Physical activity and its health consequences

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Physical activity benefits for adults and older adults

**Benefits Health**
+ Improves Sleep
+ Maintains Healthy Weight
+ Manages Stress
+ Improves Quality of Life

**Reduces Your Chance Of**
- Type II Diabetes -40%
- Cardiovascular Disease -35%
- Falls, Depression and Dementia -30%
- Joint and Back Pain -25%
- Cancers (Colon and Breast) -20%

**What should you do?**

For a healthy heart and mind: Be Active

- VIGOROUS: Run
- MODERATE: Walk

To keep your muscles, bones and joints strong: Build Strength

- SPORT: Exercise
- CYCLE: Cycling
- SOFA: Sit

To reduce your chance of falls: Improve Balance

- DANCE: Dance
- YOGA: Yoga
- TAI CHI: Tai Chi
- SWIM: Swimming
- STAIRS: Stairs

**Minutes Per Week**
- 75 OR 150
- VIGOROUS INTENSITY (Breathing fast, difficulty talking)
- MODERATE INTENSITY (Increased breathing, able to talk)
- OR a combination of both

**Break Up Sitting Time**
- 2 Days Per Week

Something is better than nothing.
Start small and build up gradually:
just 10 minutes at a time provides benefit.
MAKE A START TODAY: it’s never too late!

% adults meeting physical activity recommendations

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<td>Self report</td>
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Self-report: 38%
Device: %
Key questions

• How much physical activity is beneficial for health?

• How often, and intensely, should it be done?

• What types of activity are best?

• How much of this is heritable?

• What interventions/drugs actually work when trying to increase mobility?
UK Biobank activity monitor project

- 103,712 participants
- 7 days data / participant
- 100Hz tri-axial acceleration data
- 180 million movement readings / participant
UK Biobank: Activity profiles + health

Doherty 2017; PLoS ONE 12(2): e0169649
Kim 2017; INTERNATIONAL JOURNAL OF OBESITY
Consequences of disease on mobility

Chronic disease subgroup
- No chronic disease
- All chronic disease
- Mental health disorders
- Cardiovascular disease
- Malignant cancer
- Chronic infectious disease
- Chronic musculoskeletal disorders
- Chronic eye disorders
- Endocrine & metabolic disorders
- Chronic ear, mastoid & hearing disorders
- Chronic neurological disorders
- Chronic respiratory disease
- Chronic gastrointestinal disease
- Chronic genitourinary disorders

Geometric mean moderate activity in minutes per week
Machine learning of behaviours from sensor data

150 people – activity monitors + cameras
- Men spent more time walking (7.2% vs 6.2%, p<10^{-100})
- Women spend more time in mixed behaviours (17.4% vs 13.2%, p<10^{-100})
- Walking time is highest in spring (6.9% vs. 6.4% in winter, p=4x10^{-51})
Precise measures of phenotype enhance biological understanding

**Figure 1** Miami plot of European sex-combined GWAS of physical activity in UK Biobank measured by accelerometer (*top, n=91,112*) and self-report (*below, n=351,154*).

Self-reported activity (*n=351k*): \( \lambda = 1.05 \), LD intercept = 1.01, \( h^2 = 0.06 \), \( R^2(GWS \ loci) = \text{nan\%} \), \( R^2(5\times10^{-3} \ loci) = 0.8\% \)

Genomic control(\( \lambda \)), explained variance (\( R^2 \)) and heritability (\( h^2 \)) estimates are also provided.
Mendelian randomization suggests that overall activity lowers:

- **body fat percentage** (beta per SD: -0.44, SE=0.047, p=2.70x10⁻²¹)
- **systolic blood pressure** (beta per SD: -0.71, SE=0.125, p=1.38x10⁻⁸).
Physical activity & sleep: Where next?

Long-term associations with disease:
- Long-term follow-up
- Genetic studies including other biobanks worldwide

Identify new health-relevant patterns:
- Semi- and unsupervised ‘artificial intelligence’ methods
- New sensors

Physical activity & brain health:
- UK Biobank imaging study