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Feasibility of Dynamic Body Weight Support Use in Post-Critical Illness Rehabilitation

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Abstract

Background: Dynamic body weight support (DBWS) systems support the rehabilitation of individuals recovering from neurological diagnoses but have limited evidence in the context of critical illnesses. This study examines the feasibility of DBWS based therapies during the multidisciplinary rehabilitation of individuals recovering from critical hospitalizations.

Methods: A retrospective chart review was conducted for individuals admitted to a rehabilitation facility following critical illness. Outcome measures included number of DBWS sessions and adverse events. Correlated change in functional measures (Section GG Self-Care, 6-minute walk test [6MWT], timed up and go [TUG]), and quality of life measures (EuroQol 5-Dimension, 5-Level questionnaire [EQ-5D-5L] and visual analog scale [VAS]) were analyzed using paired t-tests or Friedman's tests.

Results: Eighteen individuals participated in DBWS mobility training, as part of their multidisciplinary inpatient rehabilitation program. Individuals completed a mean (SD) of 4(2) sessions with no adverse events. Participants reported significant improvements in global quality-of-life (ΔEQ-VAS: 21[18], p <0.001), as well as in the mobility, self-care, and usual activities domains of the EQ-5D-5L (p < 0.001). Significant gains were also observed in self-care (Δ22 points [IQR:16-25], p < 0.001), TUG time (Δ-23 [25] seconds, p <0.001), and distance ambulated on the 6MWT (Δ144[58] meters).

Conclusions: DBWS is feasible and safe for progressing the upright mobilization of individuals recovering from critical illness. These findings support further investigation of DBWS as a therapeutic tool to enhance functional recovery and quality of life in this population.

Introduction

Critical illnesses are life threatening conditions characterized by multi-organ dysfunction requiring intensive care. Early patient mobilization in the acute care hospital and inpatient rehabilitation facility (IRF) is key to ensuring optimal outcomes in persons recovering from critical illness. Indeed, early mobilization in the intensive care unit (ICU) is associated with improved muscle strength, mobility, functional independence, shorter length of stay, and reduced hospital readmissions[1]. In persons requiring mechanical ventilation, active mobilization in acute care is correlated with improved strength, functional independence, the ability to wean from ventilation, and decreased length of ICU and hospital stays[2]. Early active mobilization protocols may be initiated safely in the ICU and continued in the post-ICU setting[3,4]. Despite this, many patients who would benefit from early mobilization are difficult to mobilize due to medical complexity, muscle weakness, or body

weight, requiring the assistance of several staff members and precautions to ensure patient safety[5].

Advancements in medical treatments are increasing survival rates after discharge from the ICU; however, survivors are left with long-term impairments in the cognitive, psychiatric, and physical domains that require continued medical supervision and inpatient rehabilitation[6]. While many acute care facilities encourage early mobilization, activities can be limited to passive range of motion, in-bed exercises, and transfers; upright mobility training may not be attempted until inpatient rehabilitation. There is limited evidence informing rehabilitation strategies following discharge from the ICU[7].

Technologies supporting the safe and early mobilization of individuals recovering from critical illness may assist them in their physical recovery[8]. One such technology is dynamic body weight support (DBWS) systems. These ceiling mounted robotic trolly and harness systems provide variable body weight support to allow patients to safely practice and transition between sit to stand exercises, dynamic balance, and stair and gait training activities. Some DBWS systems, like the Vector Gait & Safety System (Bioness, Valencia, CA) analyze patient movements and prevent falls, allowing patients to challenge themselves in an environment that promotes patient and therapist safety.

DBWS has been used to improve outcomes in persons with neurological conditions such as stroke[9], traumatic brain injury[10], and spinal cord injury[11,12]. However, DBWS may also allow for earlier mobilization of additional patient populations, including persons recovering from medically complex cardiac or pulmonary conditions[13]. Recently, this IRF established in-hospital clinical guidelines for mobilizing persons with medically complex diagnoses, including individuals previously or currently mechanically ventilated, using DBWS. A retrospective analysis was conducted to determine the feasibility of DBWS based mobility training as part of multidisciplinary inpatient rehabilitation for persons recovering from critical illness. Number of DBWS sessions, adverse events, and correlated functional outcome measures and assessments of quality of life are reported.

Methods

Procedure: This retrospective cohort study reviewed the medical records of persons admitted to the cardiopulmonary unit of a free-standing IRF between March 1st, 2024 and January 31st, 2025. The purpose was to evaluate feasibility of a unit-based initiative to promote the upright mobilization of previously or concurrently mechanically ventilated persons recovering from critical illness. This study was approved by the <redacted > Institutional Review Board in accordance with the Declaration of the World Medical Association and was found to meet criteria for an exempt study based on the federal regulations defined in 45 CFR 46.104(d). This decision included a waiver of informed consent / Health Insurance Portability and Accountability Act. This study conforms to all Strengthening the Reporting of Observational Studies in Epidemiology guidelines. As part of routine practice, trained therapists followed clinical guidelines established on the unit to mobilize patients recovering from critical illness using DBWS during standard therapy hours. These guidelines included screening for any contraindications to Vector DBWS use, ensuring no major change in medical status within the last 48 hours, tolerance of traditional acute rehabilitation therapy duration and frequency, physician orders, and clearance from respiratory therapy for ventilated patients. Patients requiring significant levels of assistance with mobilization were prioritized.

Patient records were retrospectively screened to identify patients who may have been potentially appropriate for mobilization using DBWS. Inclusion criteria for record review were as follows: (1) ≥ 18 years of age at time of admission, (2) mechanically ventilated during their prior hospital stay, (3) prolonged prior hospitalization length greater than 14 days, (4) required assistance to walk 10 ft upon admission to the IRF, and (5) independent ambulator prior to illness. Exclusion criteria were as follows: (1) discharged from the IRF to an acute care hospital for a higher level of care, or (2) unable to use the Vector DBWS System due to its contraindications, which include >500 lbs or <30 lbs, external halo neck support, severe osteoporosis, uncontrolled diabetes, uncontrolled hypertension, and unstable fractures.

Outcome Measures: Functional abilities were assessed at admission and discharge using Section GG Physical Functioning mobility and self-care items on the Centers for Medicare and Medicaid Services Inpatient Rehabilitation Facility Patient Assessment Instrument[14]. Section GG Mobility Walk scores were calculated as the sum of individual mobility and walking items (rolling left to/from right, sitting to lying, lying to sitting, sitting to standing, chair/bed-to-chair transfer, toilet transfers, and car transfers, walking 10 feet, 50 feet with 2 turns, 150 feet, navigating uneven surfaces, 1 step/curb, 4 steps, 12 steps, and picking up an object). Self-care scores were calculated as the sum of individual items (eating, oral hygiene, toileting hygiene, showering/bathing, upper body dressing, lower body dressing, and donning/doffing footwear). Individual items were scored on a scale of 1–6, with 6 representing complete functional independence for the activity. Possible total scores ranged from 7 to 42 for self-care and 15 to 90 for Mobility Walk.

The 6-minute walk test (6MWT) was utilized to assess aerobic capacity and endurance upon admission and discharge from the IRF [15]. Individuals unable to ambulate

were assigned a score of 0 according to test instructions. A minimal clinically important difference of 30.5 meters has been described for adults with cardiopulmonary pathologies[16].

Patient self-assessment of health-related quality of life was assessed at admission and discharge using the Euro-Quality of Life 5 Dimension 5 Length (EQ-5D-5L) survey and Visual Analog Scale (EQ-VAS)[17]. The EQ-5D-5L includes 5 questions about self-care, mobility, usual activities, pain and anxiety/depression. Questions are scored on a 1-5 scale, where 1 indicates no problems and 5 indicates extreme problems. The EQ-VAS is a rating of perceived overall health, ranging from 0 to 100, with a score of 100 indicating the best possible health. A minimal clinically important difference of 10 has been described in the EQ-VAS for survivors of critical illness[18].

The timed up and go (TUG) test was utilized to assess fall risk, with scores >13.5 seconds indicating increased fall risk[19]. The TUG was administered during the first and last DBWS sessions.

Total distance ambulated and gait speed (meters/s) was collected during each session by Vector Gait & Safety System session analysis software.

Adverse events were evaluated via retrospective chart review and defined as a medical emergency or clinically meaningful change in vital signs (e.g. heart rate, blood pressure, respiratory rate, or oxygen saturation) that suggested hemodynamic or physiologic instability and required medical intervention occurring during DBWS training. Vital signs were evaluated at the beginning, during, and at the end of each session.

Data Analysis: Data were analyzed using the Statistical Package for Social Sciences (SPSS Version 29, 2023). Continuous variables (EQ-5D-5L VAS, 6-Minute Walk Test, TUG) are reported as mean (SD) and analyzed using paired samples *t*-tests. Ordinal scores are reported as median (interquartile range); repeated ordinal data were analyzed using Friedman's test.

Data was missing for several outcome measures: 6-minute walk test (missing 19%), maximum gait speed (17%), steps/session (22%), EQ-5D-5L (25%), TUG (33%). To minimize bias and information loss, for outcomes with < 35% missing data, missing values were imputed using multivariate imputation by chained equations (R Studio). Section GG Mobility Walk items were frequently not scored (70%) on admission for safety reasons, preventing the imputation of admission and change scores for this measure.

Results

Fifty-four individuals met eligibility criteria for record review, with 18 individuals receiving mobility training with DBWS while admitted to the IRF. Of the 36 individuals who did not receive the DBWS intervention, 32 were walking within the first week of admission. These individuals likely did not trial DBWS as the unit initiative prioritized non-ambulatory patients due to limited availability of the DBWS system and access to alternative physical therapy interventions for patients needing less assistance. Four individuals were likely deemed too medically complex for DBWS, with complications including cognitive or neurologic impairment (e.g., muscular dystrophy, Down syndrome), and end-stage kidney disease on dialysis. Among those who received DBWS training, the time from IRF admission to the initiation of training varied, ranging from 3 to 29 days. Demographic and clinical characteristics of the 18 participants receiving DBWS training are presented in Table 1. The cohort included an equal number of men and women, with an average age of 62(11) years. Participants experienced prolonged hospitalization prior to admission to the IRF with a mean acute care stay of 38(15) days, and 78% required tracheostomy placement to manage prolonged mechanical ventilation. Patients were admitted to the IRF for an average of 27(8) days, with 50% of patients requiring rehabilitation for critical illness myopathy and 50% for respiratory failure.

Regardless of DBWS use, all patients received 3 hours of therapy per day, 5 days per week as part of standard inpatient rehabilitation treatment. The average number of sessions with DBWS was 4(2) with a range of 1-9 sessions. Most (88%) patients had more than 1 session and 55% had more than 2 sessions.

Eighty-nine percent of the patients (16/18) were only completing pre-gait tasks prior to initiation of DBWS training. The other two patients were able to ambulate short-distances prior to attempting DBWS. The first session was generally utilized to establish patient-specific DBWS settings, and practice ambulation. Patients walked an average of 68(28) meters in their first session. Subsequent sessions progressed towards longer distances, stair training, and dynamic balance tasks. Total distance ambulated significantly increased from the first to second session (2nd Session: 121[37] meters, $p < 0.001$, paired *t*-test). Maximum walking speed did not significantly differ from Session 1 (0.35[0.09] m/s) to Session 2 (0.36[0.09], $p=0.422$, paired *t*-test). There were no adverse events associated with DBWS use.

Following the initial DBWS session, 61% of patients (11/18) were ambulating overground with a walker and one-person assistance without the DBWS support. Twenty-eight percent (5/18) of individuals achieved this after two sessions. The final 11% (2/18) were ambulating short distances overground prior to initiation of the DBWS.

By discharge, participants demonstrated a clinically and statistically significant increase in their self-reported assessment of health status (Δ EQ-VAS: 21[18], $p < 0.001$),

Table 1: Participant Demographics and Clinical Characteristics

Gender	Age	Diagnosis	Tracheostomy	Acute LOS	Rehab LOS	Number of DBWS Sessions	Rehab Day DBWS Trialed
M	48	Critical Illness Myopathy	N	37	35	5	15
F	68	Pneumonia/Respiratory Failure	Y	46*	36	9	4
F	40	Critical Illness Myopathy	Y	71	25	6	7
M	64	Critical Illness Myopathy	Y	52	17	4	4
F	70	Critical Illness Myopathy	Y	35	27	1	21
F	75	Acute on Chronic Respiratory Failure	Y	26	22	2	3
M	57	Respiratory Failure Post Surgery	Y	33	31	3	17
F	62	Critical Illness Myopathy	Y	30	35	6	12
M	71	Respiratory Failure Post Surgery	Y	38	25	2	19
F	79	Acute on Chronic Respiratory Failure	Y	49*	24	2	14
M	48	Acute Respiratory Failure	N	18	18	2	5
M	72	Critical Illness Myopathy	N	14	12	1	3
F	72	Acute Respiratory Failure	Y	35	30	6	6
M	65	Multiple Trauma with Acute Respiratory Failure	Y	44	32	5	8
F	58	Critical Illness Myopathy	Y	47	29	6	9
M	66	Critical Illness Myopathy	Y	61	37	3	29
F	59	Respiratory Failure	Y	49	29	2	7
M	49	Critical Illness Myopathy	N	16	15	1	5

LOS, Length of Stay, in Days; *Includes 2 prior acute stays, 1 prior to IRF admission

Table 2: Rehabilitation Outcome Measure Scores

Measure	Admission	Discharge	Change	P-value
EQ-5D-5L VAS – mean (SD)	54 (18)	75 (15)	21 (18)	<0.001
EQ-5D-5L Domains – median (IQR)				
- Mobility	5 (4 to 5)	2 (1 to 3)	-2 (-3 to -1)	<0.001
- Self-Care	4 (3 to 5)	2 (1 to 3)	-2 (-2 to 0)	<0.001
- Usual Activities	5 (4 to 5)	3 (2 to 3)	-2 (-3 to -1)	<0.001
- Pain	3 (1 to 4)	2 (1 to 3)	0 (-2 to 1)	0.564
- Anxiety/Depression	2 (1 to 3)	1 (1 to 2)	0 (-1 to 0)	0.366
Section GG Self Care – median (IQR)	12 (10-15)	35 (27 to 41)	22 (16 to 25)	<0.001
Section GG Mobility Walk – median (IQR)	not calculated	66 (44 to 81)	not calculated	not calculated
Timed Up and Go (seconds) – mean (SD)	63 (24)	39 (18)	-24 (25)	<0.001
6-Minute Walk Test (meters) – mean (SD)	0 (0)	144 (58)	144 (58)	<0.001

EQ-5D-5L scoring: (5) unable, (4) severe problems, (3) moderate problems, (2) slight problems, (1) no problems

and quality of life assessments of mobility (Δ -2[IQR: -3 to -1], $p < 0.001$), self-care (Δ-2[IQR: -2 to 0], $p < 0.001$), and usual activities (Δ-2 (IQR: -3 to -1), $p < 0.001$) on the EQ-5D-5L (Table 2). Patients demonstrated statistically significant improvements in their Section GG self-care (Δ22 [IQR:16-25], $p < 0.001$). Most individuals were unable to safely complete most Section GG Mobility Walk items on admission. However, the median Section GG Mobility Walk score at discharge was 66 out of 90 (IQR: 44 to 81). Despite remaining a high fall risk, patients made clinically and statistically significant improvements in their TUG scores (Δ-23 [25] seconds, $p < 0.001$). Patients demonstrated statistically and clinically significant improvements in their 6-minute walk test with improvements from being unable to walk on admission to ambulating 144(58) meters on discharge ($p < 0.001$) as noted in Table 2.

Discussion

Currently, there is limited evidence[13] regarding the use of dynamic body weight-controlled systems in the rehabilitation of patients following critical illness with mechanical ventilation. This study found that rehabilitation with use of DBWS was feasible and safe in this population, with no adverse events associated with use

The time to initiate DBWS training was variable and may possibly be attributed to a small number of clinicians being trained with the system, as well as clinical guidelines established on the unit ensuring patients were tolerating traditional rehabilitation intensity prior to trialing DBWS. Significant muscle weakness, impaired cognition, and medical management also proved to be a barrier for some. Patients benefited most from DBWS once demonstrating

trunk control, had the ability to tolerate standing, and had built enough endurance to tolerate a full session.

The DBWS system empowered therapists to develop more effective and challenging treatment regimens, with the potential to accelerate the rehabilitation course of persons recovering from critical illness. The open harness and overhead spreader bar allowed for accommodation of medical equipment, hemodynamic monitoring equipment, supplemental oxygen devices, tracheostomies, and mechanical ventilation tubing that is often needed during therapies of persons recovering from critical illness and cardiopulmonary pathologies. The dynamic nature of the system accommodated pre-gait exercises, using the ascent-assist setting, which allowed patients to practice sit-to-stand transitions with body weight off-loading provided and adjusted in real time based on patient effort. The security of the harness and fall recovery options allowed therapists to facilitate patient movements, instead of guarding and physically supporting individuals. This allowed for greater independence with movements and provided a safe environment that promoted confidence and encouraged task progression. While the unit initiative prioritized non-ambulatory patients, higher-level individuals may also benefit from the safety features of the system, which allowed for more challenging activities, including practice with stairs, and balance training with minimized risk of injury.

Following intensive multidisciplinary therapies at the IRF, patients demonstrated statistically significant improvements in quality of life, including gains within the mobility, self-care, and usual activities domains. Clinically meaningful increases in cardiovascular endurance were observed with gains on the 6-minute walk test, with average gains of 144 meters, far exceeding the minimal clinically significant important difference threshold (30.5 meters)[16]. While patients remained at risk of falls based on the scoring of the TUG, clinically and statistically significant improvements were made in speed, with individuals reducing TUG times by an average of 24 seconds.

While these findings support the idea that DBWS can be safely integrated as part of multidisciplinary therapy for patients recovering from critical illness, due to the retrospective nature of this study and likely contribution of other therapies received during inpatient rehabilitation, the specific role of DBWS in affecting these outcomes remains unclear. Prospective studies, using a randomized controlled design, are needed to determine if DBWS improves outcomes beyond conventional approaches.

Study limitations include the small sample size requiring imputation. Research was conducted at a single inpatient rehabilitation facility and there was variability in the number of sessions that the patients received. There is inherent selection bias, driven by unit procedures that prioritized individuals requiring higher levels of assistance with walking. Only two clinicians on the unit were trained in use of the DBWS system, and having additional staff trained would have allowed for more consistent implementation of the technology, without the constraints placed on a limited number of therapists' schedules.

Conclusion

This retrospective study describes the use of a DBWS system for safe mobility practice in persons recovering from critical illness following prolonged hospitalization with mechanical ventilation. Our research builds upon emerging evidence that this technology can be utilized to support the rehabilitation of this patient population. Adjustable Vector DBWS settings and features, including ascent assist and gait smoothing, allowed for safe and adjustable reduction in offloading assistance with patient progression. DBWS also permitted ambulatory practice with a single therapist, making therapy sessions less resource intensive.

Further studies are needed to evaluate the broader applicability, optimal protocols, and long-term benefits of DBWS in persons recovering from critical illness, including randomized controlled trials to better define its role in critical care rehabilitation.

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Conflict of Interest declaration

The authors have no conflicts of interest to declare.

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Authorship

All authors meet ICMJE criteria: substantial contribution, drafting or critical revision, final approval, accountability for all aspects.

Ethical Clearance

< redacted > Institutional Review Board (IRB) determined this study to be exempt. Study Number: < redacted >

References

1. Adler J, Malone D. Early mobilization in the intensive care unit: a systematic review. Cardiopulm Phys Therapy J. 2012; 23(1): 5-13. doi: 10.1097/01823246-201223010-00002.
2. Li A, Peng X, Zhu B, Zhang Y, Xi X. Active mobilization for mechanically ventilated patients: a systematic review. Arch Phys Med Rehabil. 2013; 94(3): 551-561. doi: 10.1016/j.apmr.2012.10.023.

3. Hodgson C, Bellomo R, Berney S, et al. Early mobilization and recovery in mechanically ventilated patients in the ICU: a bi-national, multi-centre, prospective cohort study. Crit Care. 2015; 19(1):81. doi: 10.1186/s13054-015-0765-4.

4. Hodgson CL, Bailey M, Bellomo R, et al. Early Active Mobilization during Mechanical Ventilation in the ICU. N Engl J Med. 2022; 387(19): 1747-1758. doi: 10.1056/NEJMoa2209083.

5. Perlow E, Tunney N, Lucado A. Integrating safe patient handling into physical therapist education: reducing the incidence of physical therapist injury and improving patient outcomes. J Phys Ther Educ. 2016; 30(2): 32-37. doi: 10.1097/00001416-201630020-00007.

6. Ahmad MH, Teo SP. Post-intensive Care Syndrome. Ann Geriatr Med Res. 2021;25(2):72-78. doi: 10.4235/agmr.21.0048.

7. Connolly B, O'Neill B, Salisbury L, Blackwood B: Enhanced recovery after critical illness programme group. Physical rehabilitation interventions for adult patients during critical illness: an overview of systematic reviews. Thorax. 2016; Oct; 71(10): 881-890. doi: 10.1136/thoraxjnl-2015-208273.

8. Kwakman RCH, Voorn EL, Horn J, et al. Steps to recovery: body weight-supported treadmill training for critically ill patients: a randomized controlled trial. J Crit Care. 2022; 69: 154000. doi: 10.1016/j.jcrc.2022.154000.

9. Huber J, Elwert N, Powell ES, et al. Effects of dynamic body weight support on functional independence measures in acute ischemic stroke: a retrospective cohort study. J Neuroeng Rehabil. 2023; 6: 1-9. doi: 10.1186/s12984-023-01132-9.

10. Anggelis E, Powell ES, Westgate PM, et al. Impact of motor therapy with dynamic body-weight support on Functional Independence Measures in traumatic brain injury: An exploratory study. Neurorehabilitation. 2019; 45(4): 519-524. doi: 10.3233/NRE-192898.

11. Powell ES, Lopez J, Westgate PM, et al. Effects of dynamic overground body weight support training during inpatient rehabilitation after traumatic spinal cord injury: A retrospective case series. Am J Phys Med Rehabil. 2022; 101(2): 196-200. doi: 10.1097/PHM.0000000000001828.

12. Huber JP, Sawaki L. Dynamic body-weight support to boost rehabilitation outcomes in patients with non-traumatic spinal cord injury: an observational study. J Neuroeng Rehabil. 2020; 17: 157. doi: 10.1186/s12984-020-00791-2.

13. Haught M, Bodine JK, Khan AY, et al. Dynamic overground body weight-supported gait rehabilitation in a mechanically ventilated patient. J Rehab Therapy. 2025; 8(3): 4-8. doi: 10.29245/2767-5122/2025/1.1167.

14. Centers for Medicare & Medicaid Services. Inpatient Rehabilitation Facility Patient Assessment Instrument (IRF-PAI), Version 4.2, effective October 1, 2024. Published February 1, 2024. Accessed April 6, 2026. https://www.cms.gov/files/document/irf-pai-version-42-effective-10-01-24-final.pdf

15. Matos Casano, H.A; Anjum, F. Six Minute Walk Test. In StatPearls; StatPearls Publishing: Treasure Island, FL, USA, 2022. Available online: https://www.ncbi.nlm.nih.gov/books/NBK576420/ (accessed on 30 March 2026).

16. Bohannon RW, Crouch R. Minimal clinically important difference for change in 6-minute walk test distance of adults with pathology: a systematic review. J Eval Clin Pract. 2017; 23(2): 377-381.doi: 10.1111/jep.12629.

17. Herdman M, Gudex C, Lloyd A, et al. Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). Qual. Life Res. 2011;20:1727–1736. doi: 10.1007/s11136-011-9903-x.

18. De Silva S, Neto AS, Sathe A, Higgins AM, Hodgson CL. The psychometric properties of the EuroQol 5D five level in survivors of critical illness. Crit Care Med. 2025; 53(1): e151-e160. doi: 10.1097/CCM.0000000000006516.

19. Shumway-Cook A, Brauer S, Woollacott M. Predicting the probability for falls in community-dwelling older adults using the Timed Up and Go test. Phys Ther. 2000; 14(9): 896–903. doi: 10.1093/ptj/80.9.896.