Supplemental Digital Content (SDC)

**SDC Table 1:** Overall descriptive statistics, based on the full dataset after multiple imputation. (N = absolute frequency; SD = standard deviation).

| Metric                                | Overall (N = 108677) |
|----------------------------------------|----------------------|
| **VO2max/Endurance [ml/kg min]**       |                      |
| Mean (SD)                              | 50.3 (4.7)           |
| Range                                  | 21.7 - 70.3          |
| **Standing Long Jump/Power [meters]**  |                      |
| Mean (SD)                              | 2.3 (0.2)            |
| Range                                  | 0.2 - 3.2            |
| **Creatinine [µmol/l]**                |                      |
| Mean (SD)                              | 82.0 (12.0)          |
| Range                                  | 39.0 - 149.0         |
| **Hemoglobin [g/l]**                   |                      |
| Mean (SD)                              | 157.1 (8.7)          |
| Range                                  | 102.0 - 197.0        |
| **Residential Altitude [masl]**        |                      |
| Mean (SD)                              | 616.2 (228.9)        |
| Range                                  | 360.7 - 2127.5       |
| **BMI [kg/m2]**                        |                      |
| Mean (SD)                              | 23.3 (3.8)           |
| Range                                  | 12.8 - 56.8          |
| **Motivation Score [points]**          |                      |
| Mean (SD)                              | 43.4 (11.2)          |
| Range                                  | 0.0 - 60.0           |
| **Year**                               |                      |
| 2007                                   | 18035 (16.6%)        |
| 2008                                   | 17540 (16.1%)        |
| 2009                                   | 18124 (16.7%)        |
| 2010                                   | 18667 (17.2%)        |
| 2011                                   | 18305 (16.8%)        |
| 2012                                   | 18006 (16.6%)        |
| **Recruitment Center**                 |                      |
| Lausanne                               | 45204 (41.6%)        |
| Sumiswald                              | 34359 (31.6%)        |
| Mels                                    | 29114 (26.8%)        |
| **SEP Groups**                         |                      |
| High                                   | 35652 (32.8%)        |
| Imprecise                              | 8950 (8.2%)          |
| Low                                    | 28915 (26.6%)        |
| Medium                                 | 27661 (25.5%)        |
| Pupil                                  | 7499 (6.9%)          |
| **Physical Activity Behaviour Categories** |                |
| inactive individuals                   | 13021 (12.0%)        |
| partially active individuals           | 18244 (16.8%)        |
| irregularly active individuals         | 22761 (20.9%)        |
| regularly active individuals           | 6924 (6.4%)          |
| regularly vigorously active individuals | 47227 (43.9%)        |
| **Urbanicity**                         |                      |
| non-urban                              | 66226 (60.9%)        |
| urban                                  | 42451 (39.1%)        |
| **Age Groups [years]**                 |                      |
| [18-19]                                | 26174 (24.1%)        |
| [19-20]                                | 50797 (46.7%)        |
| [20-21]                                | 23424 (21.6%)        |
| [21-22]                                | 8282 (7.6%)          |
| **CRP [mg/l]**                         |                      |
| < 5.0                                  | 101686 (93.6%)       |
| >= 5.0                                 | 6991 (6.4%)          |
SDC Table 2: Descriptive table of GAM model for unadjusted and adjusted effects of residential altitude on endurance and muscle power performance, based on the full dataset after multiple imputation. (edf = effective degrees of freedom; SE = standard error, s(x) = smooth, potentially nonlinear term in the variable x).

|                      | Estimate | SE  | t.value | p.value |
|----------------------|----------|-----|---------|---------|
| Intercept            | 43.46    | 0.1 | 432.4   | <0.001 |
| SDC Table 2:        |          |     |         |         |
| molsms               | 0.01     |     | 0.1     | 0.987   |
| 2008                 | -0.01    | 0.03| 4.3     | <0.001 |
| 2009                 | -0.15    | 0.03| 5.0     | <0.001 |
| 2010                 | -0.21    | 0.03| 6.9     | <0.001 |
| 2011                 | -0.31    | 0.03| 8.7     | <0.001 |
| 2012                 | -0.21    | 0.03| 8.7     | <0.001 |
| Urbanity*            | -0.23    | 0.03| 4.5     | <0.001 |
| Age [years]          |          |     |         |         |
| [18-19]*             | -0.01    | 0.03| 8.7     | <0.001 |
| (20-21)              | -0.19    | 0.03| 8.7     | <0.001 |
| (21-22)              | -0.39    | 0.03| 8.7     | <0.001 |
| CRP [mg/l]           |          |     |         |         |
| <5.0*                | -0.71    | 0.1 | 12.7    | <0.001 |
| >=5.0                | -0.02    | 0.02| 4.5     | <0.001 |

* Reference
**SDC Table 3:** Descriptive statistics of endurance ($\text{VO}_{2\text{max}}, \text{[ml/kg min]}$) and muscle power performance (Standing Long Jump, [meters]) per residential altitude levels per 300 masl, based on the complete case dataset. (masl = meters above sea level; N = absolute frequency; N [%] = percentage of absolute frequency, SD = standard deviation).

| Residential Altitude Groups [masl] | N   | N [%] | $\text{VO2max/Endurance}$ Mean [ml/kg min] | SD | Standing Long Jump/Power Mean [meters] | SD |
|-----------------------------------|-----|-------|-------------------------------------------|----|---------------------------------------|----|
| &ge;1800                          | 153 | 0.28  | 51.99                                     | 4.21 | 2.40                                  | 0.22 |
| 1500-1799                         | 529 | 0.95  | 50.99                                     | 4.56 | 2.34                                  | 0.26 |
| 1200-1499                         | 1162| 2.09  | 51.34                                     | 4.43 | 2.34                                  | 0.24 |
| 900-1199                          | 3710| 6.64  | 51.02                                     | 4.45 | 2.31                                  | 0.23 |
| 600-899                           | 17266| 30.84 | 50.92                                     | 4.37 | 2.32                                  | 0.22 |
| 300-599                           | 33437| 59.20 | 50.46                                     | 4.52 | 2.32                                  | 0.22 |
**SDC Table 4:** Overall descriptive statistics, based on the complete case dataset. (N = absolute frequency; SD = standard deviation).

| Overall (N=56257) |  |
|--------------------|---|
| **VO2max/Endurance [ml/kg min]** |  |
| Mean (SD) | 50.7 (4.5) |
| Range | 31.2 - 70.3 |
| **Standing Long Jump/Power [meters]** |  |
| Mean (SD) | 2.3 (0.2) |
| Range | 0.2 - 3.2 |
| **Creatinine [µmol/l]** |  |
| Mean (SD) | 81.9 (11.9) |
| Range | 42.0 - 149.0 |
| **Hemoglobin [g/l]** |  |
| Mean (SD) | 156.9 (8.7) |
| Range | 102.0 - 197.0 |
| **Residential Altitude [masl]** |  |
| Mean (SD) | 620.1 (229.6) |
| Range | 360.7 - 1989.3 |
| **BMI [kg/m2]** |  |
| Mean (SD) | 23.2 (3.4) |
| Range | 15.0 - 48.9 |
| **Motivation Score [points]** |  |
| Mean (SD) | 44.3 (10.8) |
| Range | 0.0 - 60.0 |
| **Year** |  |
| 2007 | 8343 (14.8%) |
| 2008 | 7860 (14.0%) |
| 2009 | 8295 (14.7%) |
| 2010 | 10794 (19.2%) |
| 2011 | 10540 (18.7%) |
| 2012 | 10425 (18.5%) |
| **Recruitment Center** |  |
| Lausanne | 22741 (40.4%) |
| Sumiswald | 16435 (29.2%) |
| Mels | 17081 (30.4%) |
| **SEP Groups** |  |
| High | 18189 (32.3%) |
| Imprecise | 4095 (7.3%) |
| Low | 15034 (26.7%) |
| Medium | 15300 (27.2%) |
| Pupil | 3639 (6.5%) |
| **Physical Activity Behaviour Categories** |  |
| inactive individuals | 5961 (10.6%) |
| partially active individuals | 8975 (16.0%) |
| irregularly active individuals | 11912 (21.2%) |
| regularly active individuals | 3590 (6.4%) |
| regularly vigorously active individuals | 25819 (45.9%) |
| **Urbanicity** |  |
| non-urban | 34934 (62.1%) |
| urban | 21323 (37.9%) |
| **Age Groups [years]** |  |
| [18-19) | 14273 (25.4%) |
| [19-20) | 26717 (47.5%) |
| [20-21) | 11496 (20.4%) |
| [21-22) | 3771 (6.7%) |
| **CRP [mg/l]** |  |
| < 5.0 | 52850 (93.9%) |
| >= 5.0 | 3407 (6.1%) |
SDC Table 5: Descriptive table of GAM model for unadjusted and adjusted effects of residential altitude on endurance and muscle power performance, based on the complete case dataset. (edf = effective degrees of freedom; SE = standard error, s(x) = smooth, potentially nonlinear term in the variable x).

|                                      | edf | F         | p.value |
|--------------------------------------|-----|-----------|---------|
| Unadjusted Residential Altitude VO2max/Endurance | 14.35 | 23.3 | <0.001 |
| Unadjusted Residential Altitude Standing Long Jump/Power | 14.97 | 5.0 | <0.001 |
| Adjusted VO2max/Endurance smooth     | 14.10 | 23.5 | <0.001 |
| s(Residential Altitude)              | 6.24 | 13.9 | <0.001 |
| s(Severity)                         | 2.42 | 5.1 | 0.002 |
| s(BMI)                               | 7.91 | 1892.6 | <0.001 |
| s(Days)                              | 7.95 | 11.2 | <0.001 |
| Adjusted Standing Long Jump/Power smooth | 7.92 | 1.6 | 0.109 |
| s(Residential Altitude)              | 2.15 | 2.7 | 0.049 |
| s(Severity)                         | 4.40 | 518.9 | <0.001 |
| s(BMI)                               | 6.25 | 1285.0 | <0.001 |
| s(Days)                              | 8.40 | 7.1 | <0.001 |

### Adjusted VO2max/Endurance linear

| Estimate      | SE   | t.value | p.value |
|---------------|------|---------|---------|
| Intercept     | 14.15 | 0.1 | 823.2 | <0.001 |
| Motivation Score [points] | 0.13 | 0.0 | 77.8 | <0.001 |
| Recruitment Center | - | - | - | - |
| Low           | -0.20 | 0.0 | -5.1 | <0.001 |
| Medium        | -0.21 | 0.0 | -5.3 | <0.001 |
| High*         | -0.14 | 0.1 | -2.1 | 0.032 |

### Adjusted Standing Long Jump/Power linear

| Estimate      | SE   | t.value | p.value |
|---------------|------|---------|---------|
| Intercept     | 2.00 | 0.0 | 433.2 | <0.001 |
| Motivation Score [points] | -0.01 | 0.0 | 51.9 | <0.001 |
| Recruitment Center | - | - | - | - |
| Low           | -0.01 | 0.0 | -3.7 | <0.001 |
| Medium        | -0.01 | 0.1 | 1.2 | 0.240 |
| High*         | -0.01 | 0.0 | -1.9 | 0.050 |

### Physical Activity Behavior Categories

| Category                        | Estimate | SE   | t.value | p.value |
|---------------------------------|----------|------|---------|---------|
| Inactive individuals            | -        | -    | -       | -       |
| Partially active individuals    | 0.44     | 0.1  | 7.6     | <0.001 |
| Irregularly active individuals  | 1.19     | 0.1  | 20.5    | <0.001 |
| Regularly active individuals    | 1.41     | 0.1  | 19.0    | <0.001 |
| Regularly vigorous active individuals | 2.35   | 0.1  | 64.3    | <0.001 |

### Year

| Year   | Estimate      | SE   | t.value | p.value |
|--------|---------------|------|---------|---------|
| 2007   | -0.01         | 0.1  | -0.2    | 0.847   |
| 2008   | -0.01         | 0.1  | -0.2    | 0.847   |
| 2009   | -0.18         | 0.1  | -3.3    | 0.001   |
| 2010   | -0.16         | 0.1  | -3.3    | 0.001   |
| 2011   | -0.26         | 0.0  | -5.3    | <0.001  |
| 2012   | -0.19         | 0.1  | -3.0    | <0.001  |

### Urbanicity

| Urbanicity | Estimate      | SE   | t.value | p.value |
|------------|---------------|------|---------|---------|
| Non-urban* | -             | -    | -       | -       |
| Urban      | -0.19         | 0.0  | -6.2    | <0.001  |

### Age [years]

| Age [years] | Estimate      | SE   | t.value | p.value |
|-------------|---------------|------|---------|---------|
| [16-19]*    | -             | -    | -       | -       |
| [19-20)     | -0.20         | 0.0  | -5.7    | <0.001  |
| [20-21)     | -0.44         | 0.0  | -10.1   | <0.001  |
| [21-22]     | -0.70         | 0.1  | -12.4   | <0.001  |

### CRP [mg/l]

| CRP [mg/l] | Estimate      | SE   | t.value | p.value |
|------------|---------------|------|---------|---------|
| <5.0       | -0.60         | 0.1  | -11.3   | <0.001  |

* Reference
**SDC Table 6**: Rating of explanatory factors from the adjusted endurance (VO$_{2\text{max}}$) and muscle power performance (Standing Long Jump) GAM models sorted according to contribution to AIC (Akaike's information criterion), based on the complete case dataset. (delta AIC = difference between AIC with the respective deleted term and the AIC of the full model, $s(x)$ = smooth, potentially nonlinear term in the variable $x$).

| Rank Importance | VO2max/Endurance Term | delta AIC |
|-----------------|------------------------|-----------|
| 1.              | $s$(BMI)               | 14331.3   |
| 2.              | Motivation Score       | 5743.3    |
| 3.              | Physical Activity Behavior | 3117.2  |
| 4.              | $s$(Residential Altitude) | 363.3    |
| 5.              | Age                    | 191.5     |
| 6.              | CRP                    | 125.8     |
| 7.              | $s$(Hemoglobin)        | 90.5      |
| 8.              | Days                   | 87.3      |
| 9.              | SEP                    | 69.2      |
| 10.             | Urbanicity             | 34.4      |
| 11.             | Year                   | 33.8      |
| 12.             | Recruitment Center     | 32.6      |
| 13.             | $s$(Creatinine)        | 13.3      |

| Rank Importance | Standing Long Jump/Power Term | delta AIC |
|-----------------|-------------------------------|-----------|
| 1.              | $s$(BMI)                      | 8716.1    |
| 2.              | $s$(Creatinine)               | 2710.1    |
| 3.              | Motivation Score              | 2627.9    |
| 4.              | Physical Activity Behavior    | 440.8     |
| 5.              | Recruitment Center            | 401.5     |
| 6.              | Year                          | 225.3     |
| 7.              | SEP                           | 50.4      |
| 8.              | Days                          | 47.4      |
| 9.              | Urbanicity                    | 28.4      |
| 10.             | Age                           | 21.7      |
| 11.             | CRP                           | 18.6      |
| 12.             | $s$(Residential Altitude)     | 4.7       |
| 13.             | $s$(Hemoglobin)               | 4.5       |
SDC Figure 1: Flowchart for included data. (N = absolute frequency; [%] = percentage of absolute frequency).

- **Initial medical data set**
  - N = 213’458 (N = 182’669 or 85.6% participated in the sports test)
- **Exclusion criteria**
  - N = 104’753
  - Recruitment centers Windisch, Rüti and Mt. Ceneri (cover only flat land residential areas)
- **Remaining data**
  - N = 108’705, Recruitment centers Lausanne, Sumiswald, Mels
- **Excluded observations**
  - N = 28 (0.03%)
  - Extreme cases:
    - Hb <101g/l, N = 8 (0.01%)
    - Creatinine >149µmol/l, N = 20 (0.02%)
- **Remaining data without extreme cases**
  - N = 108’677
- **Used imputed data**
  - N = 108’677
- **Imputation for missing variables**
  - (complete cases, N = 56’257)
  - Hemoglobin, N = 33’876 (31.2 %)
  - Creatinine, N = 33’481 (30.8 %)
  - CRP, N = 33’442 (30.8 %)
  - Physical Activity Behavior, N = 30’556 (28.1 %)
  - Motivation Score, N = 30’556 (28.1 %)
  - Standing Long Jump result, N = 30’055 (27.7 %)
  - VO₂max result (endurance test), N = 30’210 (27.8 %)

- **Uniquely matched**
  - (among those who participated in the sports test):
    - N = 165’542 (90.6 %)

- **Initial sports data set**
  - Wyss et al. 2018
  - Individual results for endurance and strength available

- **Initial medical data set**
  - N = 213’458 (N = 182’669 or 85.6% participated in the sports test)
**SDC Figure 2:** Recruitment center maps of Switzerland. Top: Map of Switzerland showing residential altitude of buildings containing males aged [18-25] per community. Bottom: Allocation of each community to a recruitment center (Lausanne, Sumiswald or Mels). Conscripts of grey shaded communities are not allocated to a specific recruitment center but one of the three recruitment centers that where included in our study. Conscripts of white shaded communities where not allocated to either Lausanne, Sumiswald nor Mels and therefore not included in our study.
**SDC Figure 3**: Histograms showing number of conscripts, based on the full dataset after multiple imputation.
SDC Figure 4: Histograms showing number of conscripts, based on the complete case dataset.
SDC Figure 5: GAM models with adjusted smoothed terms of the change in endurance ($\text{VO}_{2\text{max}}$ in black) respectively muscle power performance (Standing Long Jump in red) associated with residential altitude, based on the complete case dataset. (dashed lines = 95% confidence intervals, masl = meters above sea level, the scales of the primary and secondary axes are chosen according to Appendix Figure 6 in order to ensure comparability).
**SDC Figure 6:** GAM model with smoothed term changes in endurance (VO$_{2\text{max}}$ in black) and muscle power performance (Standing Long Jump in red) associated with Hb [g/l] (A), creatinine [µmol/l] (B), and BMI [kg/m$^2$] (C), based on the complete case dataset. (dashed lines = 95% confidence intervals).