

# The 100 Step Deep Water Test

Dr. Mary Wykle

The 100 Step Deep Water Test was designed to track the cardiorespiratory improvement and fitness of injured warriors and athletes. The U. S. Army's Office of the Surgeon General through the Proponency Office for Rehabilitation and Reintegration contracted with MW Associates to conduct a Performance Improvement Study and the development and implementation of Aquatic Rehabilitation and Aquatic Warrior Exercise Programs. The goals of the study were re-conditioning to achieve improved function and fitness for musculoskeletal injuries, provision of a workout of sufficient intensity and duration to improve fitness that could accommodate large groups, and provide a viable option for non-swimmers or those not desiring to swim for fitness.

Factors impacting program development and program components included:

- Addressing Fear of Water
- Obesity and physical inactivity linked to
  - Medications
  - Pain
  - Drug and Alcohol Abuse
  - Inactivity
- Physical limitations – Moderate to Extreme Difficulty to perform
  - Hopping – 75%
  - Walking 1 mile – 64%
  - Going up or down 1 flight of stairs – 57%
  - Standing for 1 hour – 67%
  - Running on even ground – 79%
  - Running on uneven ground – 81%
  - Making sharp turns while running fast – 84%
- Developing a cooperation with aquatic directors at facilities
- Implementation of the Deep Water Interval Cadence Training Program

Validated land scales were used to evaluate and track changes in Pain, Low Back Pain, Upper Extremity Function and Lower Extremity Function. A validated cardiorespiratory test specific to deep water was not available, so through trial and error, the current test was developed. The initial test design was extremely simple and did not measure with any reliability. As now defined, the test is appropriate not only for those recovering from injuries, but for any active aquatic participant desiring to monitor their fitness level. It is a natural component of Deep Water Running or Deep Water Interval Cadence training program.

After trial and error, the current administration of the test is in Deep Water with adequate floatation to maintain correct buoyancy. The test requires the subject to take 100 steps – or as many as their ability permits. The steps are counted as the non-dominant leg steps down. Knee flexion is to 45° and less than 90°. To closely monitor the alignment, knee lift, and step count, the subject is tethered to the edge of the pool. Bent arm swing is emphasized. The subject counts steps aloud, emphasizing each ten steps (10, 20, 30, etc.). If unable to continue counting aloud, the test administrator assumes the counting. There is no time limit to the test. The total time to complete the 100 steps is recorded on the data sheet in seconds.

Resting heart rate and ending heart rate are recorded. Individual assessment of RPE based on a scale of 1 to 10 is also recorded. Heart rate readings are achieved using a Heart Rate Monitor with chest strap. The one being used in the pilot study currently being conducted is the Polar RS300X. It is extremely important to quickly obtain accurate ending heart rate immediately upon ending the 100 steps while in the water.

Preparing to take the test requires practicing the correct stepping form while tethered. Subjects are taught the correct form before the first test is administered. Exercise at moderate intensity is permitted the day prior to the test.

Tests are at scheduled appointment times. The subject should arrive early to warm-up prior to the test with shallow water walking. Ten minutes prior to taking the resting heart rate, subject moves to a bench at the deep end of the pool and sits quietly with feet on the deck for approximately ten minutes, puts on Heart Rate Monitor, and test administrator records resting heart rate. Subject then puts on the floatation belt with tether attached and enters the water – using the ladder or sliding in. The free end of the tether is attached to a secure object such as the diving block or lane line “eye” hook and the subject begins slowly jogging to establish a rhythm. Using a stopwatch, the test administrator gives the commands to begin jogging and to start counting.

All test administrators were trained in Step Test Administration:

*Required equipment:*

- Stopwatch
- Heart Rate Monitor with Chest Strap (recommend Polar RS300X)
- Floatation belt(s) of adequate buoyancy
- Tether (the study uses Aqua Jogger tethers/hitches & floatation belts)

*Instructions:*

- Tester completes test administration training and administers practice tests
- Test subject practices the step test in at least one session prior to scheduled time of testing
- On day of test, subject warms up with shallow water walking

*To administer the test:*

- Move subject to a bench by the pool and ask them to sit quietly with both feet on the floor/deck – recommend 10 minutes
- Assist subject with putting on the Heart Rate chest strap and watch, take resting pulse – Tester records on form
- Put on the floatation belt with tether attached
- Ask subject to enter the water by going down the ladder
- Attach the loose end of the tether to a secure object on pool edge – diving block, lane line “eye” hook, etc
- 10 to 15 seconds before giving the command to start counting, ask them to do an easy jog to get in the rhythm – tester checks knee lift, body position
- Command to begin is “Start Counting”
- They should count aloud until too difficult to count and breathe
- Tester takes over the counting until 100 is reached if subject cannot continue counting
- Command is “Stop Stepping, Check Pulse”
- Tester records Time and Ending Heart Rate on form that will be input into the computer
- Tester must instruct the subject to strive for a RPE 8 or 9 on a scale of 10

For accurate administration of the test and collection of data, one tester at a site should be identified and conduct all testing. The test administrator is responsible for ensuring correct execution of the steps, counting of steps, time, and motivation for the subject. The desired Rate of Perceived Exertion (RPE) is based on a scale of 1 to 10 with 10 being maximum effort. An RPE of 8 or 9 is expected. Data from the first round of testing is collected and tracked. Data should be collected monthly and comparisons analyzed. The hypothesis is to see ending heart rates drop along with the time to take 100 steps in Deep Water. At the completion of this phase, it is anticipated that total step time will drop along with resting to ending heart rate ratios.

The results of 100 Deep Water Step Test for the Army showed:

- Resting Heart Rate – decreased an average of 4 BPM. 49% of the Soldiers decreased their resting heart rate between the first and last test.
- Ending Heart Rate – increased an average of 7 BPM. 61% of the Soldiers increased their ending Heart Rate between the first and last test.
- Time to Complete (Seconds) – reduced an average of 11 seconds. 75% of the Soldiers reduced the amount of time required to take the 100 Steps in Deep Water.

The current goal is to assess applicability of this test for use by health-fitness professionals to have a tool to use in evaluating cardiorespiratory improvement in their participants interested in noting fitness improvement and to serve as a motivation tool for self-challenge.

2011-2012 was the initial application and recording of test results by volunteer test administrators and participants interested in personal evaluation. Additional testing sites are still being recruited. The first results show that the Deep Water Step Test is an effective tool to evaluate participate fitness improvement. All that took part recorded scores showing increased cardiorespiratory fitness as noted below.

100 Deep Water Step Test conducted by Aquatic Exercise Association (AEA) instructors using the program showed:

- Age range – 50 to 63 years old - female
- Average Resting Heart Rate – 79.2
- Average Ending Heart Rate – 145
- Time to Complete 100 Steps – 75 seconds (age group 50 – 59 y/o)
- Time to Complete 100 Steps – 120 seconds (age group 60 – 65 y/o)
- All participants improved (elevated) Ending Heart Rate with each test while decreasing the time required to complete the 100 steps
- Assumption – cardiorespiratory fitness can be increased in all age groups and novice to experienced aquatic exerciser when putting forth effort of 8 to 10 on a scale of 10

## Summary

- Army programs continue and are growing.
- The program has expanded to include all U. S. Marine Corps installations.
- Community pools are encouraged to add deep water interval training as a regular class or as a monthly Intro class – participants track own progress and select their pool time.

Mary O. Wykle, PhD, AEA, ATRIC

[mwykle@aol.com](mailto:mwykle@aol.com), [www.mwaquatics.com](http://www.mwaquatics.com), [www.aquaticwarrior.com](http://www.aquaticwarrior.com)