# PRACTICAL RECOMMENDATIONS FOR TYPE 2 DIABETES

# HOW, WHERE AND WITH WHOM?

Pr Martine DUCLOS
Service de Médecine du Sport, CHU
Laboratoire de Nutrition Humaine (CRNH)
Université d'Auvergne
Clermont-Ferrand
France

American College of Sports Medicine and the American Diabetes Association (Diabetes Care 2010)

Francophone Diabetes Society (Diabetes & Metabolism 2013)

Exercise plays a major role in the prevention and control of insulin resistance, prediabetes, GDM, type 2 diabetes, and diabetes-related health complications. Both aerobic and resistance training improve insulin action, at least acutely, and can assist with the management of BG levels, lipids, BP, CV risk, mortality, and QOL, but exercise must be undertaken regularly to have continued benefits and likely include regular training of varying types. Most persons with type 2 diabetes can perform exercise safely as long as certain precautions are taken. The inclusion of an exercise program or other means of increasing overall PA is critical for optimal health in individuals with type 2 diabetes.

For clinicians, the question no longer concerns the efficacy of PA

but rather

## How, where and whith whom?

How can patients be motivated to practice a PA over the long term?

How can qualified exercise trainers and appropriate practice settings be found?

# RECOMMENDATIONS
## ACSM-ADA and Francophone Diabetes Society

1) Combating sedentary behaviour
   <7h/day
   + breaks of at least 1 min every hour

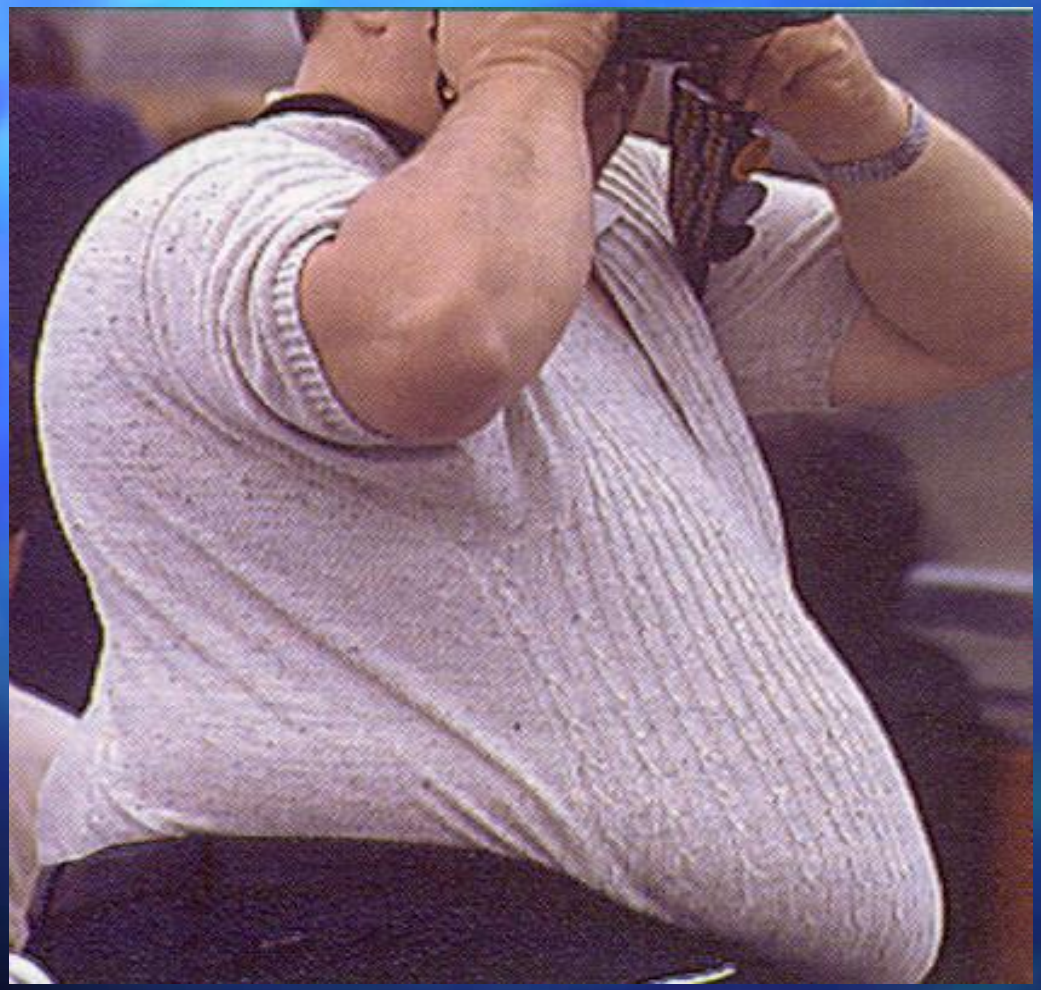
2) Increasing PA in daily life
   (unstructured activities)

3) Practicing structured physical and/or sports activities

- Endurance exercice
  150 min/week of moderate to vigorous aerobic exercise
  at least 3 days/wk with no more than 2 consecutive days without PA
- strength training (muscle strengthening): 2-3 days/week

# IN PRACTICE

Aid for the prescription of physical activity



PA must begin gradually

Using an individualised approach

Tools available to help prescribe an appropriate physical activity

# In Practice-1: Evaluation of the level of physical activity

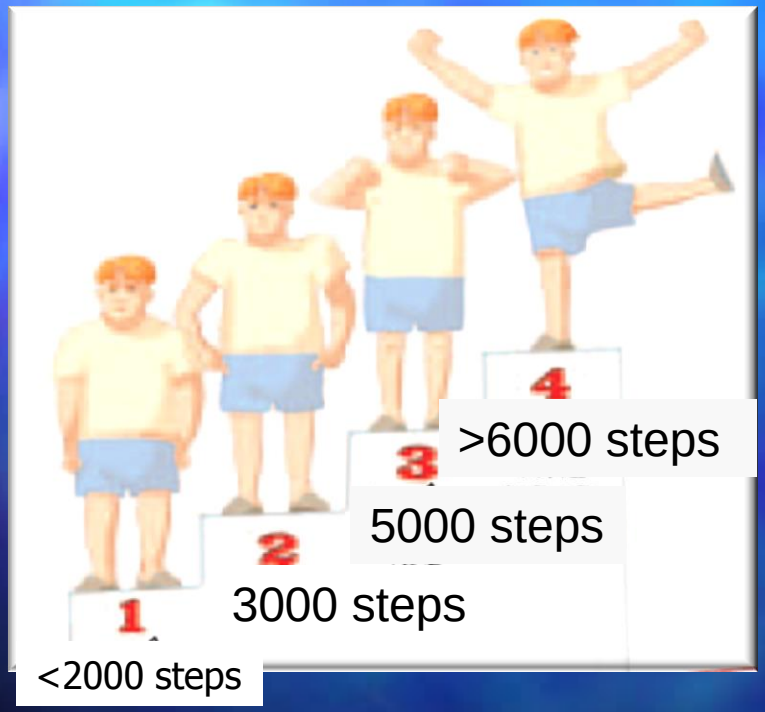
Questions for evaluating the usual level of PA in the clinical setting

| Type of activity | Note |
|---|---|
| Professional | Primary occupation, weekly work time<br>Approximate intensity of professional physical activity (low, moderate, high), as well as the duration and frequency |
| Domestic | Time spent sitting, standing, or carrying loads (light, medium, heavy). Activities done at home (e.g. home maintenance, etc.)<br>Approximate intensity of domestic physical activity (low, moderate, high), as well as the duration and frequency |
| Leisure time and sports | Current and past activities by identifying walking activity done during the leisure time<br>For each activity<br>How long it has been practiced<br>Approximate intensity (low, moderate, high)<br>Duration of each activity session<br>Frequency of practice (e.g. in the past year) |
| Transport, travel | Usual travel time (hours per day)<br>Method of "active" travel (walking, biking, etc.) |
| Sedentary occupations | Time spent in front of a screen (TV/video/computer) (hours per day)<br>At work<br>Outside of work<br>Time spent in sitting position (hours per day) |

Ciangura & Oppert 2009

# Pedometers

The simplest and the most useful motion counters
Measure the number of steps taken when walking or running


The subjects themselves can use it
for self-evaluation of their ambulatory activity

Can help in setting realistic objectives

Other devices (accelerometers, GPS, combined devices)
→ high costs, research

## In Practice-2: Evaluation of promoting factors, obstacles and motivation

### Educational assessment concerning PA support

➢ Obstacles : fatigue, fear of hypoglycemia, not feeling capable…

➢ Promoting factors

- *effects of PA on glycemia*, *health benefits*
- swimming pool, walking routes near home
- significant others motivated to offer support for doing PA, attitude and behaviours of health personnel and others

Physician= primary source of information for patients regarding lifestyle changes


Physicians = obstacles to PA?

Barriers to the practice of PA and levels of PA of the physicians are correlated to the level of PA of their diabetic patients

(Duclos et al, Diabetes Care 2011)

## In Practice-3: Before prescription of PA in Type 2 diabetic patients
## Pre-exercise evaluation of the diabetic patient

### Exercise in the presence of specific long-term complications of T2D → contraindication for practicing PA?

= existence of treated retinopathy, nephropathy, cardiovascular disease, sensorimotor neuropathy
is not a contraindication for practicing PA

They should be detected and treated (stabilisation of the pathology) before starting exercise.

The potential aggravating effects of PA on existing complications are mostly counterbalanced by the beneficial effects

The absolute contra-indication to PA in T2D :
Perforating ulcer of the foot (no weight-bearing exercise)

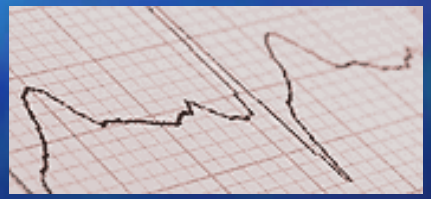
## In Practice-3: Before prescription of PA in Type 2 diabetic patients
## Pre-exercise evaluation of the diabetic patient

No additional tests need to be added beside those already done every year.

The prescription of regular PA does not change the monitoring schedule of diabetes
(check for metabolic control, investigations for degenerative complications)

## Cases in which an assessment is necessary before PA in T2D patients


If the patient whishes to begin a high intensity PA
*there may be an indication for performing an exercise stress test*.
+in patients who potentially have a very high ischaemic risk
(long duration of exposure to T2D, multiple associated and poorly controled risk factors)
(ADA 2014)



# Drug interactions and PA

## Sulfonylureas/glinides

Capable of inducing hypoglycemia

in well-controlled patients

if exercise >60 min

→ a dose adjustment may sometimes be necessary (↓ or discontinuation before the exercise)

Glinides: relative risk lower (more rapid, shorter and less glucose-lowering effects)

Caution is warranted : it is advisable to ↓ the dose before exercising

Biguanides, acarbose, « incretin » drugs (DPP-4 inhibitors, GLP-1 agonists) :

no change

Self-Monitoring of glycemia at the beginning and at the end of the exercise

It is possible that oral antidiabetic drug may be reduced after some time once the training has become effective in metabolic control

# RECOMMENDATIONS
# ACSM -ADA
# Francophone Diabetes Society

## 1) Combating sedentary behaviour

<7h/day

+ splitting up the sedentary time with breaks of at least 1 min every hour

## 2) Increasing PA in daily life (unstructured activities)

## 3) Practicing structured physical and/or sports activities

- Endurance exercices

150 min/week of moderate to vigorous aerobic exercise (at least 3 days/week with no more than 2 consecutive days between bouts of aerobic activity)

- strength training (muscle strengthening): 2-3 days/week

# Practicing structured physical and/or sports activities

Type of activity
- endurance: walking, cycling, swimming,
- strength training: free weights or water bottle (250ml =250g)

Intensity : for endurance: focus on moderate intensity (40-60% VO2 max) (→light intensity)

Duration : 30 min (each session can be divided into 10-min fractions)

Frequency : at least 3 times /week
with no more than 2 consecutive days without PA

Prescription of PA must be in accordance mith the following rules

Progressivity
Individualisation
Variety

The diversity of PA, lack of monotony and an aspect of fun promote long-term compliance

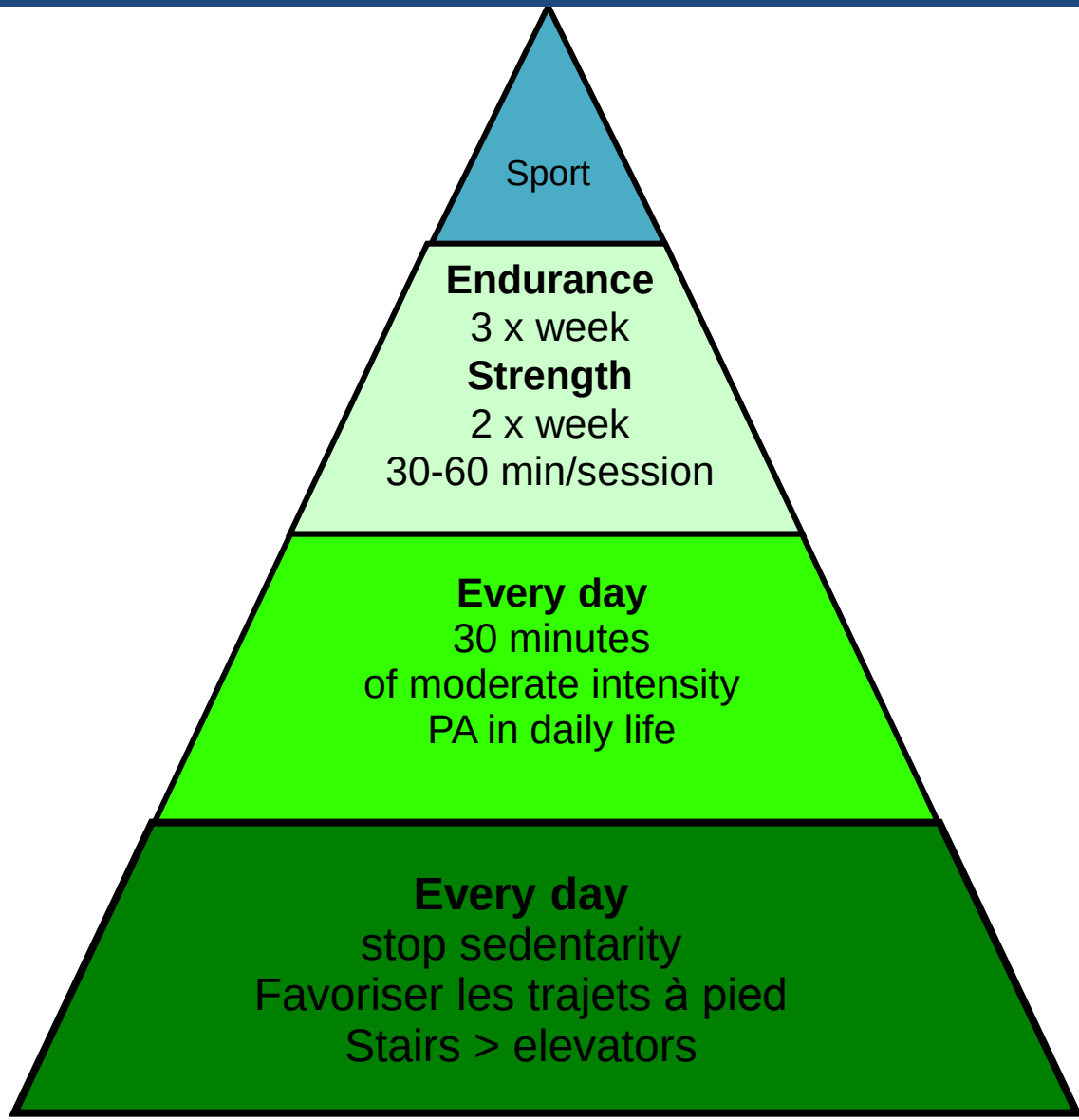
# Prescription of physical activity

**Step 4**
Sport

**Step 3**
structured physical activity

**Step 2**
Step 1
Plus physical activity

**Step 1**
Changing lifestyle
Stop sedentarity



# Monitoring

Metabolic monitoring : self-monitoring of glycemia

At the start of the practice (educational purposes)

- Patients: effects of PA on their BG

For T2D with risk of hypoglycemia (ttt, during the initiation period)
For T2D undertaking unusual and/or prolonged effort

Careful examination of the feet before and after exercise
Adequate equipment (footwear)

# Practicing structured physical and/or sports activities

Supervised training by a professional in adaptative PA
- a qualified exercise trainer -
is recommended
for most persons with type 2 diabetes

- at least for the initial period
- to ensure optimal benefits to BG control, BP, lipids, and CV risk and to minimize injury risk
- to increase compliance

Secondary, relay with :
clubs, federations, health-related associations
that have programmes and activities adapted to the issues of T2D patients

# Physical Activity Advice Only or Structured Exercise Training and Association With $HbA_{1c}$ Levels in Type 2 Diabetes

## A Systematic Review and Meta-analysis

Daniel Umpierre, MSc
Paula A. B. Ribeiro, MSc
Caroline K. Kramer, MD, ScD
Cristiane B. Leitão, MD, ScD
Alessandra T. N. Zucatti, PED
Mirela J. Azevedo, MD, ScD
Jorge L. Gross, MD, ScD
Jorge P. Ribeiro, MD, ScD
Beatriz D. Schaan, MD, ScD

**Context** Regular exercise improves glucose control in diabetes, but the association of different exercise training interventions on glucose control is unclear.

**Objective** To conduct a systematic review and meta-analysis of randomized controlled clinical trials (RCTs) assessing associations of structured exercise training regimens (aerobic, resistance, or both) and physical activity advice with or without dietary cointervention on change in hemoglobin $A_{1c}$ ($HbA_{1c}$) in type 2 diabetes patients.

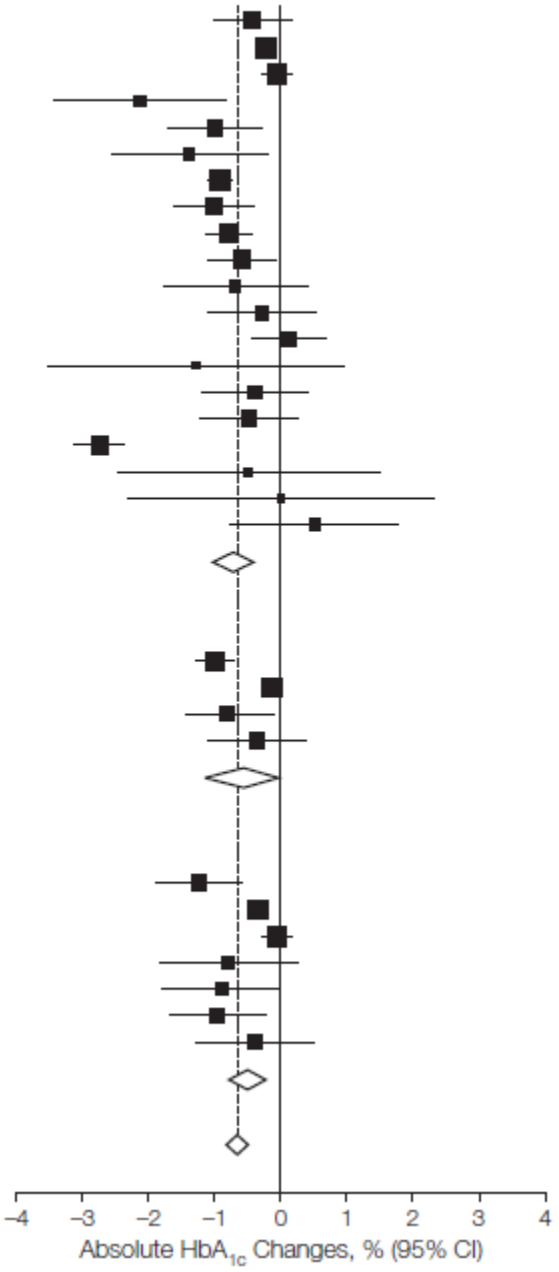
**Data Sources** MEDLINE, Cochrane-CENTRAL, EMBASE, ClinicalTrials.gov, LILACS, and SPORTDiscus databases were searched from January 1980 through February 2011.

**Study Selection** RCTs of at least 12 weeks' duration that evaluated the ability of structured exercise training or physical activity advice to lower $HbA_{1c}$ levels as compared with a control group in patients with type 2 diabetes.

*JAMA. 2011;305(17):1790-1799*

# Effects of supervised PA

| Source | No. of Patients: Intervention | No. of Patients: Control | $HbA_{1c}$ Weighted Mean Difference, % (95% CI) |
|---|---|---|---|
| **Aerobic training** | | | |
| Bjørgaas et al,[20] 2005 | 11 | 11 | −0.44 (−1.03 to 0.15) |
| Church et al,[8] 2010 | 72 | 41 | −0.23 (−0.30 to −0.16) |
| Cuff et al,[21] 2003 | 9 | 9 | −0.07 (−0.28 to 0.14) |
| Dela et al,[22] 2004 | 14 | 10 | −2.14 (−3.43 to −0.86) |
| Giannopoulou et al,[23] 2005 | 11 | 11 | −1.00 (−1.70 to −0.30) |
| Goldhaber-Fiebert et al,[24] 2003 | 33 | 28 | −1.40 (−2.56 to −0.24) |
| Kadoglou et al,[25] 2007 | 29 | 27 | −0.93 (−1.08 to −0.78) |
| Kadoglou et al,[26] 2007 | 28 | 26 | −1.02 (−1.59 to −0.45) |
| Kadoglou et al,[27] 2010[a] | 22 | 21 | −0.80 (−1.15 to −0.45) |
| Kadoglou et al,[27] 2010[b] | 23 | 23 | −0.59 (−1.11 to −0.07) |
| Lambers et al,[28] 2008 | 18 | 11 | −0.70 (−1.78 to 0.38) |
| Ligtenberg al,[29] 1997 | 25 | 26 | −0.30 (−1.11 to 0.51) |
| Middlebrooke et al,[30] 2006 | 22 | 30 | 0.10 (−0.45 to −0.65) |
| Raz et al,[31] 1994 | 19 | 19 | −0.30 (−3.53 to 0.93) |
| Ribeiro et al,[32] 2008 | 11 | 10 | −0.40 (−1.19 to 0.39) |
| Sigal et al,[7] 2007 | 60 | 63 | −0.50 (−1.22 to 0.22) |
| Sridhar et al,[33] 2010 | 55 | 50 | −2.76 (−3.13 to −2.39) |
| Vancea et al,[34] 2009[c] | 14 | 17 | −0.50 (−2.47 to 1.47) |
| Vancea et al,[34] 2009[d] | 9 | 17 | 0.00 (−2.30 to 2.30) |
| Verity and Ismail,[35] 1989 | 5 | 5 | 0.50 (−0.75 to 1.75) |
| All aerobic training<br>$I^2$ = 92.8%; *P* for heterogeneity <.001 | | | −0.73 (−1.06 to −0.40) |
| **Resistance training** | | | |
| Castaneda et al,[36] 2002 | 29 | 31 | −1.00 (−1.27 to −0.73) |
| Church et al,[8] 2010 | 73 | 41 | −0.15 (−0.22 to −0.08) |
| Dunstan et al,[37] 2002 | 16 | 13 | −0.80 (−1.46 to −0.14) |
| Sigal et al,[7] 2007 | 64 | 63 | −0.37 (−1.08 to 0.34) |
| All resistance training<br>$I^2$ = 92.5%; *P* for heterogeneity <.001 | | | −0.57 (−1.14 to −0.01) |
| **Combined training** | | | |
| Balducci et al,[38] 2004 | 51 | 53 | −1.24 (−1.88 to 0.60) |
| Church et al,[8] 2010 | 76 | 41 | −0.34 (−0.41 to −0.27) |
| Cuff et al,[26] 2003 | 10 | 9 | −0.07 (−0.29 to 0.15) |
| Lambers et al,[28] 2008 | 17 | 11 | −0.80 (−1.84 to 0.24) |
| Loimaala et al,[39] 2003 | 24 | 25 | −0.90 (−1.80 to −0.00) |
| Sigal et al,[7] 2007 | 64 | 63 | −0.97 (−1.69 to −0.25) |
| Tessier et al,[40] 2000 | 19 | 20 | −0.40 (−1.29 to 0.49) |
| All combined training<br>$I^2$ = 67.5%; *P* for heterogeneity = .005 | | | −0.51 (−0.79 to −0.23) |
| Overall<br>$I^2$ = 91.3%; *P* for heterogeneity <.001 | | | −0.67 (−0.84 to −0.49) |




Umpierre *et al.* JAMA 305: 1790-1799, 2011

# Lifestyle modification programs in the Management of T2DM

Cardiovascular Effects of Intensive Lifestyle Intervention in Type 2 Diabetes

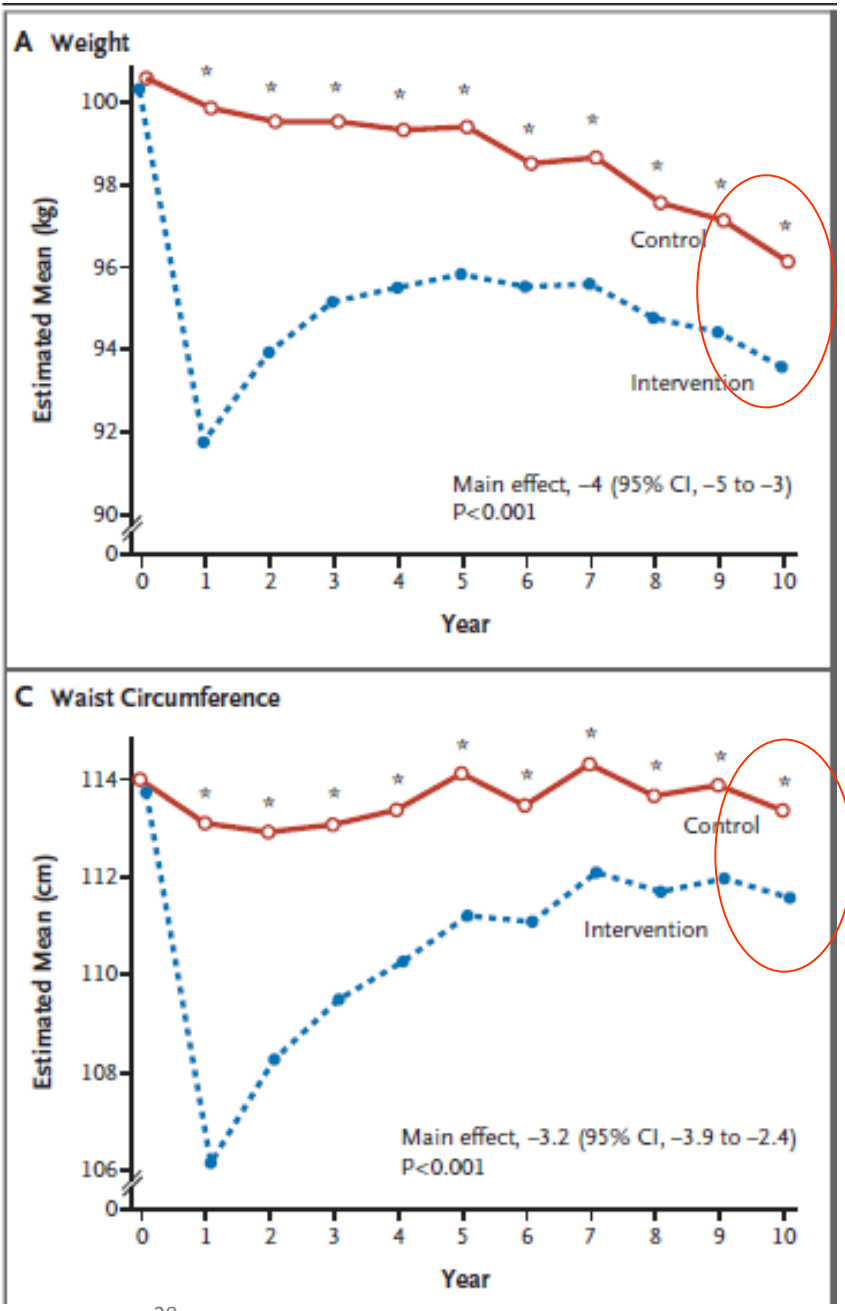
The Look AHEAD Research Group*

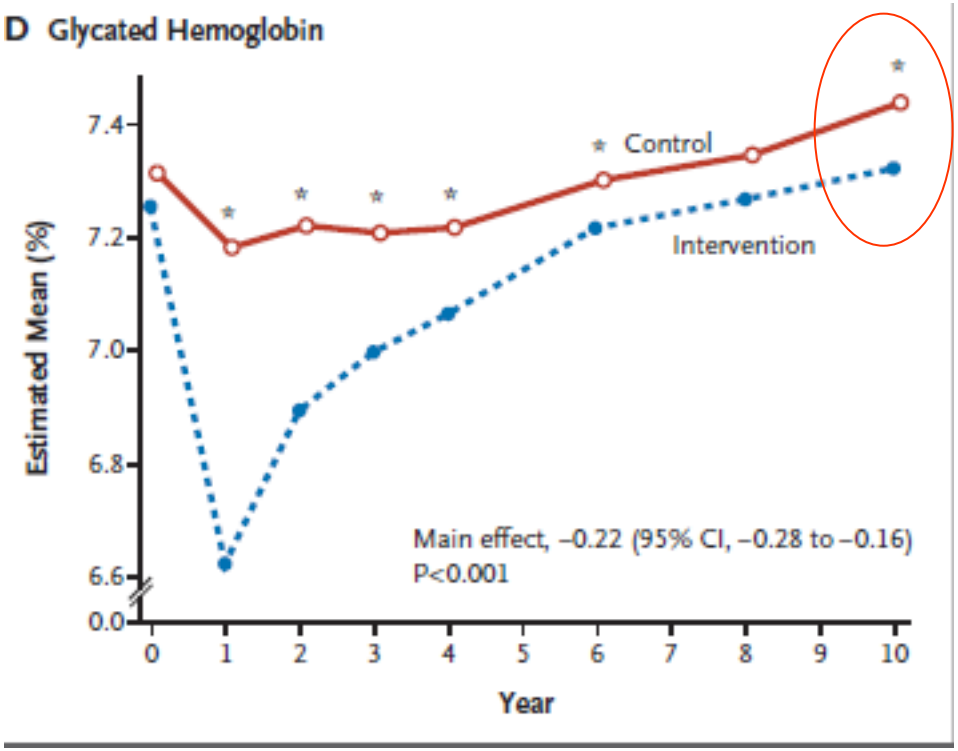
N Engl J Med 2013.
DOI: 10.1056/NEJMoa1212914

## LOOK-AHEAD

Large (n=5145 overweight or obese T2DM), randomized, controlled trial
of the long-term effects (10 years) of an intensive lifestyle intervention targeting weight loss (7% of BW) or to receive diabetes support and education
on cardiovascular outcomes in T2DM (mean age, 59 years)

# Changes in weight, WC, HbA1c levels during 10 years of follow-up




But no effect on cardiovascular outcomes (nonfatal myocardial infarction, nonfatal stroke, hospitalisation for angina)

N Engl J Med 2013.
DOI: 10.1056/NEJMoa1212914

# Open questions :
# should we throw the baby out with the bath water?

Why no effect on cardiovascular outcomes in intervention group (intensive lifestyle intervention)?

In this group vs control group :

- ✓ reduced use of cardioprotective drugs (ACE-inhibitors, statins,metformin) (the intervention ↓some cardiovascular risk factors)
- ✓ weight loss is not the good endpoint :

  ↑ physical activity and ↑ cardiorespiratory fitness

# Positive effects of physical activity + diet

- ✓ weight,
- ✓ ↓ the need for and cost of ttt
- ✓ ↓ the rate of sleep apnea
- ✓ ↑ well-being
- ✓ in some case achieve a diabetes remission

## CONCLUSION (Gerstein NEJM 2013)

However, even with no clear evidence of cardiovascular benefit, the Look AHEAD investigators have shown that attention to activity and diet can safely reduce the burden of diabetes and have reaffirmed the importance of lifestyle approaches as one of the foundations of modern diabetes care.

# Practicing structured physical and/or sports activities

Supervised training by a professional in adaptative PA
- a qualified exercise trainer -
is recommended
for most persons with type 2 diabetes

- at least for the initial period
- to ensure optimal benefits to BG control, BP, lipids, and CV risk and to minimize injury risk.

Secondary, relay with :

clubs, federations, health-related associations that have programmes and activities adapted to the issues of T2D patients

# Places where PA can be practiced and relevant skills needed

Relevant skills: physiotherapists

professionals in adaptative PA

Places where PA can be practiced

- diabetes networks
- other health networks
- associations of patients
- sporting federations
- Possibility of occasionnaly enlisting cardiovascular rehabilitation organisations

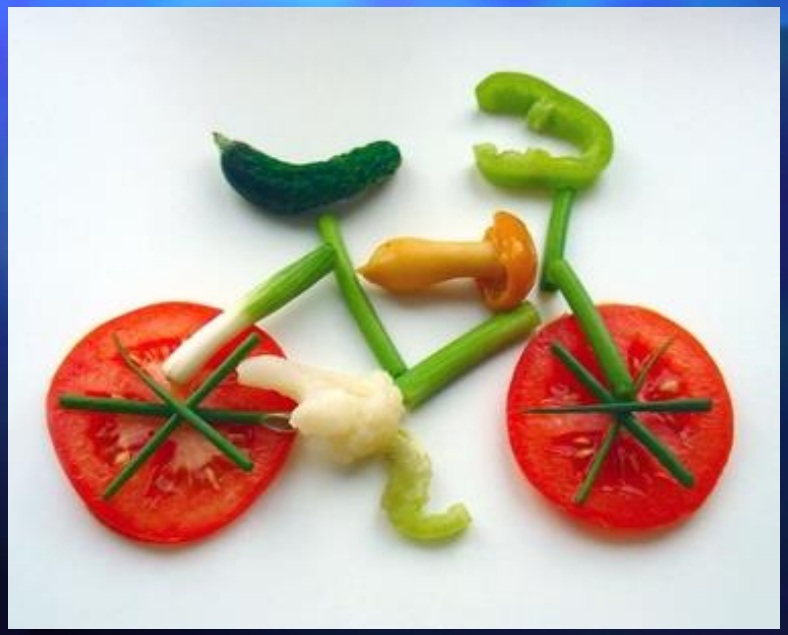
Maintenance of PA behavioural changes
And their long-term inclusion in patient's daily lifes

+ boost injections

Establishment of regular contacts between health professional and organisers of these institutions
and diabetics

# CONCLUSION

Strategies combining supervised management of physical activity in groups and with help (social, familial, patient associations, diabetes networks, etc.)
with acquisition of necessary skills for improving health state and diabetes management (importance of therapeutic education)
seem to be the best guarantee
for adopting and maintaining regular physical activity



HIGH RISK ACTIVITY