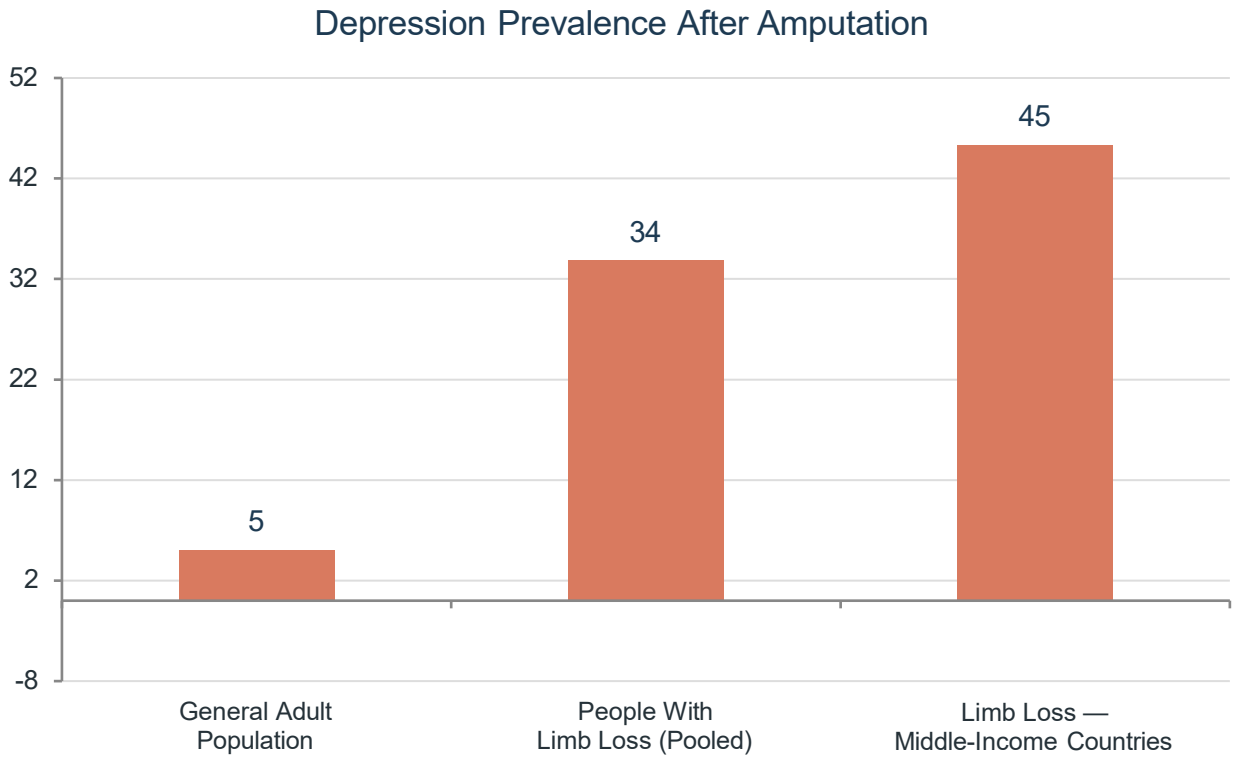
Patients rarely know to ask about maintenance burden, charging routines, noise, or how a device will affect sexuality, work, or parenting.

Decision aids built with amputee input exist specifically to surface these overlooked questions before the prescription is finalized.

Sources: Anderson et al., 2023, Prosthetics and Orthotics International; qualitative studies on decision-making in prosthetic rehabilitation, Disability and Rehabilitation, 2023.

The Psychological Weight of Limb Loss

A successful prosthetic outcome is inseparable from mental health. Treating this as a purely mechanical or logistical case invites disengagement.



What Protects Against Poor Adjustment

- Greater time since amputation and active coping strategies
- Strong social support networks
- Higher satisfaction with the prosthesis itself
- Lower phantom limb and residual limb pain

Depression and pain are also linked to unsuccessful prosthetic fitting at 4 months post-amputation — mental health screening belongs early in the case management timeline, not after problems emerge.

Sources: Singh et al., 2024, Journal of Psychosomatic Research (meta-analysis, 61 studies, n=9,852); Horgan & MacLachlan, 2004, Disability & Rehabilitation; Resnik et al., 2020, JRRD.

MODULE 6

Equity Gaps in Amputee Care

Access to appropriate prosthetic care is uneven — and the disparities compound at every stage, from amputation itself through prescription and long-term use.

Amputation Rates

Black Americans are roughly 4x more likely to undergo an amputation, and 2.5x more likely to require a second one, than non-Hispanic White Americans — even controlling for age, sex, and diabetes severity.

Timing to Amputation

Black/African American Medicare beneficiaries are more likely to receive an amputation within the first year of a diabetic foot ulcer, versus a delayed amputation (>1 year) for non-Hispanic White beneficiaries — suggesting unequal access to limb-salvage treatment.

Prosthesis Prescription

Nationally, White veterans are prescribed lower-limb prostheses at a rate 5.1 percentage points higher than Black veterans within 12 months of amputation; the gap widens for above-knee amputations and in some regions exceeds 14 points.

Outcomes After Fitting

Non-Hispanic Black veterans in rural areas are more likely to abandon their prosthesis, and those in urban areas are less likely to reach advanced mobility levels, than their White counterparts.

Sources: Pasquina et al., 2015 via Representation in Rehab, 2023; Miller et al., 2022, Diabetes Care; Miller et al., 2024, ScienceDirect (VHA cohort); Hurwitz et al., 2025, PM&R.

MODULE 6

The Cost Barrier Is Structural

From the AMA Journal of Ethics' review of access to prosthetic and rehabilitative care:

$500–$3,000

typical annual insurance caps on prosthetic services (2012 data, still cited as a structural benchmark)

$10,000

lifetime maximum for prosthetic coverage under some plans — sometimes covering only a single device for a lifetime

$3K–$100K

cost range for a single lower-limb prosthesis, with replacement typically required every 2–5 years

Patients who undergo amputation are already more likely to face financial disadvantage — compounding their ability to pay for what insurance doesn't cover. Understanding these caps helps case managers anticipate — and proactively address — gaps before they derail rehabilitation.

Source: Stastny & Ross, 2015, "Ethics in Rehabilitation: Access to Prosthetics and Quality Care Following Amputation," AMA Journal of Ethics, 17(6).

MODULE 7

Emerging Technology & Ethical Foresight

AI-driven control, haptic feedback, and powered componentry are advancing quickly. A 2024 multidisciplinary ethics review flags concerns case managers should recognize before these devices reach patients.

Widening the Access Gap

The most advanced technology is developed with little input from the clinicians and users who will rely on it — and tends to reach only well-resourced patients first.

Training Burden

Advanced control mechanisms require significant training to deliver real benefit; overlooking this need is itself a design failure, not just a user shortcoming.

Data & Privacy

Sensor-rich and AI-assisted devices raise new questions about who owns movement and biometric data collected during daily use.

Translation Gap

Many technically impressive devices (e.g., actively powered knees/ankles) have stalled in commercialization due to weight, bulk, and power limitations — meaning hype can outpace what's actually deliverable to a patient today.

Source: Gavette, McDonald, Kostick-Quenet, Mullen, Najafi & Finco, 2024, "Advances in prosthetic technology: a perspective on ethical considerations," Frontiers in Rehabilitation Sciences.

MODULE 7

The Ethical Use of High-Dollar Devices

A $100,000 knee is neither automatically the ethical choice nor automatically wasteful. The ethics live in whether it matches the person — not in the price tag alone.

Risk 1: Under-Provision

Denying advanced componentry on cost alone, even when evidence shows it prevents falls, injuries, and downstream medical spending, shifts risk onto the patient's body rather than the payer's budget.

Ask: has this denial weighed the cost of the device against the documented cost of the falls or complications it would prevent?

Risk 2: Over-Provision

Prescribing top-tier componentry a patient can't or won't maintain — skipping the training, follow-up, and environmental fit that make it usable — isn't generous care. An unused $80,000 knee in a closet serves no one.

Ask: does the documentation reflect this specific patient's function and environment, or does it default to the newest available tier?

Synthesized from: Mayo Clinic News Network, 2018 (Kaufman & Mundell); RAND Corp., 2017; Gavette et al., 2024, Frontiers in Rehabilitation Sciences; Salminger et al., 2022, Disability & Rehabilitation.

MODULE 8

The Case Manager's Ethical Role

Advocate, not clinician. Your influence over approvals is real — the ethical line is where you point that influence.

1 Defer clinical judgment

Functional and medical necessity determinations belong to the physician and prosthetist. Your role is to ensure their judgment is heard and supported, not substituted.

2 Advocate within the record

Push for documentation that reflects the patient's actual goals and trajectory — not just the minimum needed for the cheapest approval.

3 Watch for conflicts of interest

Vendor relationships, preferred-provider networks, and volume incentives can quietly shape recommendations. Ask who benefits from a suggested device or supplier.

4 Center patient-defined goals

"Return to function" means something different for a construction worker, a parent of young kids, and a retiree. Elicit their goals — don't assume a generic template.

Synthesized from: Anderson et al., 2023 & 2025 (shared decision-making); Stastny & Ross, 2015, AMA Journal of Ethics; Gavette et al., 2024, Frontiers in Rehabilitation Sciences.

Principles to Carry Forward

A K-level is a starting hypothesis, not a ceiling — support re-assessment as function changes

Device fit to a person's real life predicts acceptance better than technical sophistication alone
(S 9 - Description of Services)

Every week of authorization delay has a physical and psychological cost

Informed consent is a continuing conversation, not a signature on an intake form

Mental health screening belongs early in the timeline, not after problems surface
(Principle 1: Board-Certified Case Managers (CCMs) will place the public interest above their own at all times.)

Equity gaps in amputation and prescription are documented and actionable — not inevitable
(S 20 C - Unprofessional Behavior)

Your job is to advocate within accurate documentation, not to make the clinical call yourself
(S 1 - Representation of Practice, S 12 - Legal Compliance)

Discussion Scenario

A 34-year-old construction worker with a transtibial amputation has been classified K2 based on his first post-op mobility assessment. He tells you he intends to return to physically demanding work within six months and is frustrated that his insurer has denied a microprocessor knee as "not medically necessary at his functional level."

Discuss in small groups:

1. What documentation would support re-assessing his K-level rather than accepting the initial classification?
2. How would you elicit his actual functional goals in a way that shapes the record, not just your conversation?
3. What is the line between advocating for him and pressuring the clinical team toward a specific outcome?
4. If his employer's insurance later caps coverage below the device's replacement cycle, what is your role?

References

Anderson, C. B., et al. (2023). Improving shared decision-making for prosthetic care: A qualitative needs assessment of prosthetists and new lower-limb prosthesis users. Prosthetics and Orthotics International, 47(1), 26–42.

Biddiss, E. A., & Chau, T. T. (2007). Upper limb prosthesis use and abandonment: A survey of the last 25 years. Prosthetics and Orthotics International, 31(3), 236–257.

Darter, B. J., et al. (2018). Factors influencing functional outcomes and return-to-work after amputation: A review of the literature. Journal of Occupational Rehabilitation.

Gavette, H., McDonald, C. L., Kostick-Quenet, K., Mullen, A., Najafi, B., & Finco, M. G. (2024). Advances in prosthetic technology: A perspective on ethical considerations for development and clinical translation. Frontiers in Rehabilitation Sciences, 4, 1335966.

Highsmith, M. J., et al. (2016). Survey of U.S. practitioners on the validity of the Medicare Functional Classification Level system. Archives of Physical Medicine and Rehabilitation.

Horgan, O., & MacLachlan, M. (2004). Psychosocial adjustment to lower-limb amputation: A review. Disability and Rehabilitation, 26(14–15), 837–850.

Hurwitz, K. E., et al. (2025). Racial disparities in prosthesis abandonment and mobility outcomes after lower limb amputation from a dysvascular etiology in a veteran population. PM&R.

Living With Amplitude. (2025). Microprocessor prosthetics lower healthcare costs, summarizing Ottobock/Dobson|Davanzo & Associates study in Prosthetics and Orthotics International.

Mayo Clinic News Network. (2018). Prosthetic knee type may determine cost of care for amputees (Mundell & Kaufman study, Rochester Epidemiology Project).

Medscape. (2017). Modern prosthetic knees cut falls, morbidity, mortality in amputees, summarizing RAND Corporation, Economic Value of Advanced Transfemoral Prosthetics.

Miller, S. M., et al. (2024). Geographic variation in prosthesis prescription disparities between White and Black veterans after major lower limb amputation. ScienceDirect / Archives of Physical Medicine and Rehabilitation.

Miller, T. A., Campbell, J. H., Bloom, N., & Wurdeman, S. R. (2022). Racial disparities in health care with timing to amputation following diabetic foot ulcer. Diabetes Care, 45(10), 2336–2341.

Miller, W. C., et al. (2023). Factors that influence time to prosthesis receipt after lower limb amputation. PM&R.

Ossur Professional Resources. (2024). Medicare's major new proposal for prosthetic coverage.

Representation in Rehab. (2023). Disparities in amputee care, citing Pasquina et al. (2015).

Resnik, L., et al. (2020). Amputation care quality and satisfaction with prosthetic limb services: A longitudinal study of veterans with upper limb amputation. Federal Practitioner, 38(3), 110–120.

Resnik, L., et al. (2025). Racial disparities in prosthesis use, satisfaction, and physical function in upper limb amputation and the impact of veteran status. PM&R.

Salminger, S., et al. (2022). Current rates of prosthetic usage in upper-limb amputees. Disability and Rehabilitation, 44(14).

Sepp, L. A., Nelson-Wong, E., & Baum, B. S. (2020). Running-specific prostheses reduce lower-limb muscle activity compared to daily-use prostheses in people with unilateral transtibial amputations. Clinical Biomechanics / ScienceDirect.

Singh, S., Saini, R., Mathur, R., Sarkar, S., & Sagar, R. (2024). The prevalence of depression in people following limb amputation: A systematic review and meta-analysis. Journal of Psychosomatic Research, 181, 111677.

Stastny, J., & Ross, W. (2015). Ethics in rehabilitation: Access to prosthetics and quality care following amputation. AMA Journal of Ethics, 17(6), 535–546.

Team Tillges. (2026). Can you run with a prosthetic leg? What to know, citing Minnesota's So Every BODY Can Move legislation (2025).

Waldera, K. E., Heckathorne, C. W., Parker, M., & Fatone, S. (2012). Assessing the prosthetic needs of farmers and ranchers with amputations. Disability and Rehabilitation: Assistive Technology, 8(3), 204–212.