

One-minute sit-to-stand test for evaluating functional exercise capacity in subjects with heart failure with preserved ejection fraction (HFpEF)

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Background

Exercise intolerance is the main chronic symptom in patients with HFpEF, and leads to a reduced quality of life (QoL). Thus, exercise testing is a central tool in the clinical evaluation of HFpEF patients. Recent studies have suggested the use of the 1-min sit-to-stand test (1-min STST). In this test the patient is encouraged to stand up from a chair and sit down again as quickly and as many times as possible within one minute without using the upper limbs. The 1-min STST is shorter, requires less space and is easier to perform than the six-minute walk test (6MWT) – a test, which is already well established in the routine assessment of patients with HFpEF. Thus, it might be possible to test more patients. The 1-min STST has already been validated for patients with chronic obstructive pulmonary disease (1), but data on HFpEF patients are lacking.

Project goal

Comparison of the 1-min STST with the 6MWT in subjects with HFpEF

Patients and Methods

Twenty-nine stable HFpEF patients [mean age: 70 ± 11 yrs, 41% male, 65.5% atrial fibrillation, median New York Heart Association (NYHA) class 3 (IQR 2-4)] were prospectively assessed for cardiorespiratory fitness with the 1-min STST and the 6MWT. The two tests were applied in a randomized order and a 10-minutes break between them was attempted. Patient-reported health-related QoL was assessed with the CAMPHOR questionnaire. The Modified Borg Dyspnea Scale was used to gauge symptoms of exertional fatigue and dyspnea.

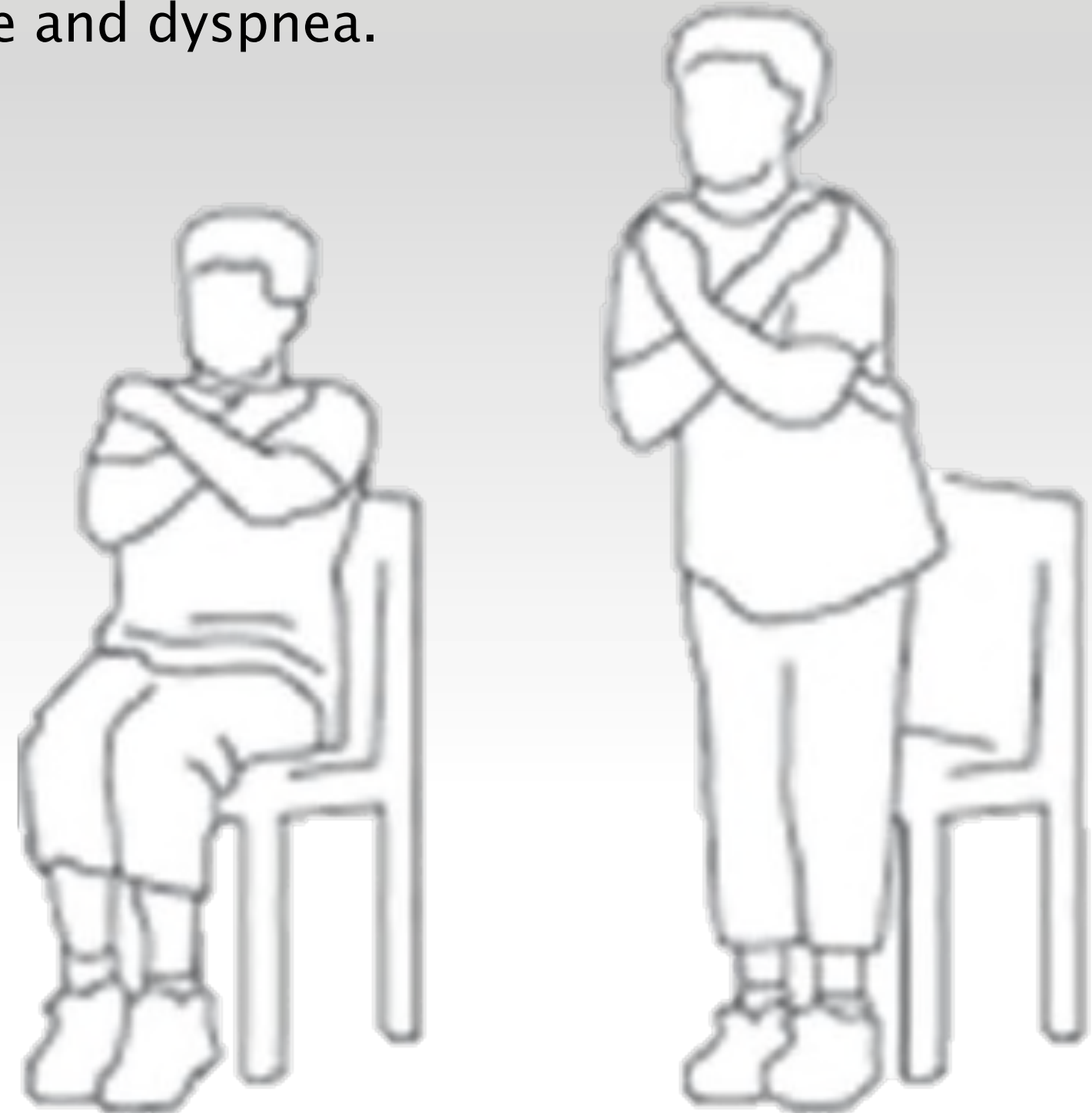


Figure 1. 1-minute sit-to-stand test

Results

The median number of 1-min STST repetitions in the overall study sample was 16 (IQR 8 – 24) and the median six-minute walk distance (6MWD) was 336 m (IQR 136 – 536 m). We observed a strong correlation between 1-min STST performance and 6MWD ($r = 0.646$, $p < .001$). Furthermore, number of chair stands were highly and inversely correlated to the responses in the CAMPHOR questionnaire (relation to symptoms: $r = -.505$, $p = .009$, activities: $r = -.433$, $p = .027$, quality of life: $r = -.581$, $p = .002$). There were no statistically significant differences between men and women in both tests and symptom score for dyspnea did not differ for both tests (median value: 5 points, $t(29) = -0.818$, $p = .420$). In all multiple regression models, New York Heart Association (NYHA) class provided the best explanation of 1-min STST performance, but age contributed as well.

Conclusion

Outcomes confirm that the 1-min STST is a simple and promising test to evaluate functional fitness and exercise capacity in chronic HFpEF patients. The prognostic value of this test remains to be established in further studies.

Reference

Reychler G, Boucard E, Peran L, Pichon R, Ber-Moy CL, Ouksef H, et al. One minute sit-to-stand test is an alternative to 6MWT to measure functional exercise performance in COPD patients. Clin Respir J. 2018;12(3):1247–56.

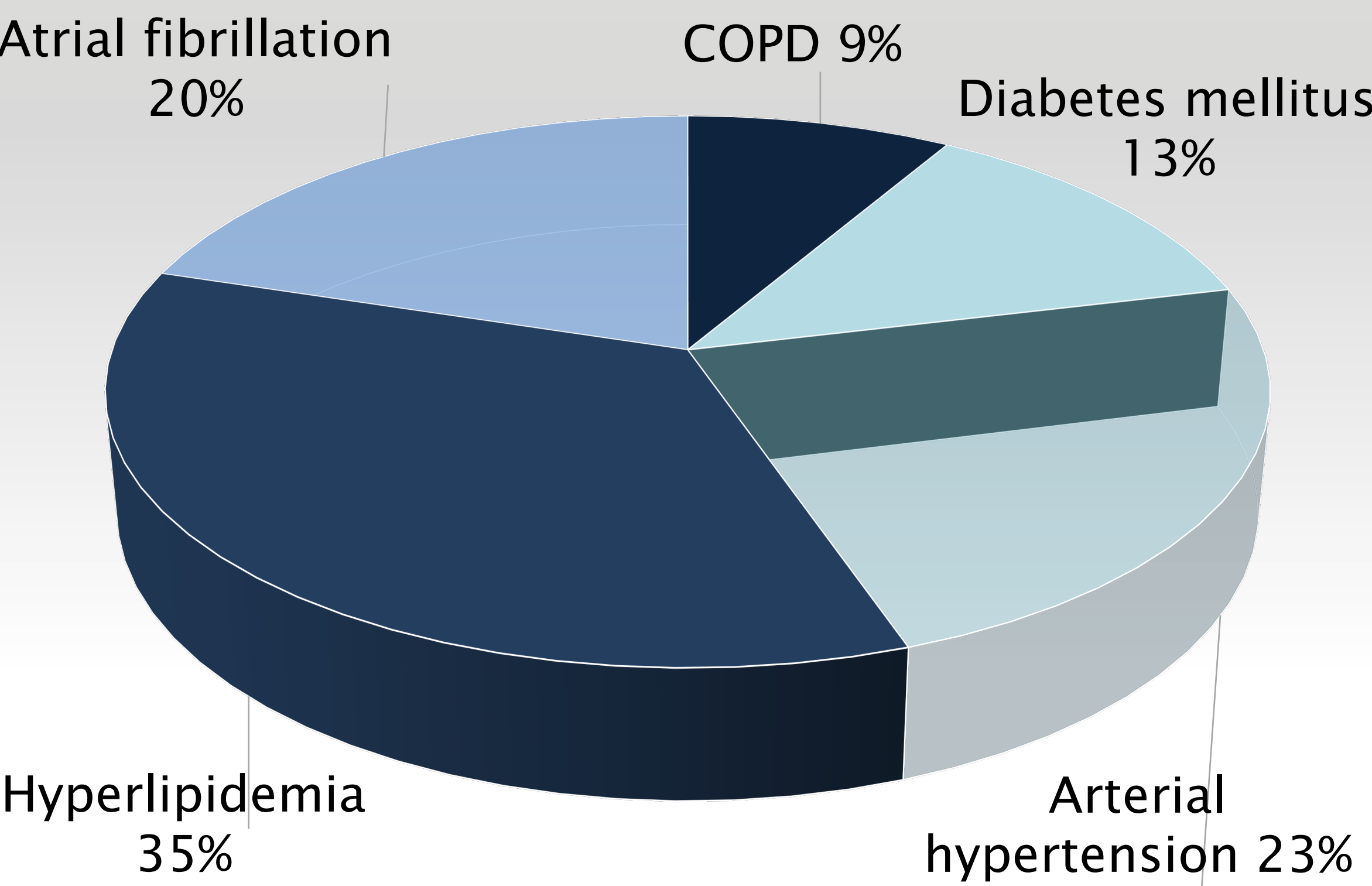


Figure 2. Comorbidities

Table 1. Patient characteristics

| Variable | Male (n = 12) | | | Female (n = 17) | | | p-value |
|---------------------------------------|-----------------------|---|-------|-----------------------|---|-------|--------------|
| <i>Demographics</i> | | | | | | | |
| Age, y | 73.1 | ± | 9.4 | 67.9 | ± | 11.7 | 0.214 |
| BMI, kg/m ² | 27.8 | ± | 5.0 | 34.2 | ± | 7.7 | 0.019 |
| NT-proBNP, pg/mL | 1367.5 (288.7-3334.0) | | | 1542.0 (357.3-2915.0) | | | 0.965 |
| NYHA class I or II | 5 (41.7%) | | | 5 (29.4%) | | | |
| NYHA class III or IV | 7 (58.3%) | | | 12 (70.6%) | | | |
| <i>Transthoracic echocardiography</i> | | | | | | | |
| LVEF | 51.89 | ± | 0.33 | 53.24 | ± | 3.15 | 0.218 |
| TI Vmax, m/s | 3.6 | ± | 0.9 | 3.6 | ± | 0.7 | 1.000 |
| <i>Right heart catheterization</i> | | | | | | | |
| mPAP, mmHg | 39.7 | ± | 9.4 | 42.5 | ± | 14.2 | 0.555 |
| PCWP, mmHg | 22.1 | ± | 4.9 | 21.4 | ± | 5.1 | 0.724 |
| PVR, dyn×s/cm ⁵ | 301.0 | ± | 231.6 | 322.3 | ± | 205.6 | 0.796 |
| CI, L/min/m ² | 2.8 | ± | 1.0 | 2.9 | ± | 1.0 | 0.683 |
| <i>Test performance</i> | | | | | | | |
| 6MWD, m | 357.1 | ± | 91.3 | 293.2 | ± | 139.0 | 0.176 |
| 6MWD % of predicted | 56.6 | ± | 13.1 | 56.1 | ± | 24.0 | 0.949 |
| 1-min STST, reps | 17.9 | ± | 5.5 | 15.4 | ± | 7.5 | 0.348 |
| 1-min STST % of predicted | 56.2 | ± | 18.6 | 48.4 | ± | 21.1 | 0.326 |

Notes. BMI indicates body mass index; NT-proBNP: N-terminal pro-brain natriuretic peptide; NYHA: New York Heart Association; LVEF: left ventricular ejection fraction; TI Vmax: peak trans-tricuspid flow velocity; mPAP: mean pulmonary artery pressure; PCWP: pulmonary capillary wedge pressure; PVR: pulmonary vascular resistance; CI: cardiac index; 6MWD: six-minute walk distance; 6MWD % of predicted: percent of the predicted six-minute walk distance; 1-min STST: 1-minute sit-to-stand test; 1-min STST % of predicted: percent of the predicted 1-minute sit-to-stand repetitions.

Relationship of 1-min STST repetitions to 6MWD

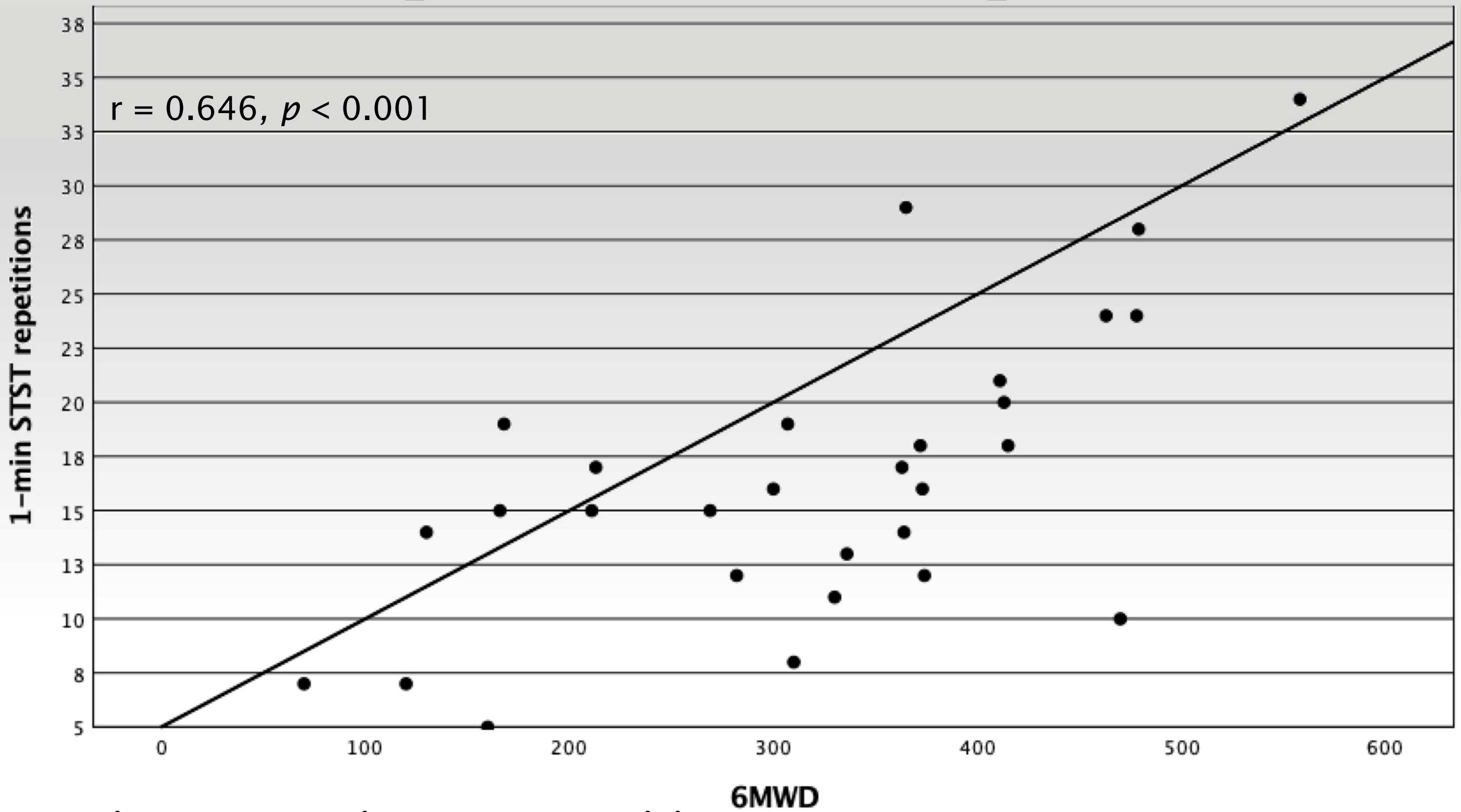


Figure 3. 1-min STST repetitions vs. 6MWD

Legend. Association between 1-min sit-to-stand test repetitions and six-minute walk distance.