



**What Is Cancer Rehabilitation and How Can it Help My Patients?**  
March 15

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Advanced Practice Provider webinars created and coordinated by Tammy Trötschel, ORNLAB/ADON, in partnership with UNC Lineberger Cancer Network

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UNC Lineberger Cancer Network


# ADVANCED PRACTICE PROVIDER

**March 15, 2023**

**What Is Cancer Rehabilitation  
and How Can it Help My Patients?**



**Sasha E. Knowlton, MD**



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OUR PRESENTER



**Sasha E. Knowlton, MD**

Sasha E. Knowlton, MD, is an Associate Professor for Physical and Medicine Rehabilitation in the UNC School of Medicine. She received her degree from The George Washington University School of Medicine and Health Sciences in 2012 and her residency at Harvard Medical School Spaulding Rehabilitation Hospital from 2013 to 2016.

Dr. Knowlton's clinical and research goals focus on improving the quality of life and functional independence for patients with cancer from the time of diagnosis through treatment and into survivorship. She believes that creating a personalized cancer rehabilitation program for each patient in a collaborative manner with a team of healthcare providers enables the best outcomes.

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OUR PRESENTER

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OUR PRESENTER

5. Sasha E. Knowlton, MD, creates a personalized cancer rehabilitation program for each patient.

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OUR PRESENTER

5. Sasha E. Knowlton, MD, creates a personalized cancer rehabilitation program for each patient.
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OUR PRESENTER

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OUR PRESENTER

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## OUR PRESENTER

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4. Her clinical and research goals focus on improving the quality of life and functional independence for patients with cancer.
3. She received her degree from The George Washington University School of Medicine and Health Sciences in 2012
2. She did her residency at Harvard Medical School Spaulding Rehabilitation Hospital from 2013 to 2016
1. She is an Associate Professor for Physical and Medicine Rehabilitation at the UNC School of Medicine.

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**What one word comes to mind when you hear the phrase "Cancer Rehabilitation"?**

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## What is Cancer Rehabilitation and How Can it Help My Patients?

Sasha E. Knowlton, MD  
Director of Cancer Rehabilitation  
University of North Carolina

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### Objectives

- Define cancer rehabilitation
- List diagnoses that physiatrists can treat in cancer patients
- Identify treatment strategies for neuropathy

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## What is Cancer Rehabilitation?

“Cancer rehabilitation involves helping a person with cancer to help himself or herself to attain maximum physical, social, psychological and vocational functioning within the limits imposed by the disease and its treatment” *Cromes 1978*

“Cancer rehabilitation is a program that helps people with cancer to maintain and restore physical and emotional well-being. Cancer rehabilitation is available before, during and after cancer treatment.” *Mayo Clinic 2012*

Cromes J, G. Fred. "Implementation of Interdisciplinary Cancer Rehabilitation." *Rehabilitation Counseling Bulletin* 21.3 (1978): 230-7.

Mayo Clinic Staff. Tests and Procedures: Cancer rehabilitation in Minnesota. <http://www.mayoclinic.org/tests-procedures/cancer-rehabilitation/basics/definition/prc-20020133>

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## What is Cancer Rehabilitation?

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### What is Cancer Rehabilitation?

Approved by the [Cancer.Net Editorial Board](#), 04/2019


Cancer and its treatment often cause physical, psychological, and cognitive problems. These problems can make it harder to do daily activities or return to work. They may also have a lasting effect on your health. Cancer rehabilitation can help with these problems, which can happen during and after cancer treatment. The goal of cancer rehabilitation is to:

- Help you stay as active as possible and participate in work, family, and other life roles
- Lessen the side effects and symptoms of the cancer and its treatment
- Help keep you as independent as possible
- Improve your quality of life

Cancer rehabilitation is given by trained rehabilitation professionals that you can work with during treatment, [follow-up care](#), or [survivorship](#).


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## Cancer Rehab Program Aims

- **Clinical**
  - Outpatient clinic at Lineberger CC
  - Inpatient consults at UNC
- **Research**
  - Functional and symptom improvement all along cancer continuum – prehab to survivorship
- **Education**
  - Physicians and other providers
  - Patients and caregivers
- **Collaboration!**
  - With oncology teams
  - With therapy teams
  - With support services and patients

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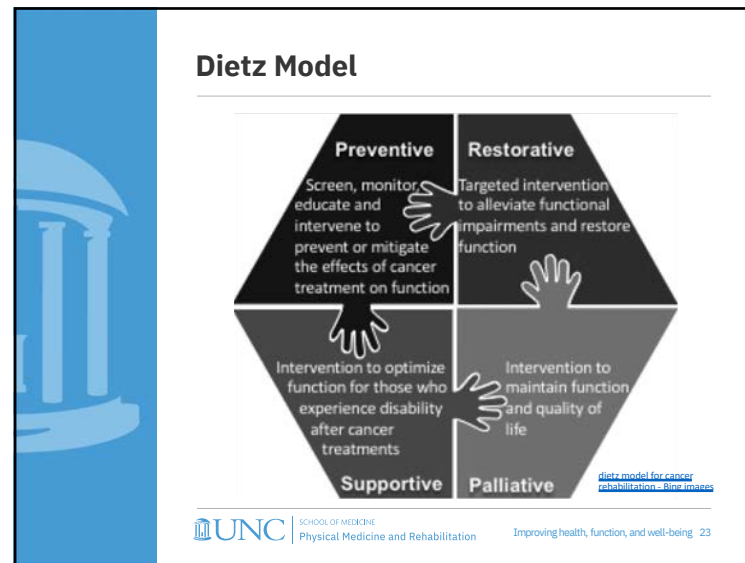
## Cancer Rehab Program Components

- Physiatry aka PM&R + Oncology teams
- Physical Therapy\*
- Occupational Therapy\*
- Speech Therapy\*
- Nursing
- Social Work/Care Coordinator
- Mental Health Support
- Orthotics/Prosthetics
- Support Groups

**Goal:** Address functional limitations and enable better tolerance of journey through treatment and survivorship in a multidisciplinary fashion

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### What does a physiatrist treat?

- Fatigue
- Arthralgia
- Myalgia
- Neuropathic pain
- Weakness
- Deconditioning
- Autonomic dysfunction
- Back pain
- Balance dysfunction
- Bowel dysfunction
- Chemotherapy-induced peripheral neuropathy
- Dystonia
- Graft-versus-host-disease
- Muscular asymmetry
- Lumbosacral plexopathy
- Neck pain
- Osteopenia/osteoporosis
- Paralysis
- Radiation Fibrosis
- Radiculopathy
- Scapular winging
- Scar adhesions
- Sensory deficits
- Sexual dysfunction
- Shoulder pain
- Dysphagia
- Trismus
- Urinary dysfunction
- Visuospatial dysfunction

Silver JK, Baima J, Mayer RS. Impairment-driven cancer rehabilitation: an essential component of quality care and survivorship. CA Cancer J Clin. 2013 Sep;63(5):295-317. doi: 10.3322/caac.21186. Epub 2013 Jul 15. PMID: 23856764.


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## How does a physiatrist evaluate a patient?

- Functional lens
- Identify:
  - Impairments
  - Disabilities
  - Handicaps
- Ask about individual limitations and concerns through a *functional history*
- Address realistic goal expectations
  - Keep in mind balancing safety and independence



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## Why is function important?

- The ability to do daily tasks independently is **vital** for a sense of self
  - “More than **70%** of older patients with *cancer* report that they would not choose a treatment that results in functional impairment, even if it improves survival” (Loh 2021)
- **Prognosis** is linked to functional outcome in cancer (Rogers 2020, DuMontier 2019, Rades 2008)


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## Predictors of functional decline


- **Demographics**
  - Older, non-white, unmarried, lower education, lack of health insurance, +tobacco use, low physical activity, poor coping
- **Disease/treatment factors and co-morbidities**
  - Type of cancer (breast, lung, colorectal), stage, progression
  - Baseline functional impairment, polypharmacy, depression, abnormal nutrition status, cognitive impairment, medical comorbidities, other symptoms (dyspnea, fatigue, weakness), higher symptom burden

• Nightingale G, Battisti NM, Loh KP, Puts M, Kenis C, Goldberg A, Haase KR, Krok-Schoen J, Lipsitz G, Sattar S, Stolz-Baskett P, Perigloti M. Perspectives on functional status in older adults with cancer: An interprofessional report from the International Society of Geriatric Oncology (SIOG) nursing and allied health interest group and young SIOG. *J Geriatr Oncol.* 2021 May;12(4):658-665. doi: 10.1016/j.jgo.2020.10.018. Epub 2020 Nov 7. PMID: 33173805; PMCID: PMC8102651.  
 • Pandya C, Magnusson A, Flannery M, Zittel J, Duberstein P, Loh KP, Ramsdale E, Gilmore N, Dale W, Mohile SG. Association Between Symptom Burden and Physical Function in Older Patients with Cancer. *J Am Geriatr Soc.* 2019 May;67(5):998-1004. doi: 10.1111/jgs.15864. Epub 2019 Mar 8. PMID: 30848838; PMCID: PMC7851835.


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## Why does functional status matter?

- Functional impairment causes
  - Shorter survival
  - Increases risk for chemotherapy toxicity
  - Higher symptom burden
- How common is it?
  - Rates range **39-78% in older adults**

• Nightingale G, Battisti NM, Loh KP, Puts M, Kenis C, Goldberg A, Haase KR, Krok-Schoen J, Lipsitz G, Sattar S, Stolz-Baskett P, Perigloti M. Perspectives on functional status in older adults with cancer: An interprofessional report from the International Society of Geriatric Oncology (SIOG) nursing and allied health interest group and young SIOG. *J Geriatr Oncol.* 2021 May;12(4):658-665. doi: 10.1016/j.jgo.2020.10.018. Epub 2020 Nov 7. PMID: 33173805; PMCID: PMC8102651.  
 • Pandya C, Magnusson A, Flannery M, Zittel J, Duberstein P, Loh KP, Ramsdale E, Gilmore N, Dale W, Mohile SG. Association Between Symptom Burden and Physical Function in Older Patients with Cancer. *J Am Geriatr Soc.* 2019 May;67(5):998-1004. doi: 10.1111/jgs.15864. Epub 2019 Mar 8. PMID: 30848838; PMCID: PMC7851835.


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## What is an instrumental activity of daily living (IADL)?

- Getting dressed
- Taking a shower
- Cooking a meal
- All of the above

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### Function ↔ Quality of Life ↔ Prognosis

- Improved quality of life is associated with improved prognosis
- Improved independence with IADLs is associated with improved survival

Fried TR, Bradley EH, Towle VR, Allore H. Understanding the treatment preferences of seriously ill patients. *N Engl J Med*. 2002 Apr 4;346(14):1061-6. doi: 10.1056/NEJMs053526. PMID: 11932474.


• Malone P, Perrone F, Gallo C, Mantone L, Piantedosi F, et al. Pretreatment quality of life and functional status assessment significantly predict survival of elderly patients with advanced non-small cell lung cancer receiving chemotherapy: a prognostic analysis of the multicenter Italian lung cancer in the elderly study. *J Clin Oncol*. 2009 Oct 1;27(26):6860-7. doi: 10.1200/JCO.2009.02.527. PMID: 19325176.

• DuMontier C, Liu MA, Murillo A, Hsieh T, Javedan H, Solfero R, Stone RM, Driver JA, Abel GA. Function, survival, and Care Utilization Among Older Adults With Hematologic Malignancies. *J Am Geriatr Soc*. 2019 May;67(5):889-897. doi: 10.1111/jgs.15835. Epub 2019 Apr 4. PMID: 30945759.

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## Pain ↔ Function

- **Multiple reasons to have pain**
  - Tumor pain
  - Fractures
  - Muscle strain
  - Spasticity
  - Radicular pain
  - Skin breakdown
- **Treatment**
  - Medication
  - PT+OT
  - Modalities
  - Compression garments
  - Bracing
  - Interventions/Surgery


Raj, V.S. and Lofton, L., 2013. Rehabilitation and treatment of spinal cord tumors. *The journal of spinal cord medicine*, 36(1), pp.11-4.

Ruppert LM. 2017. Malignant spinal cord compression: Adapting conventional rehabilitation techniques. *Phys Med Rehabil Clin N Am*. 28:503-514.

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## Examples of physiatry interventions


- Spinal cord injury from metastases
  - Trial neuropathic pain medication
  - Assess bowels/bladder and provide medication and intervention management
  - Referral to PT for mobility and OT for ADLs
  - Spasticity management
- Dropped head in a Hodgkin's case
  - Active bracing
  - Referral to PT for posture, strengthen neck extensors
- Shoulder impingement in breast cancer
  - Subacromial corticosteroid injection
  - Referral to OT to work on ADLs
  - Referral to PT to work on scapular stabilization, improve ROM

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### Spinal cord injury from metastases →...

- Pain
- Spasticity
- Neurogenic bowel
- Neurogenic bladder
- Sexual dysfunction
- Weakness
- Sensory changes
- Hemodynamic instability
- Autonomic dysreflexia\*

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### Spasticity

- Increased tone or stiffness that is velocity dependent
- Occurs when there is an injury to the spinal cord
- Can be functionally beneficial
- Treat with
  - Stretching exercises
  - Splinting or casting
  - Oral medications
  - Botox

Ruppert LM. 2017. Malignant spinal cord compression: Adapting conventional rehabilitation techniques. Phys Med Rehabil Clin N Am. 28:101-114.

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## Neurogenic bladder

- Identify upper motor (UMN) versus lower motor neuron (LMN) pattern
  - Use voiding diary, urodynamic studies, post-void residual and exam
- Pelvic Floor Therapy
- For UMN
  - Medications (alpha blockers, anticholinergics)
  - Establish catheterization program
- For LMN
  - Medications (cholinergics)
  - Crede/Valsava and double void techniques

• Raj, V.S. and Lofgren, L., 2013. Rehabilitation and treatment of spinal cord tumors. *The journal of spinal cord medicine*, 36(1), pp.11-4.  
 • Ruppert LM. 2017. Malignant spinal cord compression: Adapting conventional rehabilitation techniques. *Phys Med Rehabil Clin N Am*, 28:101-114.


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## Neurogenic bowel

- Identify upper motor (UMN) versus lower motor neuron (LMN) pattern
  - Use stooling diary and imaging to establish pattern
- Educate on diet and hydration
- Pelvic floor therapy
- For UMN
  - Combination of oral agents+stimulants “above and below”
- For LMN
  - Bulking agents and manual disimpaction

• Raj, V.S. and Lofgren, L., 2013. Rehabilitation and treatment of spinal cord tumors. *The journal of spinal cord medicine*, 36(1), pp.11-4.  
 • Ruppert LM. 2017. Malignant spinal cord compression: Adapting conventional rehabilitation techniques. *Phys Med Rehabil Clin N Am*, 28:101-114.


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## Why care about sensory and motor changes?


- **Risk of pressure ulcers, wounds and skin breakdown**
  - Learn pressure relief strategies
  - Regular skin checks
  - Nutrition education
  - Establish effective bowel and bladder program\*
- **Risk of aspiration and pneumonia**
  - Swallow studies
  - Modified diet
  - Speech therapy to strength mouth muscles
- **Risk of fractures**
  - Treat with PT/OT
  - May need bracing or equipment
  - May need intervention

\* Raj, V.S. and Lofson, L., 2013. Rehabilitation and treatment of spinal cord tumors. *The Journal of spinal cord medicine*, 36(1), pp.11-4.  
 \* Ruppert LM. 2017. Malignant spinal cord compression: Adapting conventional rehabilitation techniques. *Phys Med Rehabil Clin N Am*. 28:101-114.

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## Cognitive changes aka chemo brain, brain tumor, metastases, etc.

- Commonly described cognitive impairments include:
  - Attentional deficits
  - Memory
  - Language
  - Verbal learning and reasoning
  - Visual perception
  - Executive functioning
  - Psychomotor speed
- Treatment options include
  - Medications
  - Cognitive therapy

• Vargo M. Brain tumor rehabilitation. *Am J Phys Med Rehabil*. 2013; 30(suppl): S50-S62.  
 • Meyers CA, Weitzner MA, Valentine AD et al. Methylphenidate therapy improves cognition, mood and function of brain tumor patients. 1998. *J Clin Oncol*. 16: 2522-2527.  
 • Tumor related neurocognitive dysfunction in patients with diffuse glioma: a systematic review of neurocognitive function prior to anti-tumor treatment. *J Neurooncol*. 2017; 134:9-12.  
 • Van Kessel E, Baumfalk AJ, van Zandvoort MJE, et al. Tumor-related neurocognitive dysfunction in patients with diffuse glioma: a systematic review of neurocognitive functioning prior to anti-tumor treatment. *J Neurooncol*. 2017; 134:9-18.

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### Physiatry diagnoses in breast cancer


- AI-induced arthralgia
- Shoulder/neck pain/limited ROM/dysfunction
- Lymphedema/cording/radiation fibrosis
- Post-mastectomy/lumpectomy pain
- Chemotherapy-induced peripheral neuropathy
- In one study, 6 years after diagnosis, **>60%** of women experienced at least one impairment
- In another study of metastatic breast cancer patients, **92%** identified at least one impairment

Schmitz, Kathryn H., et al. "Prevalence of breast cancer treatment sequelae over 6 years of follow-up." *Cancer* 118.58 (2012): 2217-2225.  
Cheville, Andrea L., et al. "Prevalence and treatment patterns of physical impairments in patients with metastatic breast cancer." *Journal of Clinical Oncology* 26.16 (2008): 2621-2629.

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### Physiatry diagnosis in HNC

- Pain – nociceptive, neuropathic
- Chewing difficulties
- Dysphagia
- Xerostomia
- Mucositis
- Impaired dentition
- Reduced taste
- Trismus
- Voice loss
- Lymphedema
- Speech dysfunction
- Radiation fibrosis
- Neck and shoulder dysfunction



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### Physiatry diagnoses in BMT

- Deconditioning/fatigue
- Joint+Fascial GVHD
- Steroid myopathy
- Osteopenia/osteoporosis
- Avascular necrosis
- Chemotherapy-induced peripheral neuropathy


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## Steroid Myopathy

- At least 40% of patients with GVHD affected
- Associated with weakness and functional impairment
- Intervene early with safe exercise  $\pm$  physical therapy

• Lee HJ, Oran B, Saliba RM, Couriel DM, Shin K, Massey P, Neumann J, de Lima M, Champlin R, Giralt S. Steroid myopathy in patients with acute graft-versus-host disease treated with high-dose steroid therapy. *Bone Marrow Transplant*. 2006 Aug;38(4):299-303. doi: 10.1038/sj.bmt.1705435. Epub 2006 Jul 3. PMID: 16819637.  
 • Smith SR, Asher A. Rehabilitation in Chronic Graft-Versus-Host Disease. *Phys Med Rehabil Clin N Am*. 2017 Feb;28(1):149-151. doi: 10.1016/j.pmr.2016.08.009. PMID: 27912993.

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## Even before intervention → PREHAB!

- Obtain a baseline functional status
- Identify pre-treatment impairments
- Improve physical and emotional health **before** treatment
- **Reduce** treatment-related **morbidity** and/or **mortality**
- Decrease length of hospital stay and readmissions
- Increase available treatment options for patients
- **GOAL:** Return patients to the highest level of function possible as soon as possible


Silver, Julie K., Jennifer Balma. Cancer prehabilitation: an opportunity to decrease treatment-related morbidity, increase cancer treatment options, and improve physical and psychological health outcomes. *Am J Phys Med Rehabil*. 2013. 92(8): 715-727.

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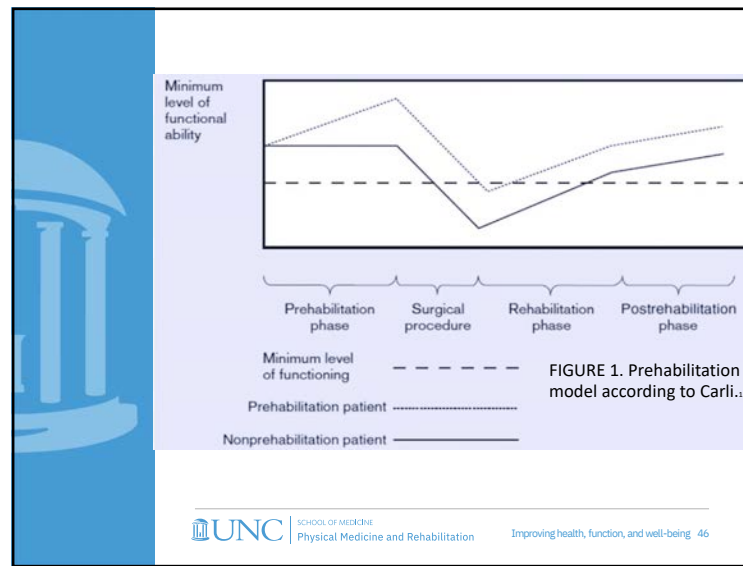
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## Goals of prehabilitation

- Address SNAP
  - Smoking cessation
  - Nutrition
  - Alcohol intake
  - “Potato” aka Sedentary behaviors
- Address competing factors
  - Medical comorbidities
  - Polypharmacy
  - Pre-existing cognitive and physical impairment
  - Frailty


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## Prehab tries to prevent... sarcopenia. What is sarcopenia?

- **Defined as:** loss of muscle mass, strength\* or function
- Increases frailty risk and adverse outcomes

Table 1  
Mechanisms in the development of sarcopenia

Physiological	Social	Pathological
Low activity Reduced oral intake Age-related declines Changes in hormones: -Reduced testosterone -Thyroid hormones -Insulin Poor dentition Swallowing difficulties	Social isolation Poverty, inability to cook and/or obtain food Loneliness Abuse  Lifestyle choices	Low activity related to Disability Inflammation Mental deterioration Comorbidities: -GI diseases -Hypermetabolism (hyperthyroidism, infection) -Other disease (cardiovascular, cancer, kidney) Medications/chemotherapy

Robertson HL, Michel C, Bartl L, Hamilton-Reeves JM. Sarcopenia in urologic oncology: Identification and strategies to improve patient outcomes. *Urol Oncol*. 2020 May 24;38(7):1439-201917-6. doi: 10.1016/j.urolonc.2020.05.003. Epub ahead of print. PMID: 32456854.

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## Sarcopenia→Deconditioning

- Associated with:

- Worse survival outcomes
- Increased post-operative and treatment complication rates in bladder, prostate and renal cancer
- Increased chemotherapy toxicity

• Jahrreis V, Laukhina E, D'Andrea D, Shariat SF. The prognostic value of sarcopenia in patients with prostate cancer: a systematic review. *Curr Opin Urol*. 2021 Jul 1;31(4):315-323. doi: 10.1097/MOU.0000000000000885. PMID: 33965982.


• Hansen TS, Onland AG, van Hermsmeider A, Johansen C, Clausen ML, Suetta C, Pappot M, Ruffin BS. Development of Sarcopenia in Patients With Bladder Cancer: A Systematic Review. *Semin Oncol Nurs*. 2021 Feb;37(1):151108. doi: 10.1016/j.soncn.2020.151108. Epub 2021 Jan 8. PMID: 33431235.

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## How to assess for sarcopenia

- Imaging – CT, MRI, ultrasound
  - Standard: Measure psoas / L3 muscle bulk
- Strength and Functional tests
  - Handgrip, 6MWT, TUG, 30 sec sit to stand, gait speed
- Screening tests- validated\*
  - SARC-F\* and SPSM\*

• Robertson HL, Michel C, Baril L, Hamilton-Reeves JM. Sarcopenia in urologic oncology: Identification and strategies to improve patient outcomes. Urol Oncol. 2020 May 24;51(7B):1439(2030197-6. doi: 10.1016/j.urolonc.2020.05.001. Epub ahead of print. PMID: 32456854.  
 • Cruz-Jentoft AI, Bahat G, Bauer J, Boirie Y, Bruyère O, Cederholm T, Cooper C, Landi F, Rolland Y, Sayer AA, Schneider SM, Sieber CC, Topinkova E, Vandewoude M, Visser M, Zamboni M; Writing Group for the European Working Group on Sarcopenia in Older People 2 (EWGSOP2), and the Extended Group for EWGSOP2. Sarcopenia: revised European consensus on definition and diagnosis. Age Ageing. 2019 Jan 1;48(1):16-31. doi: 10.1093/ageing/afy169. Erratum in: Age Ageing. 2019 Jul 1;48(4):601. PMID: 30312372; PMCID: PMC6322506.


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## How to manage sarcopenia

- Nutrition: PROTEIN! And Vitamin D
  - Standard: 0.8 g/kg of body weight
  - For sarcopenia: 1-1.5 g/kg of body weight
  - Supplementation?
- Exercise
  - Aerobic + Resistance
  - Early intervention is best (prehab)

Robertson HL, Michel C, Baril L, Hamilton-Reeves JM. Sarcopenia in urologic oncology: Identification and strategies to improve patient outcomes. Urol Oncol. 2020 May 24;51(7B):1439(2030197-6. doi: 10.1016/j.urolonc.2020.05.001. Epub ahead of print. PMID: 32456854.



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## How to manage deconditioning and fatigue

- Assess core and lower extremity strength
  - Manual muscle testing, gait, transitional movements i.e. sit to stand, balance
- Address any medical contributions
  - Anemia, thyroid dysfunction, malnutrition, etc.
- Review whether an ambulatory aid would be of assistance
- Educate about exercise and importance of regular physical activity in a safe manner
- Fall risk assessment


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## Treatment plan

- Discuss realistic short- and long-term functional goals
- **Co-develop** a plan to achieve these goals
- Involve physical  $\pm$  occupational therapy as needed
  - Alternatively design a home exercise program
- Address mental health aspect and provide resources
  - Psych, social work, support groups
- Assess need for durable medical equipment (DME)

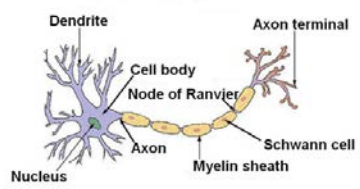
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## Chemotherapy induced peripheral neuropathy (CIPN) – An overview

- Nerves that can be affected include:
  - Sensory
  - Motor
  - Autonomic (less common)
    - Constipation
    - Urinary retention
    - Orthostatic hypotension
    - Sexual dysfunction
    - Irregular HR

### Structure of a Typical Neuron



The diagram illustrates the structure of a typical neuron. It shows a central cell body containing a nucleus. Branching out from the cell body are dendrites. A long axon extends from the cell body, covered by a myelin sheath. The axon terminates in axon terminals. A Schwann cell is shown surrounding the axon, and a Node of Ranvier is indicated on the myelin sheath.

<https://www.google.com/search?q=neuron+picture&tbm=isch&bo=uk&source=unil&sa=X&ved=2ahUKEwjk7uFdyLAbW0ND40xw6tCgQaQJHA&biw=1366&bih=623&imgref=imuvGOC-rgCaM93A>

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## CIPN Risk factors


- Risk Factors
  - Baseline neuropathy
  - Age
  - Smoking history
  - Decreased creatinine clearance
  - Sensory changes during chemotherapy
- Coasting
  - Worsening of symptoms up to 3-4 months post-treatment

• Seretny, Marta, et al. "Incidence, prevalence, and predictors of chemotherapy-induced peripheral neuropathy: A systematic review and meta-analysis." *PAIN* 155.12 (2014): 2463-2470.  
 • Han, Yiqin, and Marce T. Smith. "Pathobiology of cancer chemotherapy-induced peripheral neuropathy (CIPN)." *Frontiers in pharmacology* 4 (2013).  
 • Miltenburg, N. C., and W. Boogerd. "Chemotherapy-induced neuropathy: a comprehensive survey." *Cancer treatment reviews* 40.7 (2014): 872-882.

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## How common is CIPN?

- Thought to be underestimated
- Review by Seretny et al (2014):
  - **One month** after completing chemotherapy, prevalence was **68.1%**
  - **Three months** after completing chemotherapy, prevalence was **60%**
  - **Six months** after completing chemotherapy, prevalence was **30%**

Seretny, Marta, et al. "Incidence, prevalence, and predictors of chemotherapy-induced peripheral neuropathy: A systematic review and meta-analysis." *PAIN* 155.12 (2014): 2463-2470.

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## Why care about neuropathy?

- **Impaired Function** – Falls and ADLs
- **Quality of life**
  - Toftagen et al: **Worse** quality of life associated with increased CIPN
  - Mols et al: CIPN and quality of life systematic review
    - Majority of studies show **more CIPN symptoms correlated with lower quality of life**

• Toftagen, Cindy, et al. "Oxaliplatin-induced peripheral neuropathy's effects on health-related quality of life of colorectal cancer survivors." *Supportive Care in Cancer* 21.12 (2013): 3107-3113.  
• Mols, Floorje, et al. "Chemotherapy-induced peripheral neuropathy and its association with quality of life: a systematic review." *Supportive Care in Cancer* 22.8 (2014): 2261-2269.

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### How does neuropathy affect function?


- Worse performance on functional tests
- Conservative gait with slowed walking speed = increased fall risk
- Lower levels of function/ADLs
- Increased odds of falling x 1.8

Winters-Stone KM et al. Falls, functioning and disability among women with persistent symptoms of chemotherapy-induced peripheral neuropathy. J Clin Oncology. 35(23). 2017. 2604-2610.

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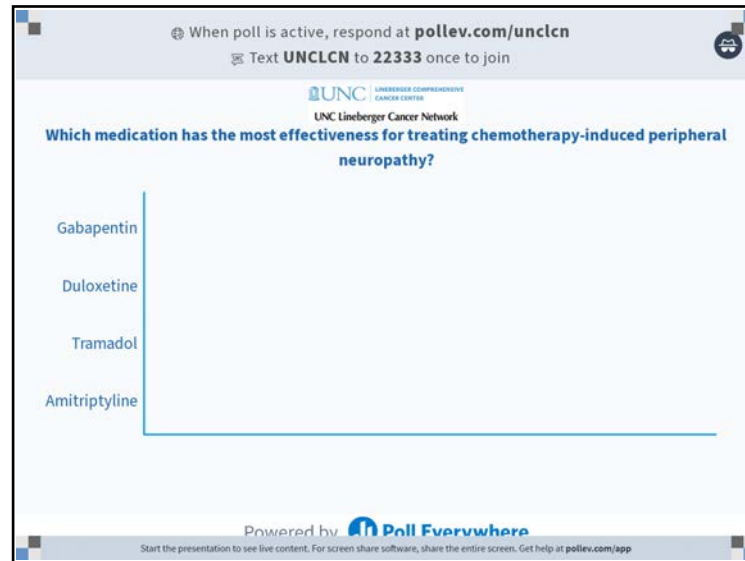
### Symptom Profile

- Positive and / or Negative symptoms
- **Positive**
  - Pain (shock, burn, stab, lancing)
  - Dysesthesia, hypersensitivity
  - Tingling
  - Pruritis, cramping
- **Negative**
  - Numbness
  - Impaired proprioception/balance
  - Weakness including foot drop


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## CIPN: Prevention and Treatment

- Hershman et al: Practice Guideline
  - No agents for prevention
  - **Duloxetine can be used for treatment**
- PT - desensitization, proprioceptive feedback, TENS
- AFOs
- Others – acupuncture

Smith, Ellen M. Lavoie, et al. "Effect of duloxetine on pain, function, and quality of life among patients with chemotherapy-induced painful peripheral neuropathy: a randomized clinical trial." *Jama* 309.13 (2013): 1359-1367.  
Argyrios, Andreas A., et al. "Chemotherapy-induced peripheral neurotoxicity (CIPN): an update." *Critical reviews in oncology/hematology* 82.1 (2012): 51-77.  
Hershman, Dawn L., et al. "Prevention and management of chemotherapy-induced peripheral neuropathy in survivors of adult cancers: American Society of Clinical Oncology clinical practice guideline." *Journal of Clinical Oncology*(2014): JCO-2013.


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## Rehab interventions for CIPN


- Decreased balance and slower walking speeds can be seen after **one dose** of taxane
- Start with static standing, then add simple manipulation, then walking, then manipulation while walking
- Work on gait training and LE strengthening and proprioception
- Hand therapy/OT can focus on strengthening, NM re-education, adaptive equipment

Monfort, S.M., Pan, X., Patrick, R., Ramaswamy, B., Wesolowski, R., Naughton, M.J., Loprinzi, C.L., Chaudhari, A.M. and Lustberg, M.B., 2017. Gait, balance, and patient-reported outcomes during taxane-based chemotherapy in early-stage breast cancer patients. *Breast cancer research and treatment*, 164(1), pp.69-77.

Wong, R., Major, P. and Sagar, S., 2016. Phase 2 study of acupuncture-like transcutaneous nerve stimulation for chemotherapy-induced peripheral neuropathy. *Integrative cancer therapies*, 15(2), pp.153-164.

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## Rehab interventions part 2


- Desensitization and TENS
- Laser therapy (photobiomodulation)
- Scrambler therapy being actively researched
- Can trial AFOs for foot drop **or** proprioception
- Ambulatory aids
- Compression socks, wool socks
- Trial acupuncture
- Skin checks

Pusan, S. and Abdi, S., 2018. Treatment of chemotherapy-induced peripheral neuropathy: systematic review and recommendations. *Pain physician*, 21, pp.571-592.

Smith, T.J., Rossini, A.R., Blackford, A.L., Ensminger, J., Sakl, C., Longo-Schoberlein, D. and Loprinzi, C.L., 2019. A Pilot Randomized Sham-Controlled Trial of MCS-A Scrambler Therapy in the Treatment of Chronic Chemotherapy-Induced Peripheral Neuropathy (CIPN). *Journal of palliative care*, p.0825859719827589.

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## Treatment for CIPN

- Exercise
  - Helps symptoms
  - Improve QOL and ADL independence
- During chemotherapy administration, those who exercised experienced **symptoms less commonly** and also **less severe symptoms** compared to those who did not exercise


Zimmer, P., Trebing, S., Timmers-Trebing, U., Schenk, A., Paust, R., Bloch, W., Rudolph, R., Streckmann, F. and Baumann, F.T., 2018. Eight-week, multimodal exercise counteracts a progress of chemotherapy-induced peripheral neuropathy and improves balance and strength in metastasized colorectal cancer patients: a randomized controlled trial. *Supportive Care in Cancer*, 26(2), pp.615-624.

Kleckner, J.R., Kamen, C., Gewandter, J.S., Mohile, N.A., Heckler, C.E., Culakova, E., Fung, C., Janelonis, M.C., Asare, M., Lin, P.J. and Reddy, P.S., 2018. Effects of exercise during chemotherapy on chemotherapy-induced peripheral neuropathy: a multicenter, randomized controlled trial. *Supportive Care in Cancer*, 26(4), pp.1019-1028.

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## How to refer in EPIC

**There will be a referral specific to cancer rehab (Ambulatory Referral to Cancer Rehab) in Epic at some point.**


**For now, please email Tina Thornhill [Tina.Thornhill@unchealth.unc.edu](mailto:Tina.Thornhill@unchealth.unc.edu) or Sharita Hairston [Sharita.Hairston@unchealth.unc.edu](mailto:Sharita.Hairston@unchealth.unc.edu) to have a patient scheduled.**

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**Contact Information**

Sasha E. Knowlton, MD

**Email:** [sasha\\_knowlton@med.unc.edu](mailto:sasha_knowlton@med.unc.edu)


**Clinic Locations:**

- Surgical Oncology
- Hematology Oncology
  - *New patient coordinator:* Sharita Hairston+Tina Thornhill

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