Re: S.F. No. 974 “Coverage of Power Standing Systems”

March 4, 2025

The Clinician Task Force (CTF) has been involved in power standing system policy on both federal and state levels as experts in seating and wheeled mobility and in the evidence base on the medical nature of this important technology. The CTF supports and appreciates coverage for power standing systems as it supports the health and function of the people who use power wheelchairs.

The CTF is a 501(c)(4) non-profit organization composed of healthcare providers that practice, serve, and provide education on best practice in seating and wheeled mobility clinical services, and advocate for individuals who require complex rehab technology (CRT) equipment. The CTF membership consists of occupational and physical therapists across the United States with expertise and advanced education in seating and wheeled mobility services, maintaining a majority of at least 80% of the membership that actively evaluate for CRT equipment in a wide variety of settings including inpatient and outpatient rehabilitation, private practice, educational settings, community-based programs, and more. Membership guidelines mandate that no more than 20% of the membership are employed full-time by CRT manufacturer/suppliers to ensure an ethical balance is maintained.

The CTF is equipped to evaluate legislative proposals for power standing systems on power wheelchairs. The following is evidence on power standing systems that the CTF has compiled to demonstrate the medical nature of these systems:

**Evidence Selection Strategy**

The following evidence review was completed using the criteria laid out in the national coverage analysis for power seat elevation systems and applied to power standing system evidence. In summary, the following criteria from the *National Coverage Analysis on Power Seat Elevation Systems*[1] were considered:

- Evidence should focus on power standing on PWCs[1] (p. 15) and demonstrate how power standing would be necessary for effective use of a power wheelchair[1] (p. 14).
- Preferred literature would be clinical studies demonstrating the biomechanical, electromyographic and/or functional abilities of wheelchair users.
- Study population includes wheelchair users; however, the search may be expanded to other populations (e.g. ambulatory older adults, manual wheelchair users) when appropriate. Seat elevation study participants were people with mobility limitations and/or physical impairments, including the frail elderly and various living situations. Furthermore, studies that could apply to a functional activity for power standing, but not use a PWC or standing system, may be included[1] (p. 53).
    - Therefore, studies in supported standing devices should be considered, when the study focuses on outcomes that would also apply to a power standing system user such as the impact of supported standing on range of motion, muscle tone and spasms, digestive health, and more.[2]
    - Therefore, studies with an adolescent population would also apply to a power standing system user, when the study examines outcomes that are not

developmental in nature and would also apply to an adult power standing system user such as mobility-related activities of daily living (MRADL) performance.[2]

- No single case studies. When evaluating studies, CMS will consider 1) Quality of individual studies, 2) generalizability of findings to the Medicare population, and 3) the extent that overarching conclusions can be drawn from the body of evidence on the direction and magnitude of the intervention's potential risks and benefits
- Included studies would 1) answer the assessment question conclusively, and 2) improve health outcomes for patients.

**Power Standing Evidence**

The studies below are categorized by health categories and participation, for assessing the quantity and quality of evidence related to each outcome. Each row specifies the abbreviated study citation, and the specific body function the study examines (column 1), the study type (column 2), the participants and standing device (column 3), and key notes about the study and a summarized study outcome (column 4).

1. Range of Motion, Muscle Strength, and Motor Function

| **Study** | **Study type** | **Participants, *technology*** | **Outcomes** |
|---|---|---|---|
| Baker et al. (2007)[3] *[ROM]* | Single blind randomized crossover design | 6 subjects with Multiple Sclerosis *Standing frame* | Hip extension/ankle dorsiflexion range of motion improved significantly. |
| Bayley et al. (2020)[6] *[ROM, motor function]* | Stepped wedge design over 12 months | 14 adolescents with parents with DMD *Power standing system* | Through video analysis, joint angles were maintained over 12 months, power standing system on PWC use was associated with improved mental health, and functional independence improved. |
| Freeman et al. (2019)[7] *[ROM, motor function]* | Randomized controlled superiority trial | 140 subjects with Multiple Sclerosis (71 usual care, 69 standing) *Standing frame* | The standing frame group had a mean 0.018 (95% CI –0·014 to 0·051) additional quality-adjusted life-years (QALYs) compared with those of the usual care group, and the estimated incremental cost-per-QALY was approximately £14 700. AMCA scores [motor function scale] was 4.7 points higher in standing group at week 36. |
| Hendrie et al. (2015)[8] | Mixed methods with quantitative single-case | 9 participants with Multiple Sclerosis *Standing frame* | Regular standing showed visual improvements and statistically significant |

| | | | |
|---|---|---|---|
| *[motor function]* | experiments over 48 weeks | | improvement across time period on AMCA. |
| Netz et al. (2007)[4]<br><br>*[Muscle strength]* | Experiment with control period | 13 residents in a nursing home unable to transfer and stand independently<br>*Supported standing device* | More improvements than deterioration noted in hip/knee extensors, abductors, and ankle muscle strength. No significant differences in hip/knee flexors and UE. |
| Riek et al. (2008)[5]<br><br>*[ROM]* | Case series | 5 subjects with Spinal Cord Injury<br>*Standing in a frame* | Lab study. Upper extremity (UE) posture in supported standing improves shoulder position. |

2. Bone mineral density (BMD)

| **Study** | **Study type** | **Participants, *technology*** | **Outcomes** |
|---|---|---|---|
| Alekna et al. (2008)[9] | Prospective study during first 2 years post-injury | 54 participants with SCI<br>*Standing frame* | Supported standing group had higher BMD in lower extremities than the non-standing group. |
| de Bruin et al. (1999)[10] | Single case experimental multiple-baseline design over 1.5 years | 19 participants with acute SCI<br>*Standing frame* | CT scans measured trabecular, cortical, and area moment of inertia. In patients with loading (standing), the type of exercise didn't cause an obvious difference, and only a moderate loss or even moderate increase in BMD was observed. |

3. Digestive, metabolic, and endocrine systems

| **Study** | **Study type** | **Participants, *technology*** | **Outcomes** |
|---|---|---|---|
| Collins et al. (2010)[12]<br><br>*[metabolic]* | Descriptive lab study | 170 adults with SCI<br>*Supported standing, likely frame* | People with incomplete SCI found that static supported standing expended 1.17 metabolic equivalents (MET), as measured after standing for at least 5 minutes, and static standing expended more energy than the person did while lying down at rest. |
| Gohlke & Kenyon (2022)[13] | Longitudinal case series over 12 | 8 participants (5 adults, 3 children) | 3 of 4 participants who reported issues with constipation at the onset of |

| | | | |
|---|---|---|---|
| *[digestion]* | months in home setting | users of *Power standing system* | the series achieved clinically significant improvements in their total PAC- QOL scores between the baseline and final PAC-QOL administrations. The 4th participant's total PAC-QOL score approached clinical significance. |
| Kaplan et al. (1981)[11]<br><br>*[endocrine]* | Experimental | 10 participants with SCI<br>*Tilt table* | Compared early and late spinal cord injury (SCI) and standing vs strengthening's impact on hypercalciuria. Participants who consistently stood earlier post-SCI had reduced calcium output over those who stood later. |
| LaBerge et al (2023)[14]<br><br>*[endocrine]* | Retrospective chart review | 13 subjects who used a *Power standing system* | 6% of people without a power standing system on their PWC had UTIs the year prior, and 3% after; 23% people who received a power standing system on their PWC had UTIs the year prior, reduced to 8% after. |
| Verschuren et al. (2014)[15]<br><br>*[metabolic]* | Exploratory cohort study | 19 subjects with Cerebral Palsy ages 4-10yrs (mean 10-14yrs)<br>*Standing frame* | Energy expenditure was >1.5 METs during standing for all GMFCS-E&R levels and, therefore, may be considered as a viable, introductory intervention to reduce sedentary behavior among children with cerebral palsy. |

4. Cardiovascular and Respiratory

| **Study** | **Study type** | **Participants, *technology*** | **Outcomes** |
|---|---|---|---|
| Antonio et al. (2019)[16] | Experimental lab study | 10 subjects with dorso-lumbar SCI<br>*Non-commercial Power standing system* | Lab study, one session. Pulse and oxygen saturation and blood pressure (BP) closer to normal in standing, with systolic BP being the most sensitive. "From a physiological point of view, a therapy with standing devices is necessary, especially for heart functioning, as it |

| | | | |
|---|---|---|---|
| | | | presents more variations that are closer to normal values." P. 822 |
| Edward & Layne (2007)[17] | Experimental lab study over 12 weeks | 4 subjects with SCI *Non-commercial standing frame* | With standing, heart rate changed for all subjects and BP changes occurred – with increases in systolic BP for 2 subjects and decreases for 2 subjects. |
| Kyriakides et al. (2019)[18] | Cross sectional lab study | 10 people w/ cervical SCI & 14 with low thoracic SCI *Standing frame* | ECG readings examined heart rate variability (HRV) in response to postural changes in sedentary and physically active groups. Measurements showed lower HRV in patients with SCI than in controls. The change in high and low frequency and the ratio of HRV following sitting was greater in controls than SCI and greater in people with paraplegia than tetraplegia. Supported standing was related to better HRV profile. |

5. Skin integrity

| **Study** | **Study type** | **Participants, *technology*** | **Outcomes** |
|---|---|---|---|
| Cotie et al. (2011)[19] | Randomized crossover design | 7 subjects with SCI 10 *Tilt table, treadmill* | Supported standing resulted in altered skin temp at all sites. One session of tilt-table use decreased temp at 2 of 6 sites. No changes in resting blood flow observed. |
| Sprigle et al. (2010)[20] | Experimental lab study | 11 subjects with SCI, 6 able-bodied subjects *Power standing system* | Full standing (seat angle 75deg) provided greater unloading than full tilt (seat angle 55deg). Only the standing position (compared to tilt and recline) decreased loads at seat and backrest simultaneously. |

6. MRADLs

Bayley et al. (2020) and Gohlke and Kenyon (2022) examine MRADL participation, but also appeared in motor function and digestion categories, respectively.

| **Study** | **Study type** | **Participants, *technology*** | **Outcomes** |
|---|---|---|---|
| Bayley et al. (2020)[6] | Stepped wedge design over 12 months | 14 adolescents with parents with DMD *Power standing system* | Power standing system on PWC use was associated with improved anxiety/depression and peer relations, and lower dependency scores on PARS III. |
| Gohlke & Kenyon (2022)[13] | Longitudinal case series over 12 months in home setting | 8 participants (5 adults, 3 children) users of *Power standing system* | COPM results increased in occupational performance issues mainly in area of reaching and upper extremity function, and kitchen tasks (stirring pot, cooking, turning water on in sink) and cleaning the house with use of power standing system. |
| Schofield et al. (2020)[21] | Delphi method | *Power standing system* on PWC users, clinicians, and parents | Power standing system users, parents, and clinicians achieved consensus that the power standing system on PWC should enable functional activities in the standing position for prescription of the system. |
| Vorster et al. (2019)[22] | *Qualitative grounded theory (CMS may not consider due to study design, but does reveal important outcomes) | adolescents with DMD, 11 parents & teachers *Power standing system* | Participants described the power standing system on PWC as supporting grooming in bathroom, standing to go toilet, reaching higher places at home, leisure activity participation. |

7. Clinical Practice Guidelines and Position Papers

Paralyzed Veterans of America (2021). Management of Neurogenic Bowel Dysfunction in Adults after Spinal Cord Injury. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8152174/pdf/i1082-0744-27-2-75.pdf "7.2 For some individuals, a standing program may be beneficial for bowel function but should be weighed against other means of physical activity, as well as against precautions to undertake the activity safely. (Level - III; Strength - C; Agreement - strong)"[23] p. 84

Multidisciplinary Association of Spinal Cord Injury Professionals (MASCIP). Clinical guideline for standing adults following spinal cord injury. https://www.mascip.co.uk/wp-

content/uploads/2015/05/Clinical-Guidelines-for-Standing-Adults-Following-Spinal-Cord-Injury.pdf. Published April 2013. Accessed June 15, 2023.[24]

Masselink CE, Detterbeck A, LaBerge NA, Paleg G. Clinician Task Force and RESNA Position on the Application of Supported Standing Devices: Current state of the literature. https://www.resna.org/Portals/0/Position%20and%20Scoping%20Review%20on%20Supported%20Standing%201_23.pdf Published February, 2023. Accessed February, 2023.[2]

The above evidence demonstrates the impact that supported standing has on the health outcomes and quality of life of PWC users that are managing complex medical conditions. The literature suggests that power standing systems start positively impact outcomes from when they are initially integrated into the person's plan of care; however certain body systems, such as bone mineral density, appears to respond better the earlier standing starts after an injury or illness disrupts ambulatory status.

Based on the evidence base and clinical consensus from experts in seating and wheeled mobility, the CTF supports legislation requiring coverage of power standing systems in the state of Minnesota.

Tamara Kittelson, MS, OTR/L, ATP/SMS
Executive Director, Clinician Task Force
Executive Director, Posture 24/7

Cara Masselink, PhD, OTRL, ATP, HPCS
Power Standing System Lead Member, Clinician Task Force
Associate Professor, Western Michigan University

References

1. Centers for Medicare and Medicaid Services. Seat Elevation Systems as an Accessory to Power Wheelchairs (Group 3) [National Coverage Analysis]. May 16, 2023. https://www.cms.gov/medicare-coverage-database/view/ncacal-tracking-sheet.aspx?ncaid=309
2. Masselink CE, Detterbeck A, LaBerge NB, Paleg G. RESNA and CTF Position on the Application of Supported Standing Devices: Current state of the literature [Position Paper]. January, 2023. https://www.resna.org/Portals/0/Position%20and%20Scoping%20Review%20on%20Supported%20Standing%201_23.pdf
3. Baker K, Cassidy E, Rone-Adams S. Therapeutic standing for people with multiple sclerosis: Efficacy and feasibility. *Int J Ther Rehabil.* 2007;14(3):104-109. doi:10.12968/ijtr.2007.14.3.23523
4. Netz Y, Argov E, Burstin A, Brown R, Heyman SN, Dunsky A, Alexander NB. Use of a device to support standing during a physical activity program to improve function of individuals with disabilities who reside in a nursing home. *Disabil Rehabil: Assist Tech.* 2007;2:1:43-49. doi: 10.1080/17483100601143371
5. Riek LM, Ludewig PM, Nawoczenski DA. Comparative shoulder kinematics during free standing, standing depression lifts and daily functional activities in persons with paraplegia: considerations for shoulder health. *Spinal Cord*. 2008;46(5):335-343. doi:10.1038/sj.sc.3102140

6. Bayley K, Parkinson S, Jacoby P, et al. Benefits of powered standing wheelchair devices for adolescents with Duchenne muscular dystrophy in the first year of use. *J Paediatr Child Health*. 2020;56(9):1419-1425. doi:10.1111/jpc.14963
7. Freeman J, Hendrie W, Jarrett L, et al. Assessment of a home-based standing frame programme in people with progressive multiple sclerosis (SUMS): a pragmatic, multi-centre, randomised, controlled trial and cost-effectiveness analysis. *Lancet Neurol.* 2019;18(8):736-747. doi:10.1016/S1474-4422(19)30190-5
8. Hendrie WA, Watson MJ, McArthur MA. A pilot mixed methods investigation of the use of Oswestry standing frames in the homes of nine people with severe multiple sclerosis. *Disabil Rehabil.* 2015;37(13):1178-1185. doi: 10.3109/09638288.2014.957790
9. Alekna V, Tamulaitiene M, Sinevicius T, Juocevicius A. Effect of weight-bearing activities on the bone mineral density in spinal cord injured patients during the period of the first two years. *Spinal Cord.* 2008; 46:727-732. doi:10.1038/sc.2008.36
10. de Bruin ED, Frey-Rindova P, Herzog RE, Dietz V, Dambacher MA, Stüssi E. Changes of tibia bone properties after spinal cord injury: effects of early intervention. *Arch Phys Med Rehabil.* 1999;80:214-20.
11. Kaplan PE, Roden W, Gilbert E, Richards L, Goldschmidt JW. Reduction of hypercalciuria in tetraplegia after weight-bearing and strengthening exercises. *Paraplegia.* 1981;19:289-293.
12. Collins EG, Gater D, Kiratli J, Butler J, Hanson K, Langbein WE. Energy cost of physical activities in persons with spinal cord injury. *Med Sci Sports Exerc*. 2010;42(4):691-700. doi:10.1249/MSS.0b013e3181bb902f
13. Gohlke JH & Kenyon LK. Exploring powered wheelchair standing device use in children and adults: a longitudinal case series. *Disabil Rehabil Assist Technol.* 2022. doi: 10.1080/17483107.2022.2120101
14. LaBerge NB, Detterbeck A, Nooijen CFJ. Comorbidities and medical complexities of mobility device users: a retrospective study. *Disabil Rehabil Assist Technol*. 2023;18(7):1-8.
15. Verschuren O, Peterson MD, Leferink S, Darrah J. Muscle activation and energy-requirements for varying postures in children and adolescents with cerebral palsy. *J Pediatr*. 2014;165:1011-6.
16. Antonio TS, Urrutia F, Larrea A, Espín V, Latta MA. Variations in vital signs associated with postural changes when using a stand-up wheelchair in patients with spinal cord injury. *Adv. Intell. Syst.* 2019;794:818-823. https://doi.org/10.1007/978-3-319-94947-5_80
17. Edward LC, Layne CS. Effect of dynamic weight bearing on neuromuscular activation after spinal cord injury. *Am J Phys Med Rehabil.* 2007;86:499-506.
18. Kyriakides A, Poulikakos D, Galata A, Konstantinou D, Panagiotopoulos E, Chroni E. The effect of level of injury and physical activity on heart rate variability following spinal cord injury. *J Spinal Cord Med*. 2019;42(2):212-219. doi:10.1080/10790268.2017.1383709
19. Cotie LM, Geurts CLM, Adams MME, MacDonald MJ. Leg skin temperature with body-weight-supported treatment and tilt-table standing training after spinal cord injury. *Spinal Cord.* 2011;49:149-153.

20. Sprigle S, Maurer C, Sorenblum SE. Load redistribution in variable position wheelchairs in people with spinal cord injury. *J Spinal Cord Med.* 2010;33(1):58-64. doi:10.1080/10790268.2010.11689674
21. Schofield C, Evans K, Young H, et al. The development of a consensus statement for the prescription of powered wheelchair standing devices in duchenne muscular dystrophy. *Disabil Rehabil*. 2022;44(10):1889-1897. doi:10.1080/09638288.2020.1810786
22. Vorster N, Evans K, Murphy N et al. Powered standing wheelchairs promote independence, health and community involvement in adolescents with Duchenne muscular dystrophy. *Neuromuscl Disord*. 2019;29:221-230.
23. Johns J, Krogh K, Rodriguez GM, et al. Management of Neurogenic Bowel Dysfunction in Adults after Spinal Cord Injury [Clinical Practice Guidelines: Spinal Cord Medicine]. Paralyzed Veterans of America. 2021. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8152174/pdf/i1082-0744-27-2-75.pdf
24. Multidisciplinary Association of Spinal Cord Injury Professionals (MASCIP). Clinical guideline for standing adults following spinal cord injury. Published April 2013. Accessed June 15, 2023. https://www.mascip.co.uk/wp-content/uploads/2015/05/Clinical-Guidelines-for-Standing-Adults-Following-Spinal-Cord-Injury.pdf.