Supplemental Material

This appendix has been provided by the authors to give readers additional information about their work.

Supplement to:
Higher body mass index in adolescence predicts cardiomyopathy risk in mid–life: a long term follow up amongst Swedish men
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Supplemental Material

Higher body mass index in adolescence predicts cardiomyopathy risk in mid–life: a long term follow up amongst Swedish men

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Supplemental Methods

Cardiomyopathy diagnoses

Cardiomyopathy cases were identified in the Swedish National Hospital Register. For diagnostic codes used, see Supplemental Table 1. A review from 2011, evaluating this register, found a high positive predicted value of between 85 and 95% for a majority of the diagnoses included. The proportion of valid diagnoses was described to be higher in patients with severe as opposed to milder forms of disease, with estimates reported to be similar to those from an equivalent Danish register (1). The validation study of cardiomyopathy diagnosis in the National Hospital Register from our group comprised more than 600 cases (mean age 58.9 (SD 15.5) years, 68.2% men) in western Sweden during a time frame of 20 years (2). Records for all patients with a cardiomyopathy diagnosis as reported to the National Hospital Register were identified in the local discharge registers in three hospitals, with different catchment areas, and validated according to the criteria determined by the European Society of Cardiology from 2008. The validation was categorized as definite, when criteria were fulfilled, uncertain, or miscoded. The accuracy rate was 85.5% for dilated cardiomyopathy, 87.5% for hypertrophic cardiomyopathy, and 100% for other cardiomyopathies, with no significant trend over time, and with a more or less uniform use of echocardiography in the investigation of suspected cardiomyopathy throughout the study period (on average 94.6%), except from the first two years (1989–90).

In the present study, we divided the cardiomyopathy diagnoses into four groups: 1) dilated cardiomyopathy, 2) hypertrophic cardiomyopathy, 3) alcohol/drug-induced cardiomyopathy, and 4) other cardiomyopathies, which was composed of less common forms (Supplemental Table 1). Patients registered with both dilated cardiomyopathy and hypertrophic cardiomyopathy at different times during the follow-up (about 3%) were not included in any of the four groups (indeterminable cardiomyopathies). Drug-induced cardiomyopathies were
categorized together with alcoholic cardiomyopathies and formed one single group. Drug-induced cardiomyopathies were, in ICD-9, formed by 425X (secondary cardiomyopathy) in combination with a prior registered substance use disorder (209, 303, 304 (ICD-8); 303, 304, 305, 965A, 969G, 969H (ICD-9)), and in ICD-10 by I42.7 (cardiomyopathy due to drugs or external agents), I42.8 (other cardiomyopathies), I42.9 (cardiomyopathy, unspecified), if prior substance use disorder (as before but additionally F10-19 (ICD-10)).

Men with acute myocardial infarction (410 (ICD-8 and 9) and I21 (ICD-10)) were censored at the date of myocardial infarction, as those patients inaccurately could have been diagnosed with a subsequent cardiomyopathy after the myocardial infarction, instead of heart failure of ischemic origin (n=1,145 of the cardiomyopathy cases). The following diagnoses were included as concomitant or pre-existing comorbidities at baseline: diabetes 250 (ICD-8 and 9), E10-E14 (ICD-10); hypertension 401-405 (ICD-8 and 9), I10-I15 (ICD-10); congenital heart disease 746-747 (ICD-8), 745-747 (ICD-9), Q20-Q28, Q87, Q89 (ICD-10).

Supplemental Results and Discussion

Cardiorespiratory fitness and muscle strength

We found that low cardiorespiratory fitness and low muscle strength measured in late adolescence were associated with an increased risk of both dilated cardiomyopathy and alcohol/drug-induced cardiomyopathy, independently of body mass index (BMI) and other factors (Supplemental Table 5 and 6), and similar to recent studies with respect to risk of heart failure and vascular disease (3, 4). Regular physical activity and less sedentary time are known to be associated with lower risk of heart failure (5, 6), mediated through a multifaceted interplay between cardiovascular, renal, pulmonary, and muscular performance, and neurohormonal balance (7), including effects on myocardial function (8). Previous research on
muscular dystrophies has reported the presence of concomitant dilated cardiomyopathy or more commonly left ventricular dilation in these patients, with similar pathology of infiltrating inflammatory cells and fibroblasts causing cell death and fibrosis in skeletal muscle as well as in the myocardium (9, 10). Accordingly, one might speculate on comparable pathophysiological mechanisms in these different types of muscle. However, we did not find any association between low fitness or muscle strength, with respect to hypertrophic cardiomyopathy, probably due to the strong genetic component of this condition.
### Supplemental Table 1. Diagnostic Categories and ICD codes.

| Frequencies | ICD 8 | ICD 9 | ICD 10 |
|-------------|-------|-------|--------|
| **Dilated cardiomyopathy**<br>n=4,477 | 425.00 Cardiomyopathy | 425E Other primary cardiomyopathies | I42.0 Dilated cardiomyopathy |
| **Hypertrophic cardiomyopathy**<br>n=673 | 425.00 Hypertrophic cardiomyopathy<br>Hypertrophic subaortic stenosis | 425B Hypertrophic cardiomyopathy<br>Hypertrophic cardiomyopathy with or without obstruction<br>Hypertrophic subaortic stenosis | I42.1 Obstructive hypertrophic cardiomyopathy<br>I42.2 Other hypertrophic cardiomyopathy |
| **Alcohol/drug-induced cardiomyopathy**<br>n=480 | - | 425F Alcohol cardiomyopathy<br>425X (if prior alcohol/substance use disorder)<br>Secondary cardiomyopathy | I42.6 Alcoholic cardiomyopathy<br>I42.7 (if prior alcohol/substance use disorder)<br>Cardiomyopathy due to drug and external agent<br>I42.8 (if prior alcohol/substance use disorder)<br>Other cardiomyopathies<br>I42.9 (if prior alcohol/substance use disorder)<br>Cardiomyopathy, unspecified |
| **Other cardiomyopathies**<br>n=538 | 425.08 Cardiomyopathy | 425A Endomyocardial fibrosis<br>425D Endocardial fibroelastosis<br>425H Nutritional and metabolic cardiomyopathies<br>425W Cardiomyopathy in other diseases classified elsewhere<br>425X (if prior alcohol/substance use disorder)<br>Secondary cardiomyopathy | I42.3 Endomyocardial (eosinophilic) disease<br>I42.4 Endocardial fibroelastosis<br>I42.5 Other restrictive cardiomyopathy<br>I42.7 (if no prior alcohol/substance use disorder)<br>Cardiomyopathy due to drug and external agent<br>I42.8 (if no prior alcohol/substance use disorder)<br>Other cardiomyopathies<br>I42.9 (if no prior alcohol/substance use disorder)<br>Cardiomyopathy, unspecified<br>I43.0 Cardiomyopathy in diseases classified elsewhere |
| Condition                  | ICD Code          | Description          |
|----------------------------|-------------------|----------------------|
| Acute myocardial infarction| 410 Acute myocardial infarction | 410 Acute myocardial infarction |
|                           | I21 Acute myocardial infarction |                       |
| Heart failure              | 427.00 Heart failure  | 428 Heart failure     |
|                           | 427.10 Heart failure  | I50 Heart failure     |

ICD indicates International Classification of Diseases.
**Supplemental Table 2.** Event rates per 100,000 observation years for indeterminable cardiomyopathy*, acute myocardial infarction, and heart failure†, by BMI category.‡

|                              | All   | BMI<18.5 | 18.5≤BMI<20 | 20≤BMI<22.5 | 22.5≤BMI<25 | 25≤BMI<27.5 | 27.5≤BMI<30 | 30≤BMI<35 | 35≤BMI |
|------------------------------|-------|----------|-------------|-------------|-------------|-------------|-------------|-----------|--------|
| **Indeterminable CM*, n (%)** |       |          |             |             |             |             |             |           |        |
| Number of events, n (%)      | 155 (0.009) | 14 (0.01) | 26 (0.009) | 46 (0.007) | 34 (0.01)  | 20 (0.02)  | 9 (0.02)   | 6 (0.02)  | –      |
| Cases per 100 000 observation years (95% CI) | 0.3 (0.3–0.4) | 0.4 (0.2–0.6) | 0.3 (0.2–0.4) | 0.3 (0.2–0.3) | 0.4 (0.3–0.5) | 0.7 (0.4–1.0) | 0.9 (0.4–1.7) | 0.9 (0.3–2.0) | –      |
| **Acute myocardial infarction, n (%)** |       |          |             |             |             |             |             |           |        |
| Number of events, n (%)      | 22033 (1.32) | 1908 (1.42) | 3882 (1.29) | 8075 (1.20) | 4647 (1.31) | 1996 (1.62) | 849 (1.94) | 547 (1.81) | 129 (1.75) |
| Cases per 100 000 observation years (95% CI) | 49.6 (49.0–50.3) | 49.1 (46.9–51.3) | 45.8 (44.4–47.3) | 44.5 (43.5–45.5) | 51.4 (50.0–52.9) | 66.6 (63.7–69.6) | 83.0 (77.5–88.7) | 81.7 (75.0–88.9) | 88.3 (73.7–104.9) |
| **Heart failure†, n (%)**    |       |          |             |             |             |             |             |           |        |
| Number of events, n (%)      | 4493 (0.27)  | 360 (0.27)  | 700 (0.23)  | 1452 (0.22) | 938 (0.26)  | 500 (0.41)  | 234 (0.54)  | 235 (0.78) | 74 (1.00)  |
| Cases per 100 000 observation years (95% CI) | 9.8 (9.5–10.1) | 9.0 (8.1–9.9) | 8.0 (7.4–8.6) | 7.7 (7.3–8.1) | 10.0 (9.4–10.7) | 16.1 (14.7–17.6) | 22.0 (19.3–25.0) | 33.8 (29.6–38.4) | 48.8 (38.3–61.2) |

*Indeterminable CM consists of cases registered with both dilated cardiomyopathy and hypertrophic cardiomyopathy at different times during the follow-up (about 3%). They are not included in any of the other four CM groups.

†As a principal diagnosis

‡CM indicates cardiomyopathy, and BMI, body mass index.
**Supplemental Table 3.** Competing–risk analysis with death as a competing event* and hazard ratios for dilated cardiomyopathy, hypertrophic cardiomyopathy, alcohol/drug-induced cardiomyopathy, and other cardiomyopathies by BMI category.†

| BMI (events/population) | Dilated cardiomyopathy | Hypertrophic cardiomyopathy | Alcohol/drug–induced cardiomyopathy | Other cardiomyopathies |
|-------------------------|-------------------------|-------------------------------|--------------------------------------|------------------------|
| BMI<18.5                | 0.85 (0.69-1.06)        | 1.02 (0.65-1.61)              | 0.77 (0.48-1.24)                     | 1.08 (0.67-1.75)       |
| 18.5≤BMI<20             | 1 (ref)                 | 1 (ref)                       | 1 (ref)                              | 1 (ref)                |
| 20≤BMI<22.5             | 1.12 (0.97-1.31)        | 1.31 (0.95-1.80)              | 0.95 (0.68-1.32)                     | 0.96 (0.69-1.35)       |
| 22.5≤BMI<25             | 1.55 (1.30-1.83)        | 1.73 (1.21-2.48)              | 1.65 (1.14-2.39)                     | 1.23 (0.84-1.81)       |
| 25≤BMI<27.5             | 2.31 (1.87-2.85)        | 3.00 (1.96-4.60)              | 1.58 (0.92-2.70)                     | 1.07 (0.62-1.88)       |
| 27.5≤BMI<30             | 3.05 (2.30-4.05)        | 2.95 (1.56-5.59)              | 2.14 (1.01-4.57)                     | 2.26 (1.18-4.32)       |
| 30≤BMI<35               | 4.73 (3.51-6.38)        | 3.05 (1.37-6.80)              | 1.89 (0.68-5.31)                     | 3.26 (1.62-6.58)       |
| 35≤BMI                  | 8.85 (5.30-14.78)       | 3.09 (0.42-22.50)             | 8.99 (2.74-29.46)                    | 4.39 (1.05-18.31)      |

*The Fine-Gray method was used to study competing risk, and fatal cardiomyopathy events were coded as cardiomyopathy events rather than deaths.

†BMI indicates body mass index; and ref, reference.
**Supplemental Table 4.** Hazard ratios for indeterminable cardiomyopathy*, acute myocardial infarction, and heart failure†, by BMI category.‡

| (events/population) | Indeterminable CM | Acute myocardial infarction | Heart failure† |
|---------------------|-------------------|-----------------------------|---------------|
| Model 1§            |                   |                             |               |
| BMI<18.5            | 155/1668781       | 22031/1668781               | 4492/1668779  |
| 18.5≤BMI<20         | 1.12 (0.58–2.14)  | 0.98 (0.93–1.04)            | 1.03 (0.91–1.17) |
| 20≤BMI<22.5         | 1.40 (0.84–2.35)  | 1.41 (1.35–1.47)            | 1.55 (1.40–1.71) |
| 22.5≤BMI<25         | 2.66 (1.48–4.78)  | 1.99 (1.88–2.10)            | 2.67 (2.38–3.00) |
| 25≤BMI<27.5         | 3.71 (1.74–7.95)  | 2.69 (2.49–2.89)            | 3.93 (3.39–4.56) |
| 27.5≤BMI<30         | 4.20 (1.72–10.23) | 3.01 (2.75–3.29)            | 6.83 (5.88–7.92) |
| 30≤BMI<35           | 5.91 (1.97–17.74) | 2.73 (2.48–3.00)            | 4.73 (3.87–5.78) |
| 35≤BMI              |               |                             |               |
| Per unit BMI×       | 1.15 (1.10–1.21)  | 1.11 (1.10–1.11)            | 1.17 (1.16–1.18) |
|                     |                   |                             |               |
| Model 2†            |                   |                             |               |
| (events/population) | 81/773805         | 15108/773805                | 2819/773804   |
| BMI<18.5            | 1.17 (0.44–3.09)  | 0.93 (0.87–0.99)            | 0.83 (0.70–0.97) |
| 18.5≤BMI<20         | 1 (ref)           | 1 (ref)                     | 1 (ref)       |
| 20≤BMI<22.5         | 1.40 (0.69–2.86)  | 1.17 (1.11–1.22)            | 1.23 (1.10–1.38) |
| 22.5≤BMI<25         | 2.18 (1.00–4.77)  | 1.52 (1.44–1.61)            | 2.02 (1.78–2.29) |
| 25≤BMI<27.5         | 3.02 (1.16–7.82)  | 2.04 (1.90–2.18)            | 3.40 (2.92–3.96) |
| 27.5≤BMI<30         | 5.91 (1.97–17.74) | 2.73 (2.48–3.00)            | 4.73 (3.87–5.78) |
| 30≤BMI<35           | 6.15 (1.64–23.13) | 3.00 (2.66–3.38)            | 8.55 (6.98–10.47) |
| 35≤BMI              |               |                             |               |
| Per unit BMI×       | 1.13 (1.05–1.22)  | 1.10 (1.10–1.11)            | 1.19 (1.17–1.20) |

*Indeterminable CM consists of cases registered with both dilated cardiomyopathy and hypertrophic cardiomyopathy at different times during the follow-up (about 3%). They are not included in any of the other four CM groups.

†As a principal diagnosis.
‡CM indicates cardiomyopathy; BMI, body mass index; and ref, reference.

§Model 1: Adjusted for age at conscription, conscription year, test center, and baseline comorbidities (diabetes, hypertension, congenital heart disease).

¶Model 2: Additionally adjusted for systolic blood pressure, diastolic blood pressure, cardiorespiratory fitness, muscle strength, parental education, and alcohol or substance use disorder.

*Calculated for BMI above 20.
### Supplemental Table 5.

Event rates per 100,000 observation years for predefined categories of cardiomyopathy by systolic blood pressure, diastolic blood pressure, cardiorespiratory fitness, muscle strength, parental education, and alcohol/substance use disorder.

| Event Category             | 100–119  | 120–125 | 126–130 | 131–138 | 139–180 |
|----------------------------|----------|---------|---------|---------|---------|
| **Systolic blood pressure**|          |         |         |         |         |
| Dilated CM                | 5.1 (4.6–5.6) | 6.1 (5.6–6.6) | 6.2 (5.7–6.7) | 6.0 (5.5–6.5) | 6.9 (6.3–7.4) |
| Hypertrophic CM           | 1.4 (1.1–1.6) | 1.4 (1.2–1.7) | 1.5 (1.3–1.8) | 1.6 (1.3–1.8) | 1.8 (1.5–2.1) |
| Alcohol/drug-induced CM   | 1.0 (0.8–1.3) | 1.3 (1.1–1.5) | 1.2 (1.0–1.5) | 0.9 (0.7–1.1) | 1.0 (0.8–1.2) |
| Other CMs                 | 1.1 (0.8–1.3) | 1.3 (1.0–1.5) | 1.1 (0.9–1.3) | 1.2 (0.9–1.4) | 1.5 (1.3–1.8) |
| **Diastolic blood pressure**| 40–59   | 60–65   | 66–70   | 71–76   | 77–100  |
| Dilated CM                | 3.9 (3.5–4.3) | 5.0 (4.5–5.5) | 5.4 (5.0–5.9) | 6.8 (6.2–7.4) | 9.4 (8.8–10.1) |
| Hypertrophic CM           | 1.3 (1.0–1.5) | 1.4 (1.2–1.7) | 1.6 (1.3–1.8) | 1.6 (1.3–1.9) | 1.8 (1.5–2.1) |
| Alcohol/drug-induced CM   | 0.9 (0.7–1.1) | 0.9 (0.7–1.1) | 1.1 (0.9–1.4) | 1.0 (0.8–1.3) | 1.6 (1.3–1.9) |
| Other CMs                 | 1.3 (1.0–1.5) | 1.0 (0.8–1.2) | 1.2 (1.0–1.4) | 1.3 (1.1–1.6) | 1.4 (1.2–1.7) |
| **Cardiorespiratory fitness**| High (v8–9) | Moderate (v5–7) | Low (v1–4) |
| Dilated CM                | 5.3 (4.9–5.8) | 5.6 (5.2–5.9) | 8.0 (7.2–8.8) |
| Hypertrophic CM           | 1.4 (1.1–1.6) | 1.4 (1.2–1.5) | 1.6 (1.3–2.0) |
| Alcohol/drug-induced CM   | 0.8 (0.6–1.0) | 1.0 (0.8–1.1) | 1.8 (1.5–2.3) |
| Other CMs                 | 1.2 (1.0–1.5) | 1.0 (0.9–1.2) | 1.4 (1.1–1.8) |
| **Muscle strength**        | High (v7–9) | Moderate (4–6) | Low (v1–3) |
| CM Type                        | High (v5–7) | Moderate (3–4) | Low (v1–2) |
|-------------------------------|-------------|----------------|------------|
| Dilated CM                   | 6.8 (6.2–7.3) | 6.6 (6.3–7.0) | 7.8 (6.9–8.7) |
| Hypertrophic CM              | 1.7 (1.4–2.0) | 1.7 (1.5–1.9) | 1.6 (1.2–2.0) |
| Alcohol/drug-induced CM      | 1.2 (1.0–1.5) | 1.3 (1.1–1.4) | 1.5 (1.2–2.0) |
| Other CMs                    | 1.5 (1.3–1.8) | 1.2 (1.0–1.4) | 1.5 (1.2–2.0) |

Parental education

| CM Type                        | High (v5–7) | Moderate (3–4) | Low (v1–2) |
|-------------------------------|-------------|----------------|------------|
| Dilated CM                   | 4.2 (3.8–4.6) | 5.6 (5.3–5.9) | 9.0 (8.4–9.6) |
| Hypertrophic CM              | 1.4 (1.2–1.6) | 1.4 (1.3–1.6) | 1.9 (1.7–2.2) |
| Alcohol/drug-induced CM      | 0.5 (0.4–0.6) | 1.0 (0.9–1.2) | 1.9 (1.7–2.2) |
| Other CMs                    | 1.1 (0.9–1.3) | 1.2 (1.0–1.3) | 1.5 (1.3–1.8) |

Alcohol/substance use disorder

| CM Type                        | No          | Yes          |
|-------------------------------|-------------|--------------|
| Dilated CM                   | 5.9 (5.7–6.1) | 10.0 (7.0–13.8) |
| Hypertrophic CM              | 1.5 (1.4–1.6) | 3.2 (1.7–5.7) |
| Alcohol/drug-induced CM      | 1.0 (0.9–1.1) | 9.4 (6.6–13.1) |
| Other CMs                    | 1.2 (1.1–1.3) | 0.5 (0.1–1.9) |

*CM indicates cardiomyopathy.*
**Supplemental Table 6.** Hazard ratios for predefined categories of cardiomyopathies by systolic blood pressure, diastolic blood pressure, cardiorespiratory fitness, muscle strength, and alcohol/substance use disorder.

|                              | Dilated CM | Hypertrophic CM | Alcohol/drug–induced CM | Other CMs |
|------------------------------|------------|-----------------|-------------------------|-----------|
| **Systolic BP**              |            |                 |                         |           |
| (events/population)          | 2610/1581995 | 662/1581995    | 475/1581995             | 526/1581995 |
| 100–119                      | 1 (ref)    | 1 (ref)        | 1 (ref)                 | 1 (ref)   |
| 120–125                      | 1.09 (0.96–1.24) | 0.98 (0.76–1.26) | 1.14 (0.87–1.51)       | 1.15 (0.87–1.51) |
| 126–130                      | 1.14 (1.00–1.30) | 1.09 (0.85–1.41) | 1.13 (0.85–1.51)       | 0.98 (0.73–1.33) |
| 131–138                      | 1.12 (0.98–1.27) | 1.11 (0.86–1.44) | 0.89 (0.65–1.22)       | 1.07 (0.80–1.44) |
| 139–180                      | 1.13 (0.99–1.29) | 1.19 (0.92–1.53) | 0.90 (0.66–1.23)       | 1.36 (1.02–1.80) |
| p-value interaction†         | 0.21       | <0.05          | 0.54                    | 0.92      |
| **Diastolic BP**             |            |                 |                         |           |
| (events/population)          | 2611/1582094 | 660/1582094    | 475/1582094             | 527/1582094 |
| 40–59                        | 1 (ref)    | 1 (ref)        | 1 (ref)                 | 1 (ref)   |
| 60–65                        | 1.13 (0.97–1.30) | 1.03 (0.79–1.35) | 0.77 (0.56–1.08)       | 0.73 (0.54–0.98) |
| 66–70                        | 1.14 (0.98–1.31) | 1.09 (0.84–1.41) | 0.94 (0.69–1.28)       | 0.86 (0.65–1.13) |
| 71–76                        | 1.34 (1.16–1.56) | 1.08 (0.82–1.43) | 0.81 (0.58–1.14)       | 0.96 (0.72–1.29) |
| 77–100                       | 1.62 (1.40–1.86) | 1.09 (0.83–1.43) | 1.10 (0.80–1.51)       | 1.00 (0.75–1.34) |
| p-value interaction†         | 0.71       | 0.56           | 0.34                    | 0.65      |
| **Cardiorespiratory fitness**|            |                 |                         |           |
| (events/population)          | 2049/1230627 | 491/1230627    | 369/1230627             | 396/1230627 |
| High (8–9)                   | 1 (ref)    | 1 (ref)        | 1 (ref)                 | 1 (ref)   |
| Moderate (5–7)               | 1.20 (1.08–1.34) | 1.14 (0.92–1.40) | 1.39 (1.06–1.81)       | 0.84 (0.67–1.06) |
| Low (1–4)                    | 1.59 (1.38–1.83) | 1.29 (0.96–1.73) | 2.32 (1.68–3.20)       | 1.02 (0.74–1.40) |
| p-value interaction†         | <0.01      | 0.47           | 0.21                    | 0.67      |
| **Muscle strength**          |            |                 |                         |           |
| (events/population)          | 2110/1089084 | 515/1089084    | 397/1089084             | 410/1089084 |

†p-value interaction between categories.
| High (7–9) | 1 (ref) | 1 (ref) | 1 (ref) | 1 (ref) |
|------------|---------|---------|---------|---------|
| Moderate (4–6) | 1.15 (1.03–1.28) | 1.15 (0.93–1.42) | 1.09 (0.85–1.39) | 0.84 (0.66–1.06) |
| Low (1–3) | 1.65 (1.42–1.93) | 1.23 (0.89–1.71) | 1.53 (1.07–2.17) | 1.09 (0.77–1.53) |
| p-value interaction† | 0.89 | 0.94 | 0.86 | 0.82 |

**Alcohol/substance use disorder**

| (events/population) | 2631/1668781 | 673/1668781 | 480/1668781 | 538/1668781 |
|---------------------|-------------|-------------|-------------|-------------|
| No | 1 (ref) | 1 (ref) | 1 (ref) | 1 (ref) |
| Yes | 1.51 (1.08–2.09) | 2.15 (1.21–3.82) | 7.43 (5.18–10.66) | 0.43 (0.11–1.72) |
| p-value interaction† | 0.14 | 0.44 | <0.05 | 0.90 |

*CM indicates cardiomyopathy; ref, reference; and BP, blood pressure. Univariate cox regression models adjusted for body mass index (BMI), age at conscription, conscription year, test center, and baseline comorbidities (diabetes, hypertension, congenital heart disease).†Interaction with BMI was calculated for BMI above 20, with BMI as a continuous variable. Systolic and diastolic blood pressure were tested as continuous variables; cardiorespiratory fitness and muscle strength levels (1-9) were tested as continuous variables; and alcohol/substance use disorder was tested as a factor of two levels.
**Supplemental Figure 1.** Flow chart of included and excluded individuals.

The figure shows median years of observation (follow-up time) with interquartile interval Q1–Q3, total person years of observation, and numbers of cardiomyopathy cases. Based on recommendations in Strengthening the Reporting of Observational Studies in Epidemiology (11). BMI indicates body mass index.
Supplemental Figure 2. Effect of BMI in adolescence on risk of alcohol/drug-induced cardiomyopathy (CM), dilated cardiomyopathy, and hypertrophic cardiomyopathy, respectively.*
*Models were adjusted for age, conscription year (as a spline with knots at 5%, 35%, 65%, and 95% (i.e. 1971, 1982, 1992, and 2004)), test center, and baseline comorbidities (diabetes, hypertension, congenital heart disease). Body mass index (BMI) was restricted to BMI between 15 and 40, and modelled as a restricted cubic spline with knots at 5%, 35%, 65%, and 95% (i.e. 18.0, 20.5, 22.4, and 27.5), with BMI 20 as reference. Long-dashed line, adjusted for baseline comorbidities. Dashed line, further adjusted for systolic blood pressure, diastolic blood pressure, cardiorespiratory fitness, muscle strength, and alcohol or substance use disorder. Solid line, further adjusted for parental education. (n=773,679)
Supplemental Figure 3. Effect of BMI in adolescence on risk of acute myocardial infarction (MI), dilated cardiomyopathy (CM), heart failure, hypertrophic cardiomyopathy, indeterminable cardiomyopathy, and other cardiomyopathies, respectively.*

*Models were adjusted for age, conscription year (as a spline with knots at 5%, 35%, 65%, and 95% (i.e. 1971, 1982, 1992, and 2004)), test center, and baseline comorbidities (diabetes, hypertension, congenital heart disease). Body mass index (BMI) was restricted to BMI between 15 and 40, and modelled as a restricted cubic spline with knots at 5%, 35%, 65%, and 95% (i.e. 18.0, 20.5, 22.4, and 27.5), with BMI 20 as reference. Long-dashed line, adjusted
for baseline comorbidities. Dashed line, further adjusted for systolic blood pressure, diastolic blood pressure, cardiorespiratory fitness, muscle strength, and alcohol or substance use disorder. Solid line, further adjusted for parental education. (n=773,679)
Supplemental Figure 4. The relation between BMI and dilated cardiomyopathy (non-ischemic heart muscle disease) and that of BMI and a diagnosis of cardiomyopathy with a prior myocardial infarction.

*Model was adjusted for age, conscription year (as a spline with knots at 5%, 35%, 65%, and 95% (i.e. 1971, 1982, 1992, and 2004)), test center, baseline comorbidities (diabetes, hypertension, congenital heart disease), systolic blood pressure, diastolic blood pressure, cardiorespiratory fitness, muscle strength, alcohol or substance use disorder, and
parental education. Body mass index (BMI) was restricted to BMI between 15 and 40, and modelled as a restricted cubic spline with knots at 5%, 35%, 65%, and 95% (i.e. 18.0, 20.5, 22.4, and 27.5), with BMI 20 as reference. (n=773,679)
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