

DEPARTMENT OF THE ARMY  
NORTH ATLANTIC REGIONAL MEDICAL COMMAND  
6900 Georgia Avenue N.W.  
Washington, DC 20307-5001

NARMC Pamphlet  
No. 40-7

Medical Services

**NEUROMUSCULAR REHABILITATION VIA TELEBIOFEEDBACK AS A PORTAL FOR HOME CARE**

1. **History** This is a new North Atlantic Regional Medical Command (NARMC) regulation.
2. **Applicability** The Neuromuscular Rehabilitation via Telebiofeedback as a Portal for Home Care Project reduces lost time for military personnel who might need medical treatment not normally available within the NARMC or TRICARE Region I.
3. **Purpose** This Clinical Business Practice is a guide to the successful implementation and operation of the Neuromuscular Rehabilitation via Telebiofeedback as a Portal for Home Care Project.
4. **References** MotoVate User Guide.
5. **Responsibilities** Referring Facility.
  - a. Requesting Health Care Provider.
    - (1) The chief will have overall responsibility for the conduct of the study and will be responsible for data analysis and the writing of the manuscript.
    - (2) Preventive Medicine and Rehabilitation (PM & R) will assist the Principal Investigator (PI) in protocol related duties, to include serving as an unbiased or "blinded" examiner for the baseline and follow-up evaluations (allowing the physical therapist the freedom of conducting the BioRehab™ sessions without subjecting him/her to the potential bias-producing situation of also performing the examinations).
    - (3) Enhanced Mobility Technologies will have consulting responsibilities as the creator of the BioRehab™ System. They will be responsible for teaching use of the BioRehab™ System to the physical therapist and for establishing the treating protocol for subjects. The contractor will assist the PI in evaluating the usability aspects of the tele-rehabilitation system with interpretation of statistical analyses. They will also serve as the second author in the preparation of the manuscript.
    - (4) Physical Therapist will be the main physical therapist and as such, will be responsible for the therapeutic sessions with the patients.
    - (5) Research Nurse will be responsible for the logistical organization and coordination of all the aspects of the protocol. They will maintain research files. They will contact and arrange for patient appointments. They will assist the Physical Therapist as needed.
    - (6) Supervisor, Gait Laboratory will be in charge of running the Gait Laboratory evaluation sessions.
    - (7) Neurology Staff will serve as Neurology Consultant for the project and will provide expertise regarding telemedicine issues (they have an approved acute stroke telemedicine protocol). They will also be the main referral source of hemiplegic patients.

(8) Biostatistician will serve as the biostatistician for the study.

(9) Occupational Therapy will serve as the point of contact and referral source from Occupational Therapy. They will also become familiar with the BioRehab™ System as this system can have future applications for research in Occupational Therapy.

b. Deployment Team. The Deployment Team is responsible for providing all technical support and training to the designated site.

c. System Administrator. The System Administrator is responsible for all of the administrative functions, e.g., validating user authorization request, noting system problems and ensuring that regular scheduling backups are scheduled.

d. Project Manager.

(1) Coordinate clinical, technical and operational requirements.

(a) Gathers and prepares necessary documentation for relevant training manuals, clinical business practices and system maintenance and support documentation.

(b) Monitors compliance with necessary legal and or ethical restrictions, including formulation and update of necessary privacy and/or security policies, as well as oversight of any intellectual property rights in the system that may be owned by the government or for which the government might be obligated/liable to third parties.

(2) Coordinate system deployment, maintenance and sustenance.

(3) Oversees development suggestions in order to ensure a uniform product.

(4) Performs application system administrator functions on a daily basis. These include:

(a) Maintaining user accounts, authorizing and deleting users from the system.

(b) Monitoring system throughout to ensure timely consult follow-up.

(c) Monitoring overall system performance and availability.

(d) Monitoring to ensure scheduled backups are performed on data and software applications.

(5) Serves as the telemedicine & technology consultant for this project.

**6. Scope of Care** The need for rehabilitation is increasing as the military strives to retain skilled soldiers (as opposed to discharging soldiers and placing them under Veterans Administration care) during these times of recruitment and retention problems. Furthermore, the costs of temporary duty (TDY) to outlying posts where rehabilitation services are not available place a double strain on the system: the costs of the TDY itself, and the cost of depriving the specialist from the health care pool of his/her base hospital.

Other rehabilitation professionals (physical and occupational therapists) are confronting similar issues. Thus, a system that can offer rehabilitation and consultation at-a-distance can serve to "force multiply" the rehabilitation assets within the military medical system. Although the sample population in this study is afflicted by neurological pathology, the principles of tele-rehabilitation used in this study can be applied to other numerous diagnostic entities. This provides further validity to the force multiplication of rehabilitation assets.

## 7. System Requirements

a. Telemedicine Web Server Support. The Neuromuscular Rehabilitation via Telebiofeedback Project is a complex system using several software tools to create the communications link, input screens, and data security.

b. The following software packages were used in the development of the Neuromuscular Rehabilitation via Telebiofeedback System:

(1) PC Anywhere Version 10.5.

(2) MotoVate System Kit.

c. System Requirements.

(1) Windows 2000 or Windows NT.

(2) Class 2 electronic device.

(3) Laser Printer (To print project forms).

(4) Computer with 800Mhz processor, 128 MB RAM Memory, 200 MB hard drive, 16 MB graphic card and 15" Monitor 1024x768 BPI.

## 8. Consult Generation Process

a. Recruitment.

(1) Patients will be recruited by referral from the Physical Therapy, Occupational Therapy, Physical Medicine & Rehabilitation, and Neurology services.

(2) Associate investigators from each of these services will serve as the points of contact through which referrals will be made.

b. Consent process.

(1) Upon referral to the study, patients will receive an appointment with the PI or his designated associate investigator, who will first verify that the subject meets the inclusion criteria for the study.

(a) Convenience sample from a population of military eligible patients, older than 18 years, of all genders and ethnic backgrounds, who are being treated for chronic hemiplegia.

(b) Gait impairment involving increased tone in ankle plantarflexion and knee extension during the swing phase of gait (i.e. hemiplegic gait).

(c) Diagnoses of cerebral palsy, hemorrhagic/ischemic stroke, brain injury, and brain tumor (non-progressive & post resection).

(d) Minimum of eight months post onset of neurologic diagnosis.

(e) Brain magnetic resonance imaging (MRI) (to be ordered if none available within the last five years). The appointment meeting will occur in the Physical Medicine & Rehabilitation Service. Once it has been determined that the patient is a candidate for the study, the patient will receive full explanation of the objectives, rationale, and methodology of the research project.

(2) The patient will then be given the consent form to read and once the patient has read the consent form, all questions that may arise will be answered to the full satisfaction of the patient.

(3) The patient will then be asked to communicate back to the Principal Investigator (PI) (or his designee) what is his/her understanding about the research study and its ramifications. Only after the patient has verbalized this understanding will the consent form be signed.

c. Study design and methodology

(1) This will be a prospective self-controlled clinical trial with repeated measures based on a convenience sample of 20 patients with chronic hemiplegia. The treatment intervention will be performed twice per week for six weeks of treatment.

(2) We will use the BioRehab™ System as the treatment intervention (*independent variable*). The BioRehab™ System is a surface electromyography (EMG) system that uses a personal computer (PC) game as an interaction metaphor and to provide feedback to the patient. The EMG device is a four channel EMG (Pathway MR-400 EMG amplifier), connected to a dedicated personal computer (Windows platform) running BioRehab™ software and adapted PC games designed to engage patients into performing specific muscle activation combinations according to the therapeutic goals established by the therapist. The system uses the muscle activation detected by the EMG electrodes to control movements of the cursor or of some game element (like a car steering wheel) on the computer's screen. The therapist can select which muscle group will be used to drive each cursor movement, and which game is more adequate for each patient, as well as the difficulty level for the patient to perform their muscle contractions.

(3) We propose two main stations for use in this project. These stations are differentiated by function and physical characteristics. The remote station is located where the patient and therapy will take place (Physical Therapy Gym); it will be equipped with the BioRehab System and video teleconference (VTC) capabilities. A therapy technician or one of the associate investigators will be present with the patient at the remote station and will be responsible for both supervising the patient during the patient's setup and treatment and operating the telemedicine system. The local site station (Therapist Station) is equipped with the same capabilities as the remote station, including a desktop sharing functionality to allow the therapist to control the computer and BioRehab System at the remote station. The therapist station will be located in the PM & R Service.

(4) All patients will have brain magnetic resonance imaging (MRI) data available at the onset of the study (if MRI is not on record and available within the last five years, a new MRI will be ordered). The information from this MRI will be used to evaluate and account for any possible wide variation in improvement from one patient to the other that could be explained by the location of the infarction (for example, when one patient has had a large infarction destroying the internal capsule as compared to another patient with a minor cortical infarction).

(5) Patients will be given the opportunity to accept a referral/consultation to the Stroke Rehabilitation Clinic of the National Institutes of Health (NIH) (Building # 10, 7<sup>th</sup> floor; Appointments: 301-402-1916). This referral is being made because we feel that the subjects in our study represent an ideal population for the evaluation of neuroplasticity, which cannot be performed at Walter Reed Army Medical Center (WRAMC) due to the non-availability of the sophisticated equipment needed for these evaluations. Upon referral, the patients will be screened for possible inclusion into one of several National Institutes of Health (NIH) protocols on Transcranial Magnetic Stimulation (TMS). Transcranial Magnetic Stimulation is a technique that allows for the evaluation of cortical maps and their plasticity. No collaboration exists between the NIH and the investigators in this protocol.

(6) *Measurements/Dependent Variables* (to be performed at baseline, at end of the 6 weeks of treatment, and two months following treatment). The demographic data (age, gender, race, highest level of education, medical diagnosis, side of injury, side of hemiplegia, physical examination, level of pain) collected only at baseline. Tests include Tinetti and Berg tests of gait and balance, Spasticity Measurement (Pendulum Test & Modified Ashworth Scale), seated toe tapping, standing toe raises and heel raises (number of raises in one minute). The gait will consist of free walking, on a level surface, at a self-selected pace (without orthotic but with assistive devices as needed), distance walked in six minutes (endurance) (*this is the primary outcome variable*), velocity for three meter distance (middle three of nine meter walking), time to ascend three stairs with handrail as needed and time to descend three stairs with handrail as needed.

(7) Gait laboratory evaluation: the gait analysis will employ six infrared cameras to determine three dimensional marker trajectories, one force-platform, (and a dynamic EMG machine). The gait lab equipment will be calibrated prior to each subject's data collection. Spherical markers will be placed on specific bilateral anatomic and bony landmarks using hypoallergenic tape. The subject will stand motionless for one second in the center of the walkway so that reference kinematic values can be collected. The subject will then ambulate the length of the walkway (30 feet) until six sets of data are collected (three sets with each foot striking the platform) and sufficient for analysis (without mechanical errors, with good foot placement on the force-platform, with each marker being visible to at least two cameras at all times). A gait cycle involves two phases per lower limb: stance phase and swing phase. Data for each gait cycle will be analyzed in accordance with its gait cycle phase. Kinematic & Kinetic parameters will be measured.

d. *User Acceptance*. An evaluation of the acceptance of the system by our two main groups of users (therapist and patients) will be conducted. The evaluation will occur via a questionnaire that conforms to the standards for telemedicine methods approved by the American National Standards Institute. Due to the novelty of the telemedicine technological innovations, there are no standardized validated questionnaires to evaluate user acceptance in this field. The information gathered with this tool will be presented in purely descriptive terms.

### 3. Data Collection

(1) Appendix A contains the Inclusion & Exclusion Criteria Checklist.

(2) Appendix B contains the General Data Collection Form. The eleven items listed in the table on page four of this form are general physical examination evaluations routinely performed in patients with spasticity and balance problems when presenting for rehabilitation evaluations and as such, can be considered standard of care clinical evaluation tools. The Modified Ashworth Scale has been found to be reliable in the measurement of spasticity after stroke (Kappa 0.84 for inter-rater and 0.83 for intra-rater [51]). The six minute walk test has been found to be a reliable and valid tool in the evaluation of mobility (one week test-retest reliability Kappa 0.95 [52]).

(3) Appendix C contains the Gait Laboratory Data Collection Sheet.

(4) Appendix D contains the User Acceptance Questionnaire (Part I – Therapist; Part II – Patient). As stated previously, this questionnaire conforms to the standards for telemedicine methods approved by the American National Standards Institute. Due to the novelty of the telemedicine technological innovations, there are no standardized validated questionnaires to evaluate user acceptance in this field.

(5) Appendix E contains the Tinetti & Berg Test.

**APPENDIX A**  
Inclusion/Exclusion Criteria Check List

**STUDY CODE #:** \_\_\_\_\_

	<b>Meets Inclusion Criteria?</b>	
	<b>Yes</b>	<b>No</b>
<b>Subject Inclusion Criteria:</b>		
1. Military eligible patient		
2. Older than 18 years		
3. Hemiplegic gait		
4. Diagnoses of cerebral palsy, hemorrhagic/ischemic stroke, brain injury, and brain tumor (non-progressive & past resection)		
5. Minimum of 8 months post onset of neurologic diagnosis		
6. Brain MRI (within the last 5 years) New MRI ordered?		
<b>Subject Exclusion Criteria:</b>		
1. Moderate or severe cognitive impairment (unable to follow or recall instructions as per Minimental Status Examination)		
2. Unable to perceive the computer games on the monitor		
3. Progressively degenerative neurologic or musculoskeletal Condition		
4. Female of childbearing age Pregnancy test positive?		
5. History of claustrophobia (if a new brain MRI study is needed).		

**APPENDIX B**  
General Data Collection Sheet

Subject Study ID Code: \_\_\_\_\_

Date (baseline evaluation): \_\_\_\_\_

Diagnosis/Onset: \_\_\_\_\_ Side of Injury: \_\_\_\_\_ Side of Hemiplegia: \_\_\_\_\_

Previous treatment: \_\_\_\_\_

\_\_\_\_\_

Current Medications: \_\_\_\_\_

\_\_\_\_\_

Medical history: \_\_\_\_\_

\_\_\_\_\_

Pregnant – if child bearing age: (circle one) n/a    yes    no  
 If unsure, urine pregnancy test result: \_\_\_\_\_

Other: \_\_\_\_\_

\_\_\_\_\_

Referring Service/Physician: \_\_\_\_\_

Gender: M    F    Age: \_\_\_\_\_

Highest Level of Education: \_\_\_\_\_

Race: \_\_\_\_\_Caucasian, \_\_\_\_\_African American, \_\_\_\_\_  
 Hispanic, \_\_\_\_\_Asian, \_\_\_\_\_Other (specify: \_\_\_\_\_)

General Data Collection Sheet - Page 2

Motor Control: \_\_\_\_\_ isolated \_\_\_\_\_ part isolated \_\_\_\_\_ synergistic  
 (describe) \_\_\_\_\_

Strength: (as appropriate) / ROM

Left	Muscle	Right
/	Hip flexion	/
/	Hip extension	/
/	Hip abduction	/
/	Hip adduction	/
/	Knee extension	/
/	Knee flexion	/
/	Dorsiflexion	/
/	Plantarflexion	/

ROM: document limitations of UE, Trunk, and LE in addition to the following:

Left

Right

	Popliteal angle	
	SLR	

Reflexes: \_\_\_\_\_

Tone: \_\_\_\_\_

General Data Collection Sheet – Page 3

Sensation: (impaired-normal) (left/right)

Lt touch \_\_\_\_\_  
Pain \_\_\_\_\_  
Proprioception \_\_\_\_\_  
Kinesthesia \_\_\_\_\_

Pain: 0 1 2 3 4 5 6 7 8 9 10  
(zero = no pain 10=severe pain)

Notes:

General Data Collection Sheet – Page 4

	Baseline Values (date: _____ )	6 Week Values (date: _____ )	2 Month Values (date: _____ )
Tinetti Gait Test Score			
Berg Balance Test Score			
Pendulum Test			
Modified Ashworth Scale 1 No increase in tone 2 Slight increase in tone, giving a "catch" when affected part(s) is moved into flexion or extension 3 More marked increase in tone but affected part(s) easily moved 4 Considerable increase in tone; passive movement difficult. Affected part(s) rigid in flexion or extension			
Seated Toe Tapping			
# Toe Raises in 1 minute			
# Heel Raises in 1 minute			
Distance Walked in 6 minutes (3 <sup>rd</sup> floor North hallway). Distance in meters.			
Velocity (time to walk middle 3 meters of a 9 meter walkway)			
Time to ascend a 3-step stair			
Time to descend a 3 step stair			

**APPENDIX C  
Gait Laboratory Data Collection**

Study ID#: \_\_\_\_\_

Date: \_\_\_\_\_

Height: \_\_\_\_\_ cm \_\_\_\_\_ in

Weight: \_\_\_\_\_ kg \_\_\_\_\_ lbs

Foot:

	Left	Right
Length (cm)		
Width (cm)		
Ankle diameter (cm)		
Knee diameter (cm)		

**ROM: document limitations of UE, Trunk, and LE in addition to the following:**

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**APPENDIX D**  
**User Acceptance Questionnaire, Part 1 - Therapist**

On the scale of 1 to 9 with: 1 being most difficult, effortful or least useful and 9 being easiest, least effortful or most useful, Please rank each of the following with respect to the BioRehab System.									
What degree of effort was required for you to turn on the system?	1	2	3	4	5	6	7	8	9
What degree of effort was required for you to attach electrodes to your patient?	1	2	3	4	5	6	7	8	9
What degree of effort was required for you to set the limits for the EMG signal?	1	2	3	4	5	6	7	8	9
What degree of effort was required for you to set the threshold of the EMG signal for your patient?	1	2	3	4	5	6	7	8	9
What degree of effort was required for you to choose which game to use with your patient?	1	2	3	4	5	6	7	8	9
What degree of effort was required for you to use the game with your patient?	1	2	3	4	5	6	7	8	9
What degree of effort was required for you to shut down the prototype system?	1	2	3	4	5	6	7	8	9
Overall, what degree of effort was required for you to set-up your patient for and explain the procedures for treatment?	1	2	3	4	5	6	7	8	9
What degree of effort was required to establish communications with your patient's remote system?	1	2	3	4	5	6	7	8	9
Was the video image of your therapist clear?	1	2	3	4	5	6	7	8	9
Was it difficult to hear your therapist's instructions?	1	2	3	4	5	6	7	8	9
How many minutes did it take you to set up your patient for treatment the first time?									
How many minutes do you think it should take you to set up your patient for treatment after you have used the system 4-5 times?									
What is the potential for use of a BioRehab System treatment intervention with your patient population?	1	2	3	4	5	6	7	8	9
Compared to other rehabilitation therapy modalities that you have used for your patient's condition, how would you rate the BioRehab System?	1	2	3	4	5	6	7	8	9
Would you recommend the BioRehab System treatment via telemedicine to other therapists who may have patients with limited access to their services?	1	2	3	4	5	6	7	8	9
Would you recommend the BioRehab System by itself (i.e.: without the telemedicine component) to other therapists to use in their clinics?	1	2	3	4	5	6	7	8	9

**APPENDIX D**  
**User Acceptance Questionnaire, Part I - Patient**

<p align="center">On the scale of 1 to 9 with:                      1 being most difficult, effortful or least useful and                      9 being easiest, least effortful or most useful,                      Please rank each of the following with respect to the BioRehab System.</p>									
What degree of effort was required for you to understand the BioRehab system?	1	2	3	4	5	6	7	8	9
What degree of effort was required for you to operate the computer system?	1	2	3	4	5	6	7	8	9
What degree of effort was required for you to follow the instructions given?	1	2	3	4	5	6	7	8	9
What degree of effort was required to establish communications with your therapists remote system?	1	2	3	4	5	6	7	8	9
What degree of effort was required for you to advance to higher degrees of difficulty within the game?	1	2	3	4	5	6	7	8	9
What degree of effort was required for you to use the game with your therapist?	1	2	3	4	5	6	7	8	9
What degree of effort was required for you to terminate your treatment session?	1	2	3	4	5	6	7	8	9
Was the video image of your therapist clear?	1	2	3	4	5	6	7	8	9
Was it difficult to hear your therapist's instructions?	1	2	3	4	5	6	7	8	9
How many minutes did it take your therapist to set you up for treatment the first time?									
How many minutes do you think it should take your therapist to set you up for treatment after you have both used the system 4-5 times?									
Compared to other rehabilitation therapy modalities that you have received for your condition, how would you rate the BioRehab System?	1	2	3	4	5	6	7	8	9
Would you recommend the BioRehab System treatment via telemedicine to other patients with your same condition?	1	2	3	4	5	6	7	8	9
Would you recommend the BioRehab System by itself (i.e.: without the telemedicine component) to other patients with your same condition?	1	2	3	4	5	6	7	8	9

## APPENDIX E

Tinetti's Balance and Mobility Assessment

Total = \_\_\_\_\_ (Max 28)

(Patients who score <19 are probably at a high risk for falls. Adapted from Tinetti, ME: Performance-oriented assessment of mobility problems in elderly patients. *J Am Geriatr Soc* 24:119-126)

**Balance Tests**

Initial Instructions: Subject is seated in a hard, armless chair. The following maneuvers are tested.

- |  |  |
|--|--|
| <p>1) Sitting balance = _____<br/>0= Leans or slides in chair<br/>1= Steady, safe</p> <p>2) Arises = _____<br/>0= Unable without help<br/>1= Able, uses arms to help<br/>2= Able without using arms</p> <p>3) Attempts arise = _____<br/>0= Unable without help<br/>1= Able, requires &gt; 1 attempt<br/>2= Able to rise on 1 attempt</p> <p>4) Immediate standing balance = _____<br/>0= Unsteady (swaggers, moves feet, trunk sway)<br/>1= Steady but uses walker or other support<br/>2= Steady without walker or other support</p> <p>5) Standing balance = _____<br/>0= Unsteady<br/>1= Steady but wide stance (medial heels &gt; 4 inches apart) and uses cane or other support<br/>2= Steady, narrow stance without support</p> | <p>6) Nudged = _____<br/>(Subject at maximum stance position with feet as close together as possible, examiner pushes lightly on subject's sternum with palm of hand 3 times)<br/>0= Begins to fall<br/>1= Stagger, grabs, catches self<br/>2= Steady</p> <p>7) Eyes closed standing = _____<br/>0= Unsteady<br/>1= Steady</p> <p>8) Turning 360 degrees = _____<br/>0= Discontinuous steps<br/>1= Unsteady (grabs, staggers)<br/>2= Continuous</p> <p>9) Sitting down = _____<br/>0= Unsafe (misjudged distance, falls into chair)<br/>1= Uses arms or not a smooth motion<br/>2= Safe, smooth motion</p> <p>Balance Score = _____ (Max 16)</p> |
|--|--|

**Gait Tests**

- |  |   |
|--|---|
| <p>1) Initiation of gait = _____<br/>(immediately after told to go)<br/>0= Any hesitancy or multiple attempts to start<br/>1= No hesitancy</p> <p>2) Step length and height<br/>a. Right swing foot = _____<br/>0= Does not pass left stance foot with step<br/>1= Passes left stance foot<br/>0= Right foot does not clear floor completely with step<br/>1= Right foot completely clears floor</p> | <p>b. Left swing foot = _____<br/>0= Does not pass right stance foot with step<br/>1= Passes right stance foot<br/>0= Left foot does not clear floor completely with step<br/>1= Left foot completely clears floor</p> <p>3) Step symmetry = _____<br/>0= Right and left step length not equal (estimate)<br/>1= Right and left step appear equal<br/>Step continuity = _____<br/>0= Stopping or discontinuity between steps<br/>1= Steps appear continuous</p> |
|--|---|

4) Path = \_\_\_\_\_

(Estimated in relation to floor tiles, 12 inch width; observe excursion of 1 of the patient's feet over about 10 foot of the course)

- 0= Marked deviation
- 1= Mild/moderate deviation or uses walking aid
- 2= Straight without walking aid

5) Trunk = \_\_\_\_\_

- 0= Marked sway or uses walking aid
- 1= No sway but flexion of knees or back pain or spreads arms out while walking
- 2= No sway, no flexion, no use of arms and no use of walking aid

6) Walking stance = \_\_\_\_\_

- 0= Heel apart wide base
- 1= Heels almost touching while walking

Balance Score = \_\_\_\_\_ (Max 12)

**Berg Functional Balance Scale**

Grading: Mark the lowest category that applies. (4=best, 0=worst).

**1. Sitting to standing \_\_\_\_\_**

*Instruction:* Please stand up. Try not to use your hands for support.

- (4) able to stand, no hands and stabilize independently.
- (3) able to stand independently using hands.
- (2) able to stand using hands after several tries.
- (1) needs minimal assistance to stand or to stabilize.
- (0) needs moderate or maximal assistance to stand.

**2. Standing unsupported \_\_\_\_\_**

*Instruction:* Stand for two minutes without holding.

- (4) able to stand safely 2 min.
- (3) able to stand 2 min with supervision.
- (2) able to stand 30 seconds unsupported.
- (1) needs several tries to stand 30 seconds unsupported.
- (0) unable to stand 30 seconds unassisted.

NOTE: IF THE SUBJECT IS ABLE TO STAND 2 MINUTES SAFELY, SCORE FOUR (4) POINTS FOR ITEM #3, SITTING UNSUPPORTED, AND PROCEED TO ITEM #4.

**3. Sitting unsupported, feet on floor \_\_\_\_\_**

*Instruction:* Sit with arms folded for two minutes.

- (4) able to sit safely and securely for two minutes.
- (3) able to sit two minutes under supervision.
- (2) able to sit 30 seconds.
- (1) able to sit 10 seconds.
- (0) unable to sit without support 10 seconds.

**4. Standing to sitting \_\_\_\_\_**

*Instruction:* Please sit down.

- (4) sits safely with minimal use of hands.
- (3) controls descent by using hands.
- (2) uses back of legs against chair to control descent.
- (1) sits independently but has uncontrolled descent.
- (0) needs assistance to sit.

**5. Transfers \_\_\_\_\_**

*Instruction:* Please move from chair to bed and back again. (One way toward a seat with armrests and one way toward a seat without armrests).

- (4) able to transfer safely with only minor use of hands.
- (3) able to transfer safely with definite need of hands.
- (2) able to transfer with verbal cueing and /or supervision.
- (1) needs one person to assist.
- (0) needs two people to assist or supervise to be safe.

**6. Standing unsupported with eyes closed \_\_\_\_\_**

*Instruction:* Close your eyes and stand still for 10 seconds.

- (4) able to stand 10 seconds safely.
- (3) able to stand 10 seconds with supervision.
- (2) able to stand 3 seconds.
- (1) unable to keep eyes closed 3 seconds but remains steady.
- (0) needs assistance to prevent falling.

**7. Standing unsupported with feet together \_\_\_\_\_**

*Instruction:* Place your feet together and stand without holding.

- (4) able to place feet together independently and stand 1 minute safely.
- (3) able to place feet together independently and for 1 minute with supervision.
- (2) able to place feet together independently but unable to hold for 30 seconds.
- (1) needs help to attain position but able to stand 15 seconds, feet together.
- (0) needs help to attain position and unable to hold 15 seconds.

THE FOLLOWING ITEMS ARE TO BE PERFORMED WHILE STANDING UNSUPPORTED

**8. Reaching forward with outstretched arm \_\_\_\_\_**

*Instruction:* Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. (Examiner places a ruler at end of fingertips when arm is at 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that the fingers reach while the subject is in the most forward lean position).

- (4) can reach forward confidently >10 inches.
- (3) can reach forward >5 inches safely.
- (2) can reach forward >2 inches safely.
- (1) reaches forward but needs supervision.
- (0) needs assistance to prevent falling.

**9. Pick up object from floor \_\_\_\_\_**

*Instruction:* Pick up the shoe/slipper that is placed in front of your feet.

- (4) able to pick up slipper safely and easily.
- (3) able to pick up slipper but requires supervision.
- (2) unable to pick up but reaches 1-2 inches from slipper and keeps balance independently.
- (1) unable to pick up object and requires supervision while attempting.
- (0) unable to attempt/requires assistance to prevent falling.

**10. Turn to look behind/over left and right shoulders \_\_\_\_\_**

*Instruction:* Turn to look behind you over/toward left shoulder. Repeat to right.

- (4) looks behind from both sides and weight shifts well.
- (3) looks behind one side only, other side shows less weight shift.
- (2) turns sideways only, but maintains balance.
- (1) needs supervision when turning.
- (0) needs assist to keep from losing balance or falling.

**11. Turn 360 degrees \_\_\_\_\_**

*Instruction:* Turn completely around in a full circle. Pause. Turn a full circle in the other direction.

- (4) able to turn 360 degrees safely in <4 seconds each direction.

- (3) able to turn 360 degrees safely one side only in <4 seconds.
- (2) able to turn 360 degrees safely but slowly.
- (1) needs close supervision or verbal cueing.
- (0) needs assistance while turning.

**12. Alternating steps on stool \_\_\_\_\_**

*Instruction:* Place each foot alternately on the stool. Continue until each foot has touched the stool four times.

- (4) able to stand independently and complete 8 steps in 20 seconds.
- (3) able to stand independently and complete 8 steps in >20 seconds.
- (2) able to complete 4 steps without assistance with supervision.
- (1) able to complete >2 steps, requires minimal assistance.
- (0) needs assistance to prevent falling/unable to try.

**13. Standing unsupported, one foot in front (Tandem Stance) \_\_\_\_\_**

*Instruction:* (Demonstrate to patient) Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot.

- (4) able to place foot tandem independently and hold 30 seconds.
- (3) able to place foot ahead of the other independently and hold 30 seconds.
- (2) able to take small step independently and hold 30 seconds.
- (1) needs assistance to step, but can hold 15 seconds.
- (0) loses balance while stepping or standing.

**14. Stand on one leg \_\_\_\_\_**

*Instruction:* Stand on one leg as long as you can without holding.

- (4) able to lift leg independently and hold >10 seconds.
- (3) able to lift leg independently and hold 5-10 seconds.
- (2) able to lift leg independently and hold > or = 3 seconds.
- (1) tries to lift leg; unable to hold 3 seconds but remains standing independently.
- (0) unable to try or needs assistance to prevent fall.

**TOTAL SCORE \_\_\_\_\_ /56**

45 or > usually indicates patient less likely to fall, safe ambulator, no assistive device.

37 or > usually indicates safe ambulator with assistive device.

36 or lower relate to 100% risk of falls in community living older adults.

The proponent agency of this publication is the office of the North Atlantic Regional Medical Command, Walter Reed Army Medical Center, Telemedicine Directorate. Users are invited to send suggestions and comments on DA Form 2028 (Recommended Changes to Publications and Blank Forms) to Commander, Walter Reed Army Medical Center, ATTN: MCAT-CL-T, 6900 Georgia Avenue NW, Washington, DC 20307-5001.

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