

24-hour movement behaviours, obesity and cardiometabolic risk

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Leicester Diabetes Centre

The 5S's

SITTING

SWEATING

STEPPING

SLEEP

STRENGTHENING





Linking cardiometabolic disease health outcomes to the 24-h movement behaviours

Diabetes Care 2022; <https://doi.org/10.2337/dci22-0034>;

Diabetologia 2022; <https://doi.org/10.1007/s00125-022-05787-2>.

FIGURE 2: IMPORTANCE OF 24-HOUR PHYSICAL BEHAVIOURS FOR TYPE 2 DIABETES

	Glucose/insulin	Blood pressure	HbA _{1c}	Lipids	Physical function	Depression	Quality of life
 SITTING/BREAKING UP PROLONGED SITTING	↓	↓	↓	↓	↑	↓	↑
STEPPING	↓	↓	↓	↓	↑	↓	↑
SWEATING (MODERATE-TO-VIGOROUS ACTIVITY)	↓	↓	↓	↓	↑	↓	↑
STRENGTHENING	↓	↓	↓	↓	↑	↓	↑
 ADEQUATE SLEEP DURATION	↓	↓	↓	↓	?	↓	↑
GOOD SLEEP QUALITY	↓	↓	↓	↓	?	↓	↑
CHRONOTYPE/CONSISTENT TIMING	↓	?	↓	?	?	↓	?

IMPACT OF PHYSICAL BEHAVIOURS ON CARDIOMETABOLIC HEALTH IN PEOPLE WITH TYPE 2 DIABETES

↑ Higher levels/improvement (physical function, quality of life); ↓ Lower levels/improvement (glucose/insulin, blood pressure, HbA_{1c}, lipids, depression); ? no data available;

↑ Green arrows = strong evidence; ↑ Yellow arrows = medium strength evidence; ↑ Red arrows = limited evidence.

The 5S's concept for obesity and cardiometabolic health outcomes

Sleep



Importance of 24 hour physical behaviours for obesity



SLEEP

Aim for consistent, uninterrupted sleep, even on weekends



Quantity - Short sleep durations ($\leq 6h$) negatively impact obesity risk. Less research exists for longer sleep durations ($>8h$).

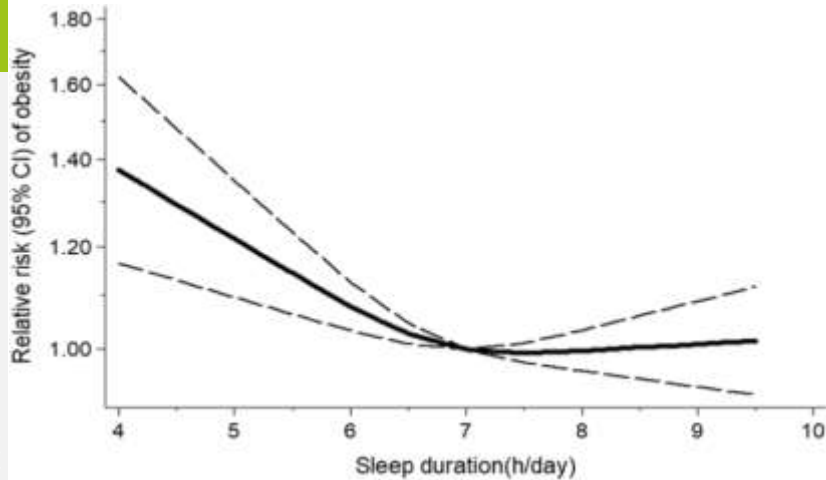


Quality - Poor sleep is associated with a higher BMI. Severe obesity is associated with significant sleep disturbances resulting in sleep debt affecting appetite and physical activity negatively.



Chronotype - Evening chronotypes are less successful in adapting to weight loss treatments and long-term weight control. Bariatric surgery induced weight loss is less effective in evening chronotypes.

Sleep and obesity

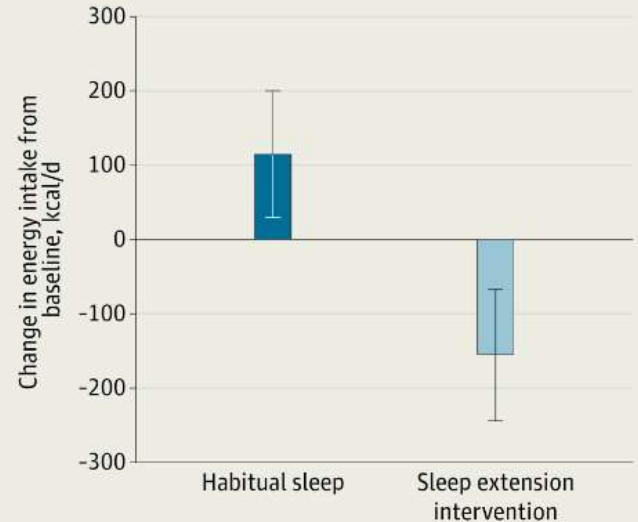


Sleep duration	Obesity
4h	1.37 (1.16-1.62)
5h	1.22 (1.09-1.35)
6h	1.08 (1.03-1.13)
7h	1.00
8h	1.00 (0.96-1.03)
9h	1.01 (0.94-1.09)

Qionggui et al. 2019. Sleep Breathing Physiology and Disorders

FINDINGS

The 2-wk sleep extension intervention significantly reduced daily energy intake compared to the habitual sleep (control) group



Between-group difference in change from baseline in energy intake: -270 kcal/d (95% CI, -393 to -147 kcal/d); $P < .001$

Tasali et al, 2022. JAMA

Sitting



Importance of 24 hour physical behaviours for obesity



SITTING/BREAKING UP PROLONGED SITTING

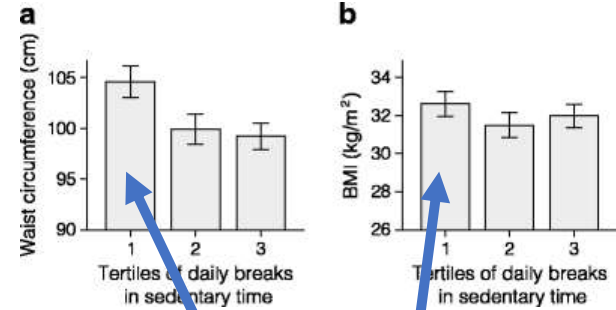
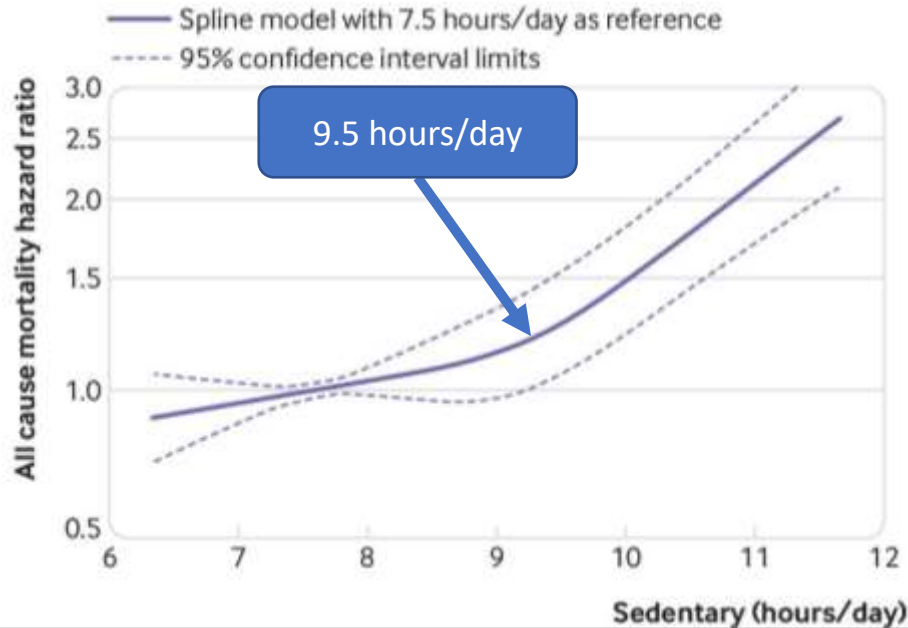


- Limit sitting, time spent sedentary is adversely associated with cardiometabolic health with detrimental effects on overweight and obesity.
- Breaking up prolonged sitting (every 30 min) with short regular bouts of slow walking/ simple resistance exercise is positively associated with measures of adiposity.
- Time spent sedentary may be a more important indicator of poor health than MPA

Associations between

Sedentary time and mortality

Sedentary breaks and adiposity



Less daily breaks in sedentary time is associated with higher waist circumference and BMI in obesity

Distinct risk factors associated with time spent sedentary...

Depression

Obesity

Hypertension

All cause mortality

Cardiovascular disease
mortality

Some cancers

Type 2 Diabetes

Dyslipidaemia

Insulin resistance

...even after accounting for time spent in moderate-to-vigorous physical activity

Sedentary breaks and obesity related metabolic outcomes

Prolonged sitting
(6.5 hours)



Broken Sitting
(5 minutes every 30 minutes)



↓ 34% glucose
=
↓ 20% insulin

↓ 28% glucose
=
↓ 37% insulin

Postprandial glucose & insulin
↓ when sitting is interrupted
with light physical activity
greater in higher BMI's

Stepping



Importance of 24 hour physical behaviours for obesity

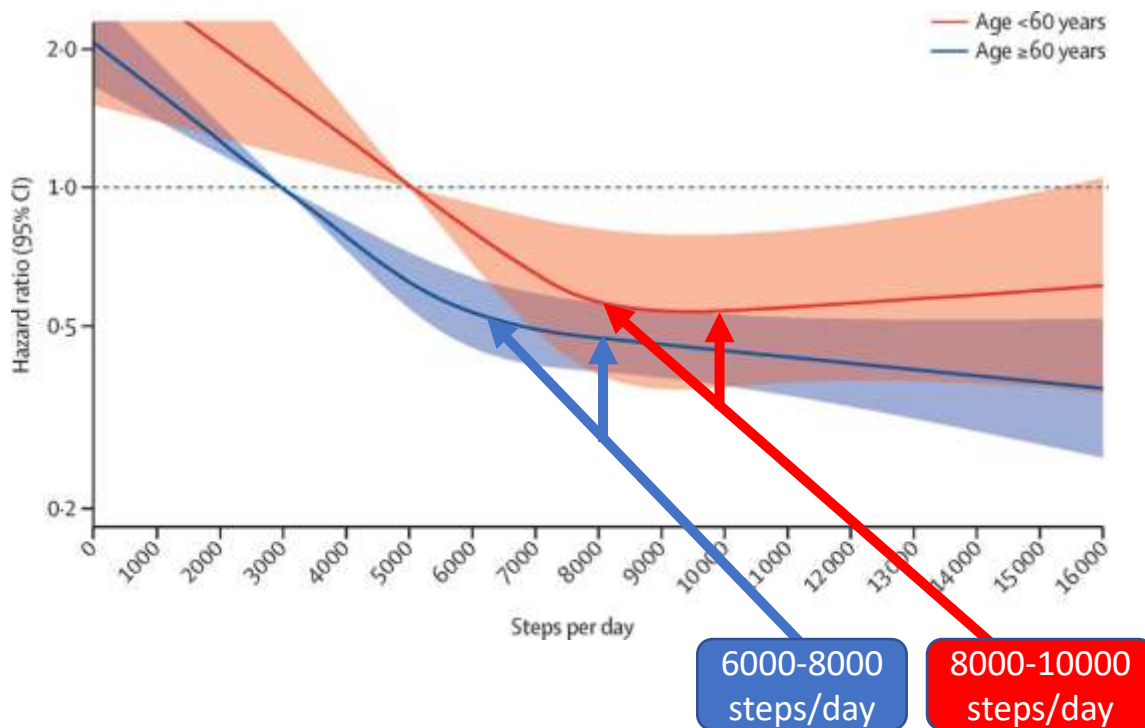


STEPPING

- An increase of only 500 steps/day is associated with 2-9% decreased risk of cardiovascular morbidity and all-cause mortality.
- A 5 to 6 min brisk intensity walk per day equates to ~4 years' greater life expectancy.

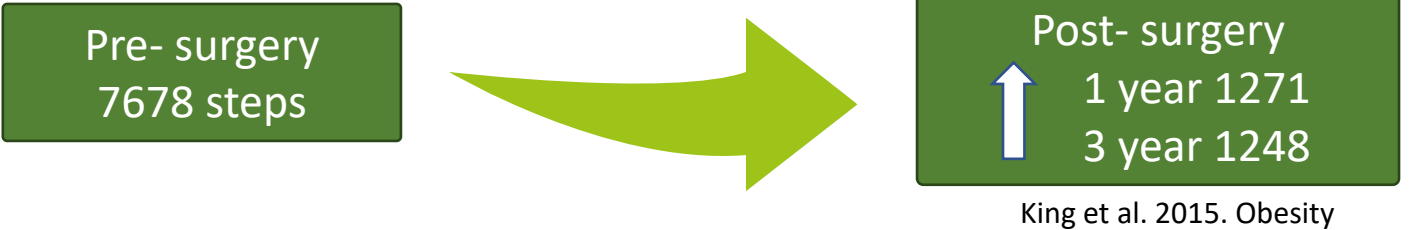


Association of stepping with health (all-cause mortality)

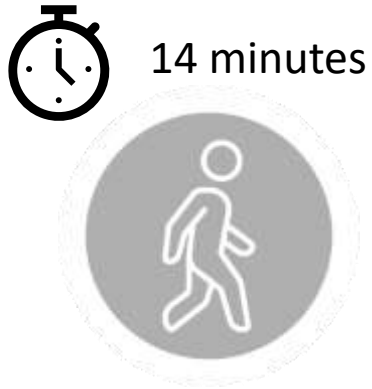


As measured by accelerometers, 9500 steps/day had a 35.05% lower risk of cardiovascular events than 3500 steps/day

Stepping and metabolic & bariatric surgery



Pick up the pace



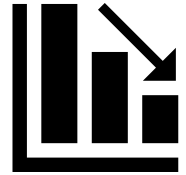
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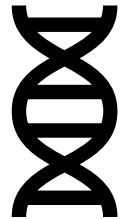
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Additional 14%
reduction in
the risk of CVD



biological age
16 years younger



Walk fast = die old(er)



5-6
minutes



~ 500 steps



~ 4 year greater life
expectancy



Sweating



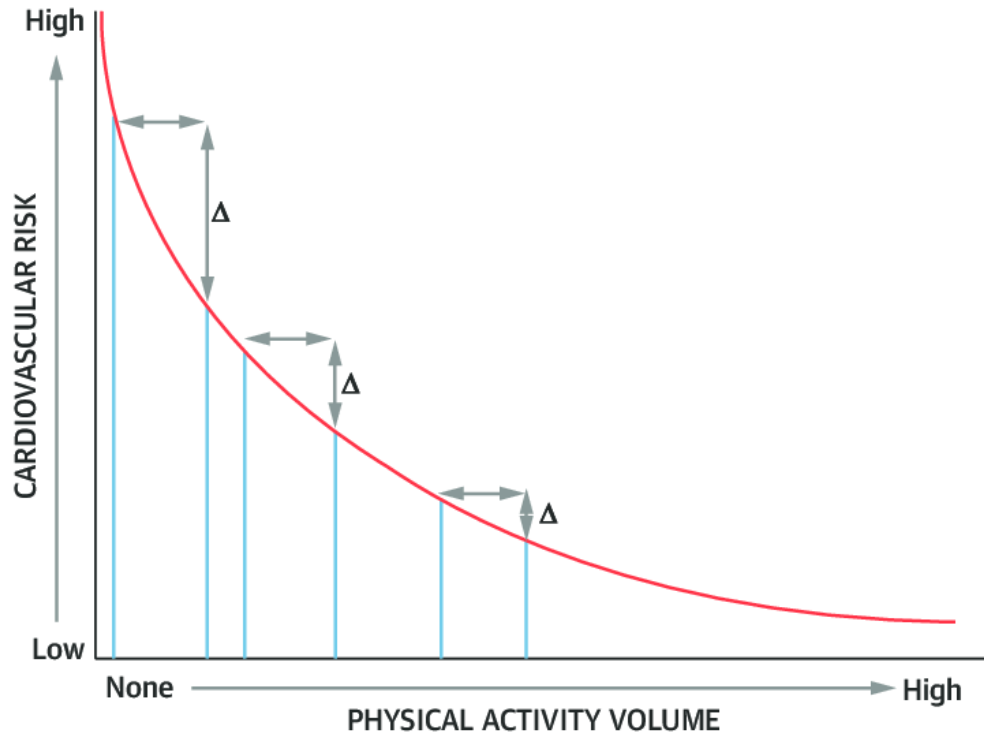
Importance of 24 hour physical behaviours for obesity

SWEATING (MODERATE-TO-VIGOROUS ACTIVITY)



- Recommendations suggest varying amounts of MPA depending on an individual's weight or health related goal
 - 150 min/wk for maintaining and improving health
 - 150-250 min/wk for the prevention of weight gain
 - 200-300 min/wk to prevent weight gain after weight loss
 - 225-420 min/wk to promote clinically significant weight loss
- Supplement with two to three resistance, flexibility and/or balance sessions

Something is always better than nothing
(at least when it comes to exercise)



‘Weekend Warrior’
Increased activity, even
when concentrated within 1
to 2 days each week, may
be effective for improving
cardiovascular risk profiles

Khurshid et al, 2023. JAMA

MVPA and metabolic & bariatric surgery outcomes

More lower intensity physical activity in first 6 months of surgery

Herring et al. 2015 Obesity Reviews

Patients are no less sedentary following bariatric surgery

James et al, 2022. physiotherapy

Lifestyle intervention (Diet & MVPA)
3-6m



No effect on weight loss, physical activity, sedentary
behaviour levels, physical function/QoL

Jassil et al, 2023. Clinical trials and investigations

Point of weight
plateau/ regain
12-24m



MVPA

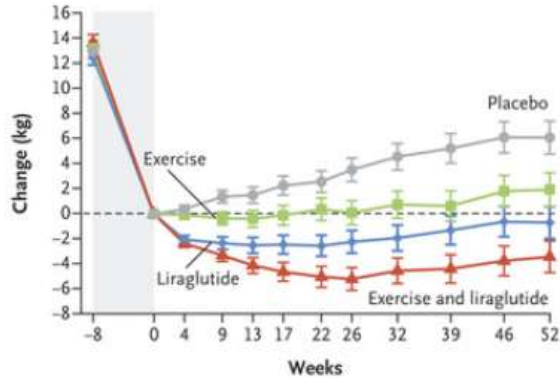


Physical function



Weight loss
maintenance

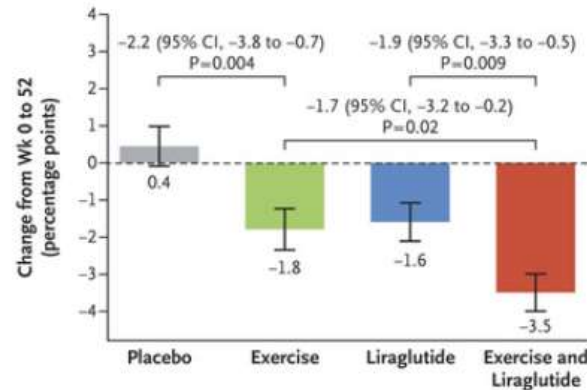
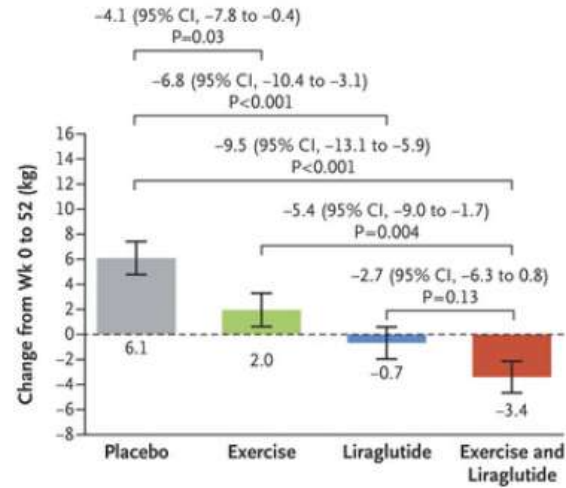
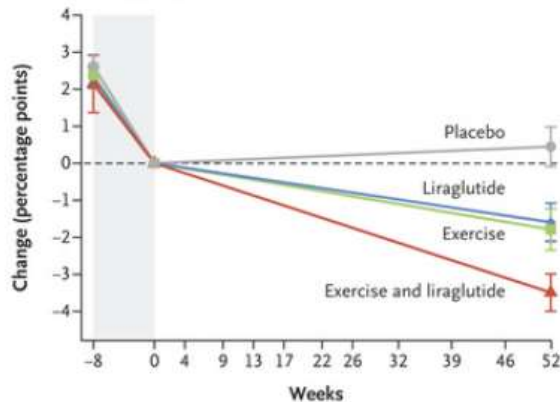
A Change in Body Weight



No. of Participants: 215, 195, 187, 183, 181, 178, 178, 175, 171, 169, 168, 166

No. Who Underwent Randomization	49	48	49	49
No. Who Completed Trial	40	40	41	45

B Change in Body-Fat Percentage



MVPA's role in maximising weight loss

Pharmacotherapy (semaglutide) licensed for 2 years in UK (NICE)

Strengthening



Importance of 24 hour physical behaviours for obesity



STRENGTHENING



- Resistance exercise can minimise muscle and bone mass loss during weight loss, improve glucose and insulin sensitivity.



Physical Function / Frailty

- Resistance exercise is important in helping to prevent frailty, commonly linked to both obesity and weight loss in older adults.
- Adulthood obesity increases the likelihood of frailty/ pre frailty in older age 2.5 fold. Routine assessment of BMI and waist circumference could identify and lower this frailty risk.

Exercise to maximise weight loss outcomes

Intervention	Physical function	Lean body mass	Relative aerobic capacity
Diet induced energy restriction	↑	↓↓	↓
Structured exercise training	↑↑	↔ ↑	↑↑↑
Diet + exercise	↑↑↑	↔	↑

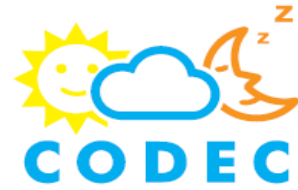
Weight loss without exercise may limit long-term benefits, leaving individuals at an increased risk of poor physical function and frailty.

Functional improvements were greater with combination training (21%) than with either aerobic or resistance alone(14%).

Weight loss plus combined aerobic and resistance exercise is the most effective in improving functional status of obese older adults.

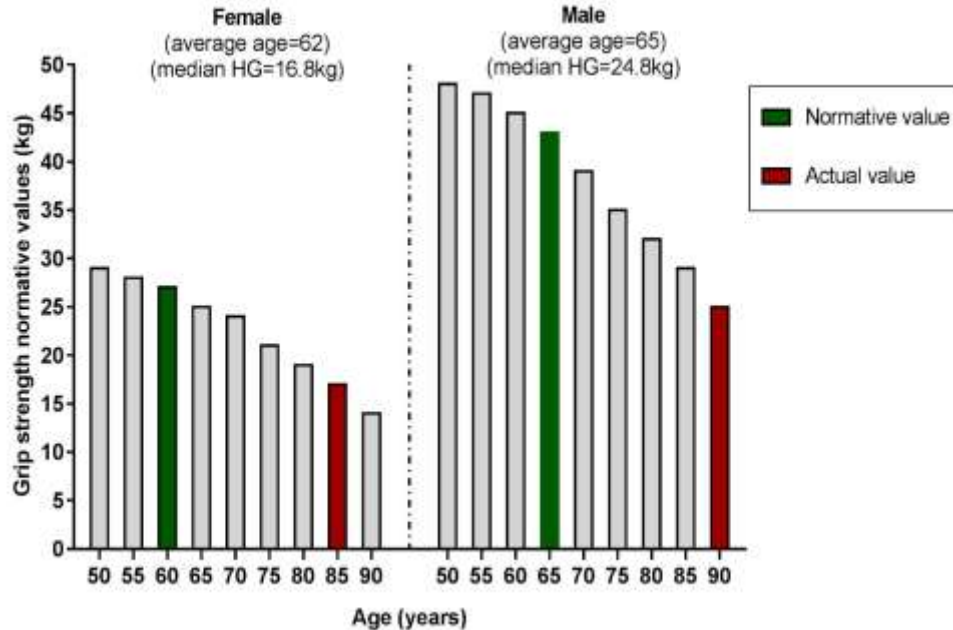
Frailty is not a simple correlate of age, necessarily progressive nor irreversible

Functional tests (Handgrip Strength and Sit-to-Stand)

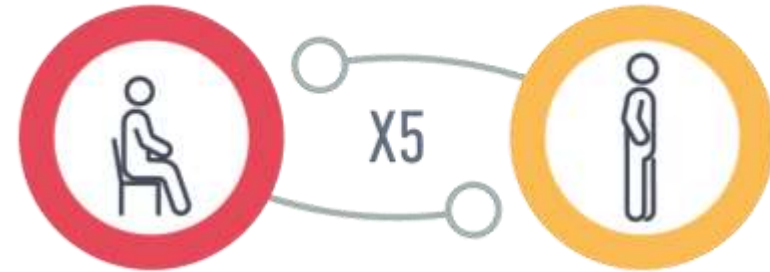


>800 people (BMI=31kg/m²) with T2DM have undergone physical function tests. The 30% with impaired physical function had a functional age >20 years older than their chronological age (grip strength).

Handgrip Strength



Sit-to-Stand



 **20.4s**
Equivalent to a 90+ year old

PA expertise is needed in routine weight management services

Objectively measured 24-h physical behaviours are important in routine weight management

Physical activity & sleep measurements

Quantifiable physical behaviours



Personalised care pathway

From hypothesis generation to population and patient benefit: The Leicester translational pathway for physical activity research

Epidemiology

Generating new knowledge for the link between lifestyle and health (Hypothesis generation)

Experimental (efficacy)

Testing new lifestyle therapies to investigate mechanisms, optimal dosing, and impact on health

Effectiveness

Evaluating the longer-term effectiveness of lifestyle interventions at initiating and sustaining behaviour change or improving health outcomes

Implementation

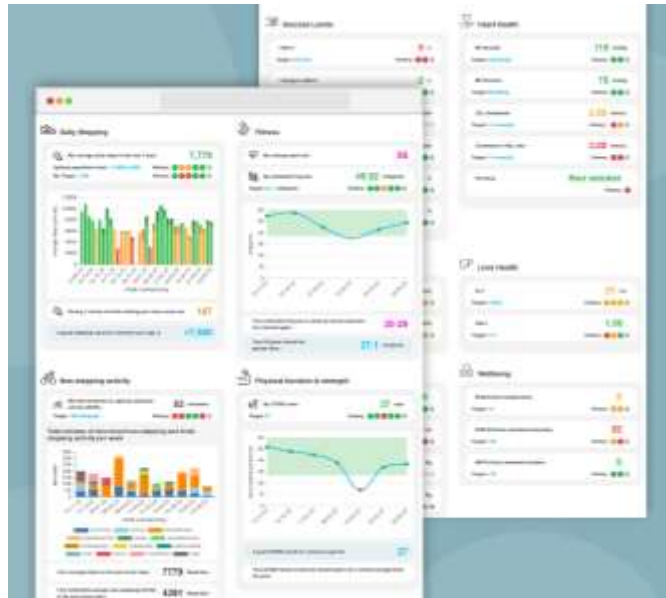
Implementing lifestyle interventions with evidence of effectiveness into clinical, community or occupational settings

Our physical activity tools

Our Steps4Health web app and the physical activity and health metrics dashboard are available for user testing.

Contact us if interested on

LDCImplementation@uhl-tr.nhs.uk



Personalised physical activity goals



Holistic coaching



The 5S's, appears an essential concept for improving obesity and cardiometabolic health outcomes



Leicester Diabetes Centre

Thank you for listening

No conflicts of interest

www.leicesterdiabetescentre.org.uk