**Supplementary material**

**Methods**

**International physical activity questionnaire**

A *low level* of activity was defined as “no activity reported or some activity reported but not enough to meet categories two or three”, a *moderate level* of activity was defined as three or more days of vigorous activity of at least 20 min per day or five or more days of moderate- intensity activity and/or walking of at least 30 min per day or five or more days of any combination of walking, moderate-intensity, or vigorous intensity activities achieving a minimum of at least 600 metabolic equivalent of tasks, min/week. A *high level* of activity was defined as vigorous-intensity activity on at least three days and accumulating at least 1500 metabolic equivalent of tasks, min/week or seven or more days of any combination of walking, moderate- or vigorous-intensity activities accumulating at least 3000 metabolic equivalent of tasks, min/week. The sitting question was developed as a separate indicator and not as part of the total summed physical activity score (1). Data was calculated according to the scoring protocol (2) and was summed within each item (i.e. vigorous intensity, moderate intensity, and walking) to estimate the total amount of metabolic equivalent of tasks, min/week spent on physical activity. If the patient provided an estimation of the amount of time or days spent on physical activity, the lowest number the patient had written was used for calculation. If the option *“don’t know/unsure”* was used, it was interpreted as zero instead of being excluded. One metabolic equivalent of tasks equals the energy expenditure of sitting down quietly (VO2=3.5ml\*kg-1\*min-1) (3). Ainsworth has listed different types of physical activity and their equivalent metabolic equivalent of tasks (3).

**Calculations to compare results from the submaximal exercise tests for patients included in the study, with maximal reference values.**

Due to some patients ending the submaximal ergometer bicycle test before the level of watt was finished i.e. 4.5 or 5 min, the results of the submaximal bicycle test was calculated according to Strandell (4) as follows: (Submaximal watt RPE 15-17-25) + (25\*n/4.5) where submaximal watt RPE 15-17 is the highest watt level attained during the test, 25 is the starting watt value, n the minutes on the last level, and 4.5 is the minutes on each level of watt.

To allow for differences in loading patterns and the achieved rate of perceived exertion (RPE), two corrections have to be made. First, the values for patients who had not cycled to 17 on the Borg rating of perceived exertion scale (5) were transformed to a WRPE17 value according to the following equation (6):

WRPE17  = Wfinal \* ( 11 / ( RPEfinal-6 ) ) ( 1/1.6 ) Equation. 1

where the value six is the start of rating of perceived exertion scale, 11 is the increase to 17, and 1.6 is an empiric value for normal subjects performing bicycle exercise tests. Wfinal and RPEscalefinal are the final working load and rating of perceived exertion scale, respectively, irrespective of loading pattern. The second correction, transforms the WRPE17 between different loading patterns or protocols using the following equation (7):

∑ti Wi5 = K Equation. 2

where Ti is the duration of the workload Wi and summarized over all steps (i) giving K, which is an individual constant. This equation is valid even for small steps, allowing generalizing to ramp exercise tests (7). In this study, two steady state (Wss) protocols were used, both with 25 watts steps (∆W); one with increasing loads every 4.5 min, the other increasing loads after 5 min. To transform Wss to six-min-steps (Wss(6min)), the 4.5 and 5 minutes protocols were multiplied by 0.941 and 0.963, respectively, using Equation 2. The values were then transformed to ramp exercise tests (Wramp) using Equation 3 to allow comparisons with maximal reference values:

Wramp = (36b)1/6(1/∆W)0.075 Wss (6min)0.898 Equation 3

where b is the increase in load (watts per min; 15 for men, 10 for women). Equation 3 is accurate for ∆W=25-50 watts, and in this study ∆W =25 watts. The obtained value could then be compared with maximal “*WRPE17”* values (ramp protocol) as presented in Brudin et al (6).

**Results**

Descriptive data for all patients are presented in Supplementary table S1. Results of the multiple regression analysis are shown in Supplementary table S2.

**References**

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4. Strandell T. Circulatory studies on healthy old men. With special reference to the limitation of the maximal physical working capacity. Acta Med Scand Suppl. 1964;414:SUPPL 414:1-44.

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6. Brudin L, Jorfeldt L, Pahlm O. Comparison of two commonly used reference materials for exercise bicycle tests with a Swedish clinical database of patients with normal outcome. Clin Physiol Funct Imaging. 2014 Jul;34(4):297-307.

7. Wallin L, Brudin LH. Physical working capacity determined by different types of bicycle exercise tests. Clin Physiol. 1988 Oct;8(5):529-37.

**Supplementary Table S1.** Descriptive data for all patients, n=1310.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Included patientsn=747 | Not included patients n=563 | P-value |
| Age, in years: mean (SD) | 34.7 (13.8) | 34.3 (14.7) | ns |
| Men n (%)Women n (%) | 390 (52%)357 (48%) | 288 (51%)275 (49%) | ns |
| Diagnosis group: Less complicated n (%)Corrected n (%)Complex n (%) | 568 (76%)139 (18.6%)40 (5.4%) | 451 (80.1%)90 (16%)22 (3.9%) | ns |
| NYHA class: I/II/III/IV n (%) | 618 (82.7%)111 (14.9%)18 (2.4%)0 (%) | 456 (81%)79 (14%)24 (4.3%)4 (0.7%) | ns |

*Less complicated* diagnosis consisted of simple shunts, aortic valve malformations, aortic anomalies, mitral valve lesions, pulmonary valve lesions, and tricuspid valve lesions. *Corrected* diagnosis consisted of right ventricular/tetralogy of Fallot and transposition of the great arteries. *Complex* diagnosis consisted of truncus arteriosus, univentricular repair and others. NYHA=New York Heart Association.

**Supplementary Table S2.** Sex, age, diagnosis group, and NYHA and their influence on exercise capacity, level of physical activity, and health-related quality of life.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Sex | Test | Variable | Estimate |  95% CI | p-value | R2 |
|  |  |  |  | Lower limit | Upper limit |  |  |
| M | Exercise  | Age  | -0.227 | -0.522  | 0.068  | 0.130  | 0.105 |
|  | capacity,  | Corrected  | -11.52  | -20.70 | -2.348 | 0.014 |  |
|  | Watt | Complex  | -31.22  | -49.52 | -12.93 | <0.001  |  |
|  |  | NYHA II  | -22.97  | -35.84 | -10.09 | <0.001  |  |
|  |  | NYHA III  | -68.84  | -133.0  | -4.689 | 0.036 |  |
| F |  | Age  | -0.289  | -0.509  | -0.069 | 0.010 | 0.155 |
|  |  | Corrected  | -6.748  | -15.96  | 2.467 | 0.150 |  |
|  |  | Complex  | 3.952  | -11.69  | 19.59 | 0.619  |  |
|  |  | NYHA II  | -23.41  | -32.56 | -14.27 | <0.001  |  |
|  |  | NYHA III  | -39.59  | -74.06  | -5.132 | 0.025 |  |
| M | Total MET- | Age | -18.68 | -43.37 | 6.005 | 0.137 | 0.000 |
|  | min/week | Corrected  | 191.3  | -593.9  | 976.5 | 0.632  |  |
|  |  | Complex  | 12.52  | -1465 | 1490 | 0.987 |  |
|  |  | NYHA II  | -666.1  | -1847  | 515.0 | 0.268 |  |
|  |  | NYHA III  | -1882 | -7208 | 3444 | 0.487 |  |
| F |  | Age  | 6.378  | -10.45  | 23.20 | 0.456  | 0.000 |
|  |  | Corrected  | 31.80  | -682.3  | 745.9 | 0.930  |  |
|  |  | Complex | 141.4  |  -949.1 | 1232 | 0.799  |  |
|  |  | NYHA II  | -257.5  | -949.0  | 433.9 | 0.464  |  |
|  |  | NYHA III | -937.9  | -2365 | 488.7 | 0.197 |  |
| M | SF-36 PF | Age | -0.282  | -0.379  | -0.186 | <0.001  | 0.263 |
|  |  | Corrected  | -2.480  | -5.467  | 0.506 | 0.103 |  |
|  |  | Complex  | -9.300  | -15.14  | -3.455 | 0.002 |  |
|  |  | NYHA II  | -12.50  | -16.69  | -8.316 | <0.001  |  |
|  |  | NYHA III  | -34.76 | -55.17 | -14.35 | 0.001 |  |
| F |  | Age  | -0.203  | -0.343  | -0.063 | 0.005  | 0.218 |
|  |  | Corrected  | 0.356  | -5.369  | 6.082 | 0.903  |  |
|  |  | Complex | -4.310  | -13.14  | 4.520 | 0.337 |  |
|  |  | NYHA II  | -14.07  | -19.88  | -8.247 | <0.001  |  |
|  |  | NYHA III  | -35.19  | -46.88 | -23.49 | <0.001  |  |
| M | SF-36 RP | Age | -0.449 | -0.699  | -0.199 | <0.001  | 0.130 |
|  |  | Corrected  | -7.660  | -15.38  | 0.059 | 0.052  |  |
|  |  | Complex  | -6.183  | -21.28  | 8.918 | 0.421  |  |
|  |  | NYHA II  | -22.06  | -32.88 | -11.24 | <0.001  |  |
|  |  | NYHA III  | -71.11 | -123.8 | -18.38 | 0.008 |  |
| F |  | Age  | -0.259  | -0.553  | 0.034 | 0.083  |  |
|  |  | Corrected  | -11.47  | -23.47  | 0.534 | 0.061  | 0.077 |
|  |  | Complex | -18.75  | -37.28  | -0.231 | 0.047  |  |
|  |  | NYHA II  | -13.94  | -26.22  | -1.661 | 0.026 |  |
|  |  | NYHA III  | -29.33 | -53.83  | -4.829 | 0.019  |  |
| M | SF-36 BP  | Age | -0.431  | -0.629  | -0.234 | <0.001  | 0.067 |
|  |  | Corrected  | 1.151  | -4.957  | 7.260 | 0.711  |  |
|  |  | Complex  | -6.801  | -18.75  | 5.152 | 0.264 |  |
|  |  | NYHA II  | -4.222  | -12.79  | 4.344 | 0.333 |  |
|  |  | NYHA III  | -22.63 | -64.37  | 19.11 | 0.287 | 0.023 |
| F |  | Age  | -0.023  | -0.242  | 0.197 | 0.839  |  |
|  |  | Corrected  | -5.284  | -14.29  | 3.719 | 0.249 |  |
|  |  | Complex | 0.465  | -13.42  | 14.35 | 0.948 |  |
|  |  | NYHA II  | -11.24  | -20.39  | -2.089 | 0.016 |  |
|  |  | NYHA III  | -15.66  | -34.05  | 2.727 | 0.095 |  |
| M | SF-36 GH | Age | -0.247  | -0.419  | -0.075 | 0.005  | 0.119 |
|  |  | Corrected  | -6.877  | -12.21  | -1.545 | 0.012 |  |
|  |  | Complex  | -5.585  | -16.02  | 4.849 | 0.293 |  |
|  |  | NYHA II  | -17.04  | -24.51  | -9.561 | <0.001  |  |
|  |  | NYHA III  | -28.82 | -65.26  | 7.614 | 0.120 |  |
| F |  | Age  | 0.152  | -0.021  | 0.325 | 0.085  | 0.159 |
|  |  | Corrected  | -5.710  | -12.81  | 1.391 | 0.115 |  |
|  |  | Complex | -1.972  | -12.92  | 8.979 | 0.723 |  |
|  |  | NYHA II  | -20.50  | -27.72 | -13.28 | <0.001  |  |
|  |  | NYHA III  | -29.69  | -44.19 | -15.18 | <0.001  |  |
| M | SF-36 VT | Age | -0.172  | -0.354  | 0.010 | 0.064  | 0.070 |
|  |  | Corrected  | -4.322  | -9.964  | 1.319 | 0.133  |  |
|  |  | Complex  | -2.108  | -13.15  | 8.931 | 0.707 |  |
|  |  | NYHA II  | -14.27  | -22.19 | -6.364 | <0.001  |  |
|  |  | NYHA III  | -39.48 | -78.03 | -0.928 | 0.045 |  |
| F |  | Age  | 0.222  | 0.040  | 0.404 | 0.017  | 0.053 |
|  |  | Corrected  | 1.020  | -6.423  | 8.464 | 0.787  |  |
|  |  | Complex | -1.872  | -13.35  | 9.608 | 0.748 |  |
|  |  | NYHA II  | -12.52  | -20.08 | -4.953 | 0.001 |  |
|  |  | NYHA III  | -16.09  | -31.30 | -0.888 | 0.038 |  |
| M | SF-36 SF | Age | -0.116  | -0.285  | 0.052 | 0.175  | 0.053 |
|  |  | Corrected  | -1.869  | -7.086  | 3.349 | 0.481  |  |
|  |  | Complex  | 2.527  | -7.683  | 12.74 | 0.627  |  |
|  |  | NYHA II  | -12.78  | -20.10  | -5.466 | 0.001 |  |
|  |  | NYHA III  | -35.96 | -71.61  | -0.304 | 0.048 |  |
| F |  | Age  | 0.081  | -0.090  | 0.251 | 0.352  | 0.065 |
|  |  | Corrected  | -5.496  | -12.48  | 1.490 | 0.123 |  |
|  |  | Complex | -9.285  | -20.06  | 1.487 | 0.091 |  |
|  |  | NYHA II  | -11.94  | -19.04  | -4.841 | 0.001 |  |
|  |  | NYHA III  | -4.390  | -18.66  | 9.876 | 0.545 |  |
| M | SF-36 RE | Age | -0.087  | -0.375  | 0.200 | 0.549  | 0.021 |
|  |  | Corrected  | -3.900  | -12.79  | 4.991 | 0.389  |  |
|  |  | Complex  | 1.020  | -16.36  | 18.40 | 0.908  |  |
|  |  | NYHA II  | -7.789  | -20.25  | 4.671 | 0.220  |  |
|  |  | NYHA III  | -81.09 | -141.8 | -20.39 | 0.009 |  |
| F |  | Age  | 0.040  | -0.240  | 0.322 | 0.776  | 0.092 |
|  |  | Corrected  | -7.752  | -19.23  | 3.723 | 0.185  |  |
|  |  | Complex | -28.15  | -45.86 | -10.44 | 0.002  |  |
|  |  | NYHA II  | -13.10  | -24.84  | -1.364 | 0.029  |  |
|  |  | NYHA III  | -32.51 | -55.94  | -9.079 | 0.007  |  |
| M | SF-36 MH | Age | -0.033  | -0.186  | 0.119 | 0.667  | 0.023 |
|  |  | Corrected  | -2.177  | -6.898  | 2.545 | 0.365  |  |
|  |  | Complex  | 0.437  | -8.802  | 9.676 | 0.926  |  |
|  |  | NYHA II  | -10.03  | -16.65 | -3.405 | 0.003 |  |
|  |  | NYHA III  | -13.65 | -45.91 | 18.61 | 0.406 |  |
| F |  | Age  | 0.172  | 0.029  | 0.328 | 0.019  | 0.055 |
|  |  | Corrected  | 0.970  | -4.921  | 6.862 | 0.746  |  |
|  |  | Complex | -3.715  | -12.80  | 5.371 | 0.422 |  |
|  |  | NYHA II  | -10.75  | -16.74 | -4.768 | <0.001  |  |
|  |  | NYHA III  | -0.577  | -12.61 | 11.46 | 0.925 |  |
| M | SF-36 PCS | Age | -0.173 | -0.235 | -0.111 | <0.001  | 0.183 |
|  |  | Corrected  | -1.135 | -3.040  | 0.770 | 0.242  |  |
|  |  | Complex  | -3.703 | -7.548  | 0.141 | 0.059  |  |
|  |  | NYHA II  | -5.592 | -8.289 | -2.894 | <0.001  |  |
|  |  | NYHA III  | -16.22 | -29.12 | -3.311 | 0.014 |  |
| F |  | Age  | -0.079 | -0.154 | -0.003 | 0.042  | 0.145 |
|  |  | Corrected  | -2.148 | -5.235  | 0.938 | 0.172  |  |
|  |  | Complex | -1.035 | -5.797  | 3.727 | 0.669  |  |
|  |  | NYHA II  | -6.366 | -9.522 | -3.209 | <0.001  |  |
|  |  | NYHA III  | -14.61 | -20.91 | -8.316 | <0.001  |  |
| M | SF-36 MCS | AgeCorrected | 0.023 1.644 | -0.074 -4.647 | 0.1201.359 | 0.637 0.282  | 0.018 |
|  |  | Complex  | 2.068  | -3.993  | 8.130 | 0.502  |  |
|  |  | NYHA II  | -5.000  | -9.253 | -0.747 | 0.021  |  |
|  |  | NYHA III  | -16.55 | -36.89 | 3.794 | 0.110 |  |
| F |  | Age  | 0.117  | 0.027  | 0.206 | 0.011  | 0.060 |
|  |  | Corrected  | -0.954  | -4.596  | 2.689 | 0.607  |  |
|  |  | Complex | -5.431  | -11.05  | 0.188 | 0.058 |  |
|  |  | NYHA II  | -4.912  | -8.637 | -1.188 | 0.010  |  |
|  |  | NYHA III  | -1.064  | -8.497  | 6.369 | 0.778  |  |

NYHA=New York Heart Association. CI=Confidence interval. M=Male, F=Female. Diagnosis group: Less complicated/Corrected/Complex, MET=Metabolic equivalent of tasks. Scores of SF-36 as follows: PF=physical function, RP=physical role function, BP=bodily pain, GH=general health, VT=vitality, SF=social functioning, RE=role limitations caused by emotional problems, MH=mental health, PCS=physical component score, MCS=mental component score.