Physical Activity as Part of DPP- Based Community Lifestyle Intervention Efforts

Andrea M. Kriska, PhD

Institute of Medicine's Roundtable on Obesity Solutions
Washington, DC
April 14-15, 2015

Diabetes Prevention Program

The Evidence Behind the Translation Efforts

The Landmark Study that Demonstrated
Lifestyle Intervention Prevented Type 2 Diabetes

NIDDK | NATIONAL INSTITUTE OF DIABETES AND DIGESTIVE AND KIDNEY DISEASES

Diverse

- Age
- Ethnic/Racial
- Geographic

- 3,234 individuals at unhealthy higher weights and with pre-diabetes from across 27 US sites
- Randomly assigned to one of 3 arms:
  lifestyle, drug (metformin), or placebo.

NIDDK | NATIONAL INSTITUTE OF DIABETES AND DIGESTIVE AND KIDNEY DISEASES

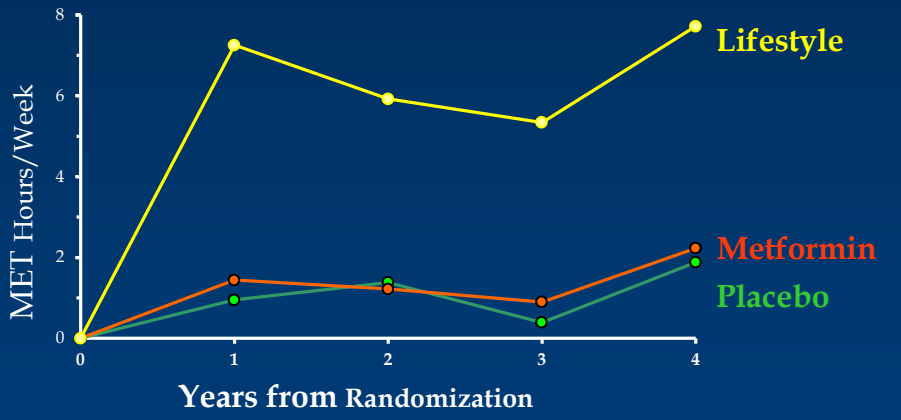
Program Goals

- Lose 7% of body weight
- Do 150 minutes (2½ hours) of moderate intensity physical activity per week

  (These were minimum goals)

Physical Activity and Weight Change in Lifestyle Participants

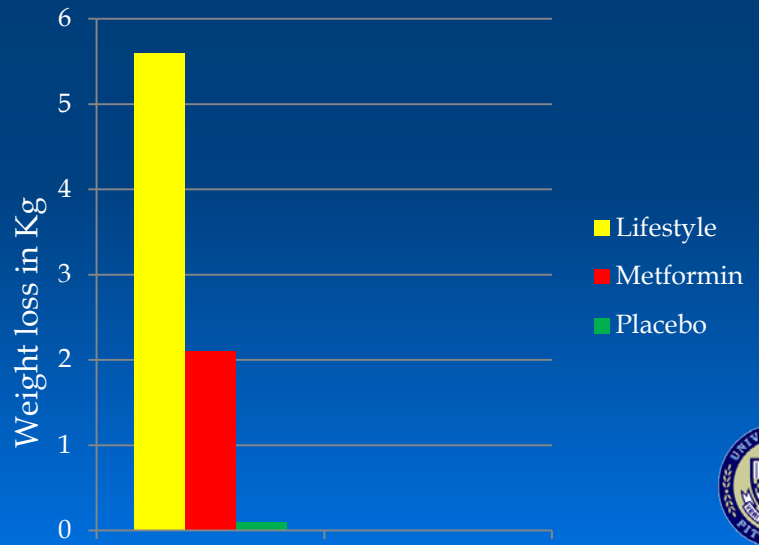
Lifestyle participants had a significantly greater increase in physical activity levels than the other two randomized arms



and…..

Lifestyle participants also had a relatively and significantly greater weight loss by the end of the DPP (At year #1; 7.1-8.4% wt loss in all race-sex groups except black women who lost 4.5%*).

* West; Obesity, 2008



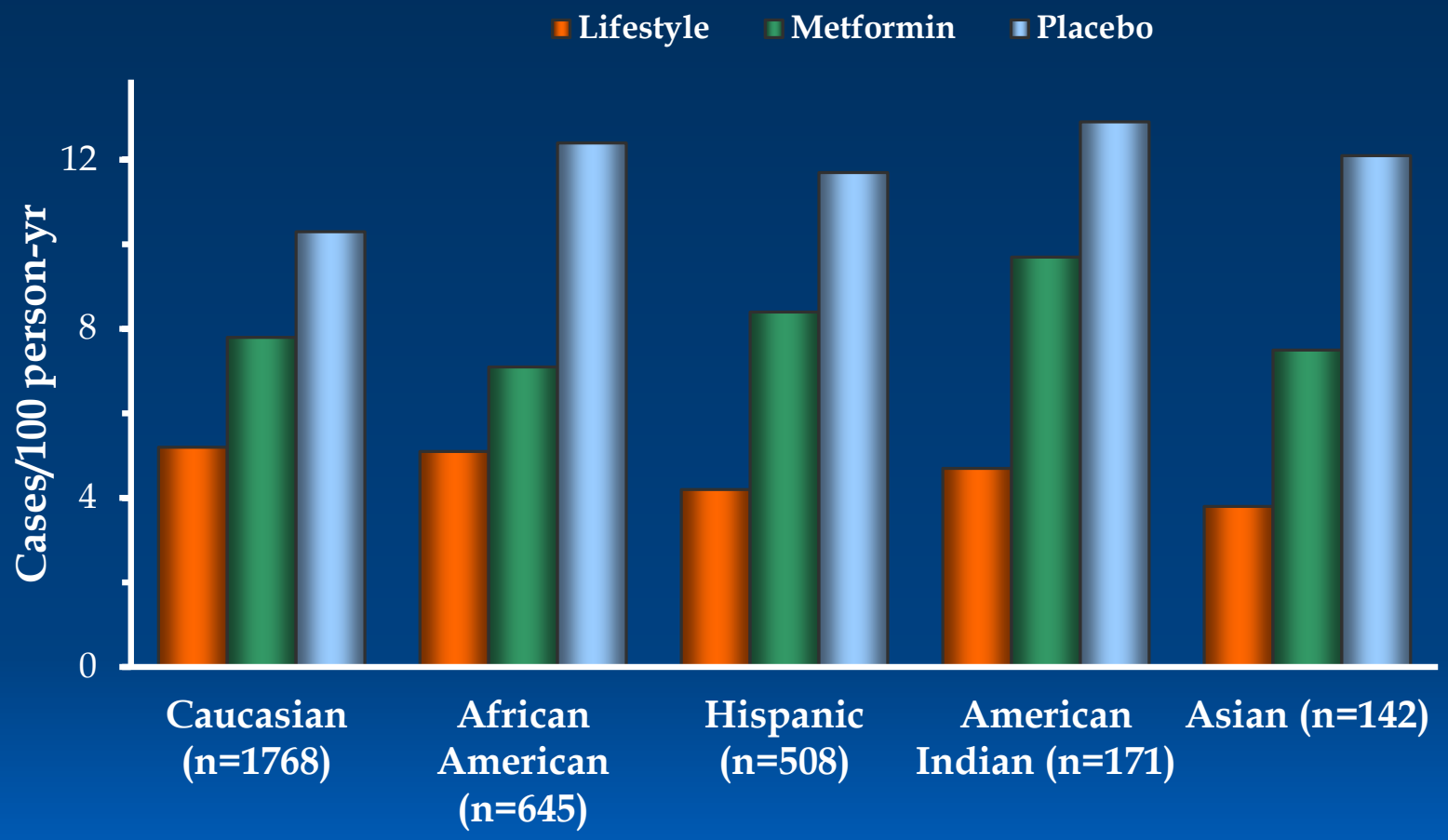
DPP Research Group; NEJM 2002

Prevention

- 58% decrease in diabetes incidence in the lifestyle vs. placebo groups
- Worked across all subgroups, including age, sex, baseline BMI and ethnic/race
- 41% decrease in incidence of metabolic syndrome in the lifestyle vs. placebo groups

NIDDK NATIONAL INSTITUTE OF DIABETES AND DIGESTIVE AND KIDNEY DISEASES

Diabetes Incidence Rates by Ethnicity



The DPP Research Group, *NEJM 346*:393-403, 2002

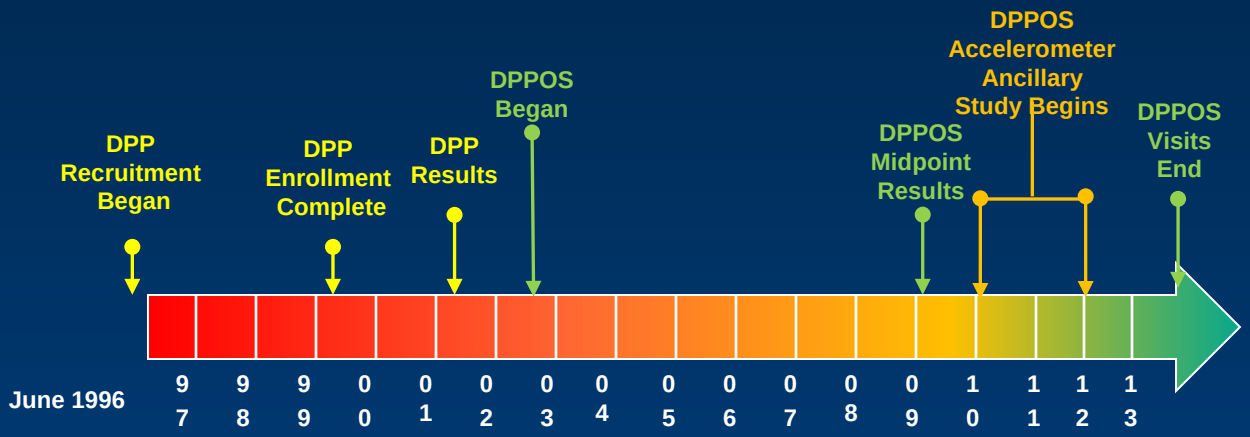
In the DPP, an investigation was done to examine the impact of change in weight and activity on risk of developing diabetes among lifestyle participants.*

- Weight change significantly predicted reduced diabetes incidence (for every kg of weight, there was a 16% reduction in risk).

- Change in physical activity levels was not related to diabetes incidence.
- In contrast, achieving the PA goal did result in a 46% reduction in diabetes.

*Hamman et al; Diabetes Care, 2006

DPP to DPPOS

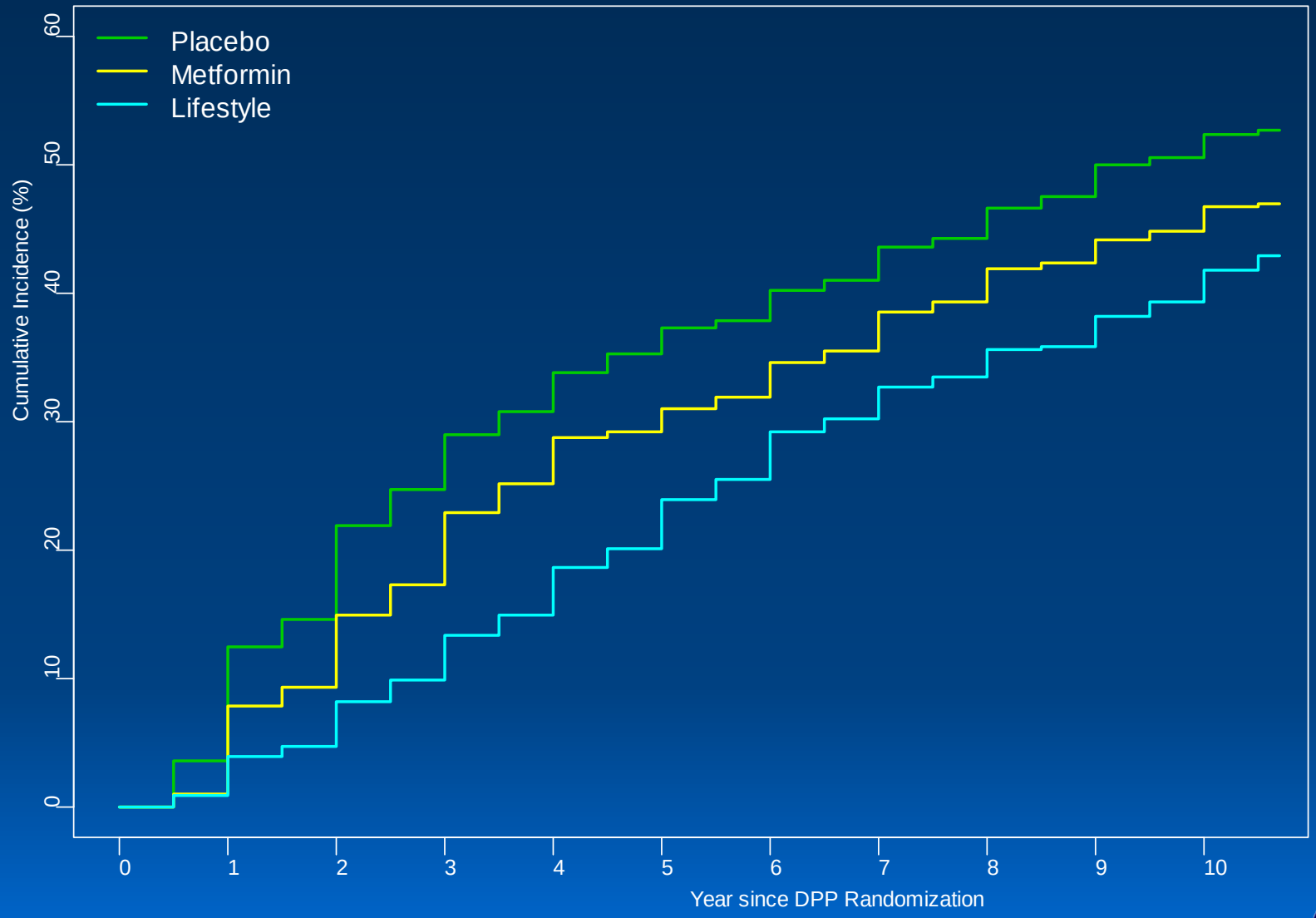


- January - June 2002; all participants were offered a group version of the DPP Lifestyle Intervention Program

- September 2002-present; the DPPOS study began (N = 3251; 88% of all original DPP groups)

- June 2010 – July 2012; the DPPOS Accelerometer Ancillary Study was conducted

DPPOS Incidence of Diabetes



Lancet 2009. 374(9702): p. 1677-1686.

Accelerometer

- Measures all intensities of movement throughout the day:
  - –Inactivity – Sitting time
  - –Light Activity
  - –Moderate Activity
  - –Vigorous Activity
- Best at capturing activities that resemble walking (and running)

Worn on a belt around the waist

Median (interquartile range) values of physical activity and time spent sedentary by treatment arm in years 9/10 of DPPOS

	Lifestyle N=536	Metformin N=543	Placebo N = 543
Activity related variables (minutes/day)	Median (IQR)	Median (IQR)	Median (IQR)
MV intensity PA	20.7 (10.0-41.8)	19.6 (8.6-36.6)	19.6 (8.5-40.2)
Light intensity PA	363 (297-436)	353 (286-417)	353† (282-425)
Total (MV + Light) PA	389 (320-469)	376 (308-451)	377* (307-461)
Time spent Sedentary	470 (403-532)	483 (406-547)	471 (400-547)

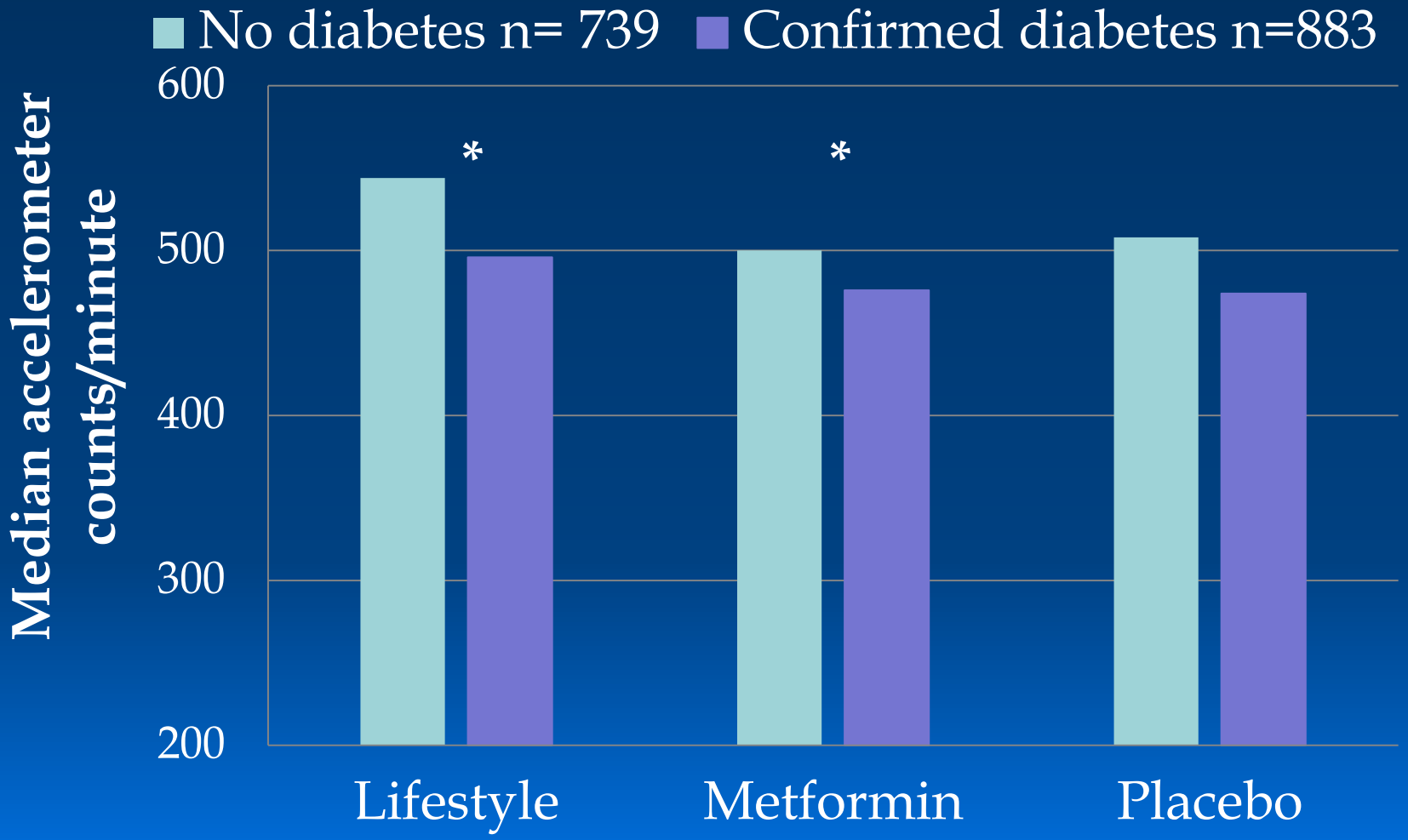
Note: Total counts/day and steps/day followed a similar trend.

***Kruskal Wallis p-value <.05** was used to determine significant differences between treatment groups.

† **p< 0.10**

Adapted from Kriska et al., Diabetes. 2014; 63 (suppl 1): A68-A69.

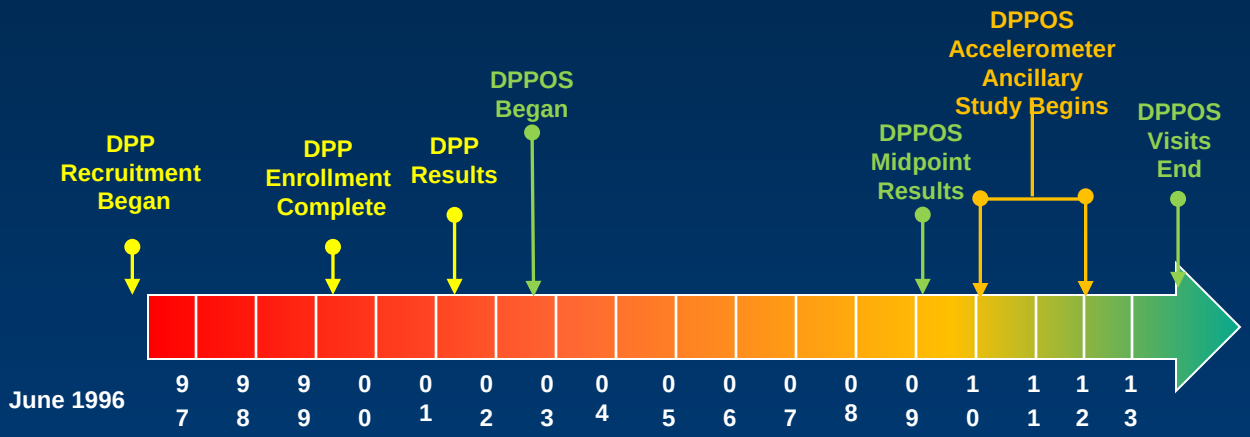
Median values of accelerometer counts/minute (*total counts/wear time*) for those without diabetes vs. those with confirmed diabetes at the time of accelerometer monitoring



Kriska et al., ADA presentation 2014

* dif. between groups p< 0.05

DPP to DPPOS



- January - June 2002; all participants were offered a group version of the DPP Lifestyle Intervention Program

- September 2002-present; the DPPOS study began (N = 3251; 88% of all original DPP groups)

- June 2010 – July 2012; the DPPOS Accelerometer Ancillary Study was conducted

So what do we know….

- We can prevent diabetes with lifestyle intervention
- Physical activity is a critical component of this intervention effort

So how about translation?

- Can we take this behavioral lifestyle intervention into the community and get successful results?

The Diabetes Prevention Support Center University of Pittsburgh

The DPSC guides community translation efforts thru facilitating all aspects of delivery of a modified DPP lifestyle intervention program, the Group Lifestyle Balance ™.

- Up-to-date one-year curriculum
- Approved by CDC Diabetes Prevention Recognition Program
- Delivered in a group setting
- 12 core, 4 core transition , and 6 post-core monthly sessions
- DVD version of core curriculum available
- Training and ongoing support for lifestyle coaches

GROUP LIFESTYLE BALANCE

Group Lifestyle Balance Translation Research Project

National Institutes of Health
The Nation's Medical Research Agency

- University of Pittsburgh translational research study funded by NIH
- Purpose: To formally evaluate delivery of the GLB lifestyle intervention research program in three very different community settings:
  - Community Senior Centers of varying SES
  - Worksite
  - Military

DPP-GLB Program Evaluation Participant Eligibility

- ≥18 years of age
- No reported history of diabetes
- BMI ≥24kg/m^2 (≥22kg/m^2 for Asians)
- Pre-diabetes and/or the metabolic syndrome
  - Pre-diabetes:
    - Fasting glucose 100 mg/dL - 125 mg/dL and/or
    - Hemoglobin A1c 5.7% - 6.4%
  - Metabolic Syndrome (at least 3 of the following):
    - Waist >35 (F) / >40 (M) inches
    - Blood Pressure ≥130 and/or ≥85 mm Hg (or on treatment)
    - HDL Cholesterol <50 (F) / <40 (M) mg/dL
    - Triglycerides ≥ 150 mg/dL)

GROUP LIFESTYLE BALANCE

Baseline Characteristics of Participants in the DPP-GLB Intervention

(N=287*)

Characteristic	Mean (sd)
Age (years)	58.4 (11.3)
Sex: % (n) Female	62.7 (180)
Education: %(n) ≥Bachelor's Degree	64.1 (184)
Race/Ethnicity: % (n) Non-Hispanic White Non-Hispanic Black Hispanic/Latino Other	 86.1 (247) 7.0 (20) 3.1 (9) 3.8 (11)
Weight (lbs.)	208.0 (43.0)
BMI (kg/m^2)	33.7 (5.9)
Physical Activity (MET-hours/week); Median (IQR)	10.5 (3.75-21.50)

*Participants who attended baseline and 6 month assessment visits

GROUP LIFESTYLE BALANCE

Attendance at 6 Months

During the first 6 months there were 16 possible sessions

- Median attendance: 14 out of 16 sessions
- 75% of study participants attended 12 or more sessions

GROUP LIFESTYLE BALANCE

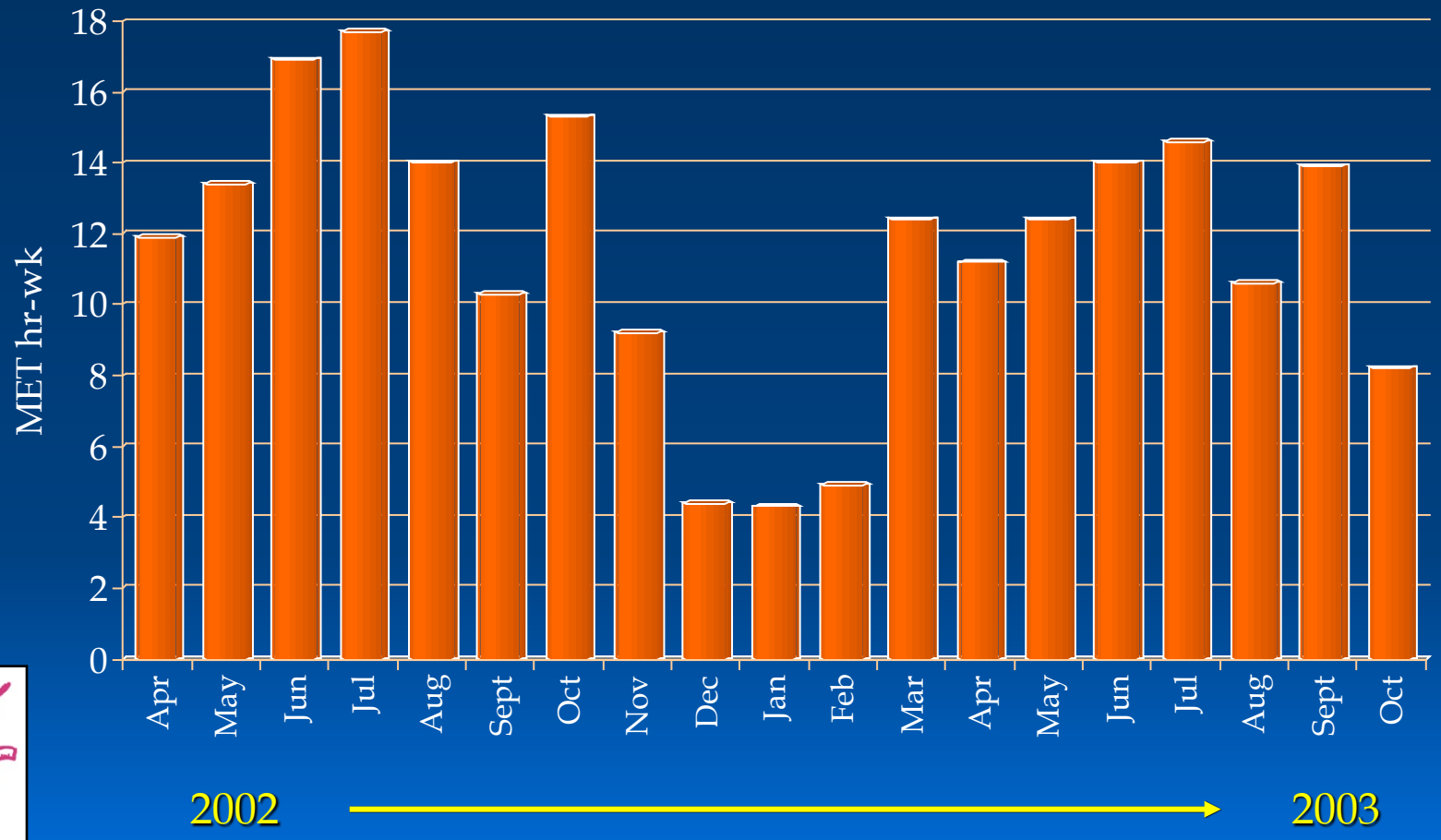
Reporting of Physical Activity in DPP Community Translation Efforts

- Systematic Review of 71 articles representing 57 DPP Translation Studies
- **100%** include PA as a primary intervention goal
- **82%** report how PA was assessed (predominantly self-report, subjective measures)
- **60%** report PA-related outcomes (most often percent of participants meeting goal)

Eaglehouse et. al., 2015 (under review)

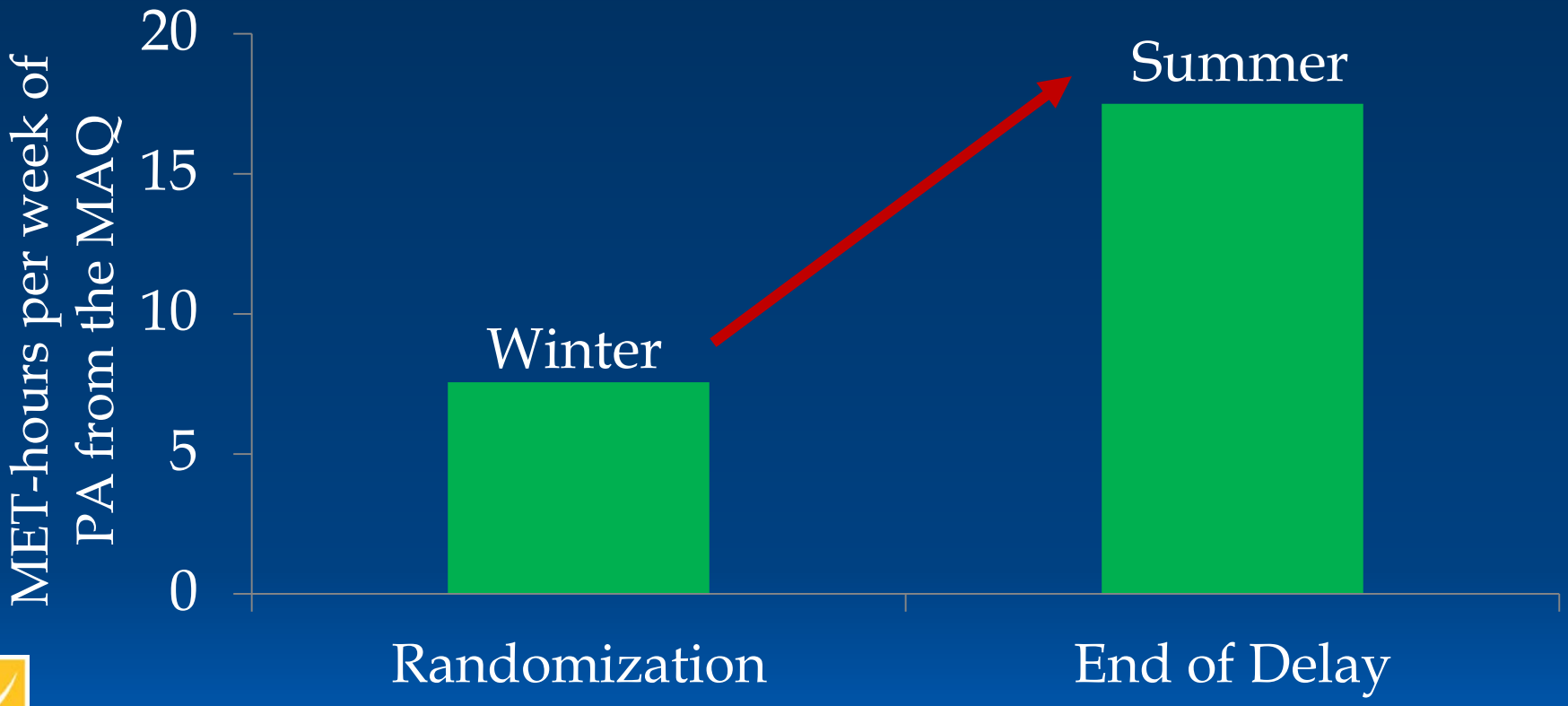
What Impact Does Season/Weather Have on Physical Activity

Past Week MAQ at Baseline Clinic Visit (n=500)



Newman; MSSE 2009

Delayed Participants (N=71) PA Levels Prior to Intervention



Winter to Summer p-change<0.0001; MAQ=Modifiable Activity Questionnaire

Positive Impact of Intervention on Diabetes and CVD Risk Factors

Risk Factor[a]	6 Month Change (N=286)	12 Month Change (N=190‡)
Fasting Glucose	✔	✔
Hemoglobin A1c (%) †	✔	✔
Systolic BP	✔	✔
Diastolic BP	✔	✔
LDL Cholesterol	✔	
HDL Cholesterol		✔
Triglycerides	✔	✔

[a]Participants with relevant medication changes excluded from analysis; ‡12 month data collection from military participants in progress; †HbA1c not available for military participants

GROUP LIFESTYLE BALANCE

Positive Impact of Intervention on Risk Factors: All Work Site Participants and Those at High-risk[a]

	All Work Site Participants		Work Site High-risk[a]	
Risk Factor[b]	**N**	**6 Month Change (mean)**	**N**	**6 Month Change (mean)**
Fasting Glucose (mg/dL)	82	0	17	**-4.4***
Hemoglobin A1c (%)	82	**-0.07****	41	**-0.13****
Systolic BP (mm/Hg)	77	**-4.2****	25	**-7.7****
LDL Cholesterol (mg/dL)	72	-2.1	43	**-7.7***
HDL Cholesterol (mg/dL)	73	1.0	27	**2.0****
Triglycerides (mg/dL) (M, IQR)	73	**-14.0****	30	**-51.5****

[a] Meeting clinical cut-points for metabolic syndrome (NCEP-ATP III) or pre-diabetes for individual risk factors
[b] Participants with relevant medication changes excluded from analysis
**p<0.01, *p<0.05

Adapted from Kriska et al.,Diabetes. 2014; 63 (suppl 1): A171.

GROUP LIFESTYLE BALANCE

How Does Intervention Impact Risk Factors For Those Who are High-Risk[a]?

Baseline Value (regardless of pharmacological treatment):

- Fasting Glucose $\geq$ 100 mg/dL
- Hemoglobin A1c $\geq$ 5.7%
- Systolic Blood Pressure $\geq$ 130 mmHg
- LDL Cholesterol $\geq$ 100 mg/dL
- HDL Cholesterol <50 (f) and <40 (m) mg/dL
- Triglycerides $\geq$ 150 mg/dL)

[a]Meeting clinical cut-points for metabolic syndrome (NCEP-ATP III) or pre-diabetes for individual risk factors

Lessons Learned

- Both efficacy trials, including the DPP, and effectiveness trials (like our GLB efforts in the community) suggest that we can increase participants' PA levels
- DPP provides evidence that this improvement in PA levels may have a significant impact on health outcome including the prevention of diabetes

Lessons Learned (Cont.)

When investigating the effect of community translation efforts…

- Consider the high risk approach when examining the intervention's impact on participants health
- Pay attention to the potential influence of season in intervention and analysis

Sedentary behavior and health outcomes

Your Body's Biggest Enemy
The dangers of living a sedentary life: Learn how to ward off the nasty effects of a new epidemic called Sitting Disease
Selene Yeager
Women's Health Magazine

Stand Up While You Read This!
By OLIVIA JUDSON
NYTIMES

Sitting Too Much Could be Deadly

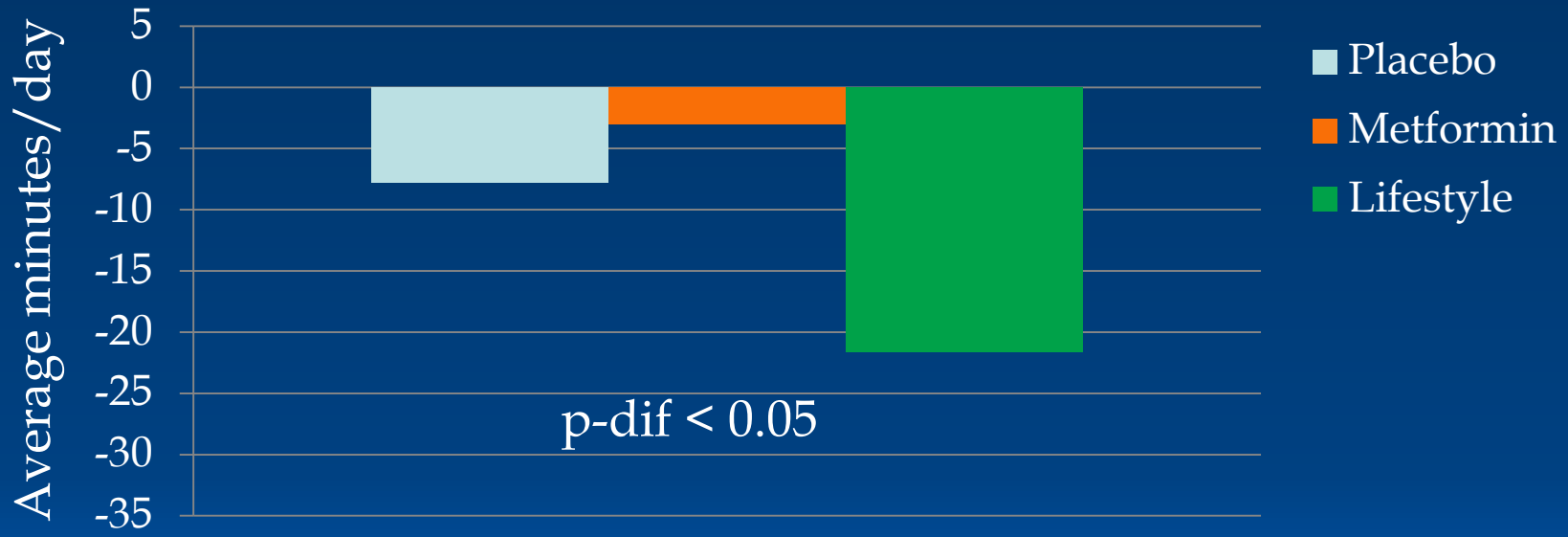
Research is preliminary, but several studies suggest people who spend most of their days sitting are more likely to be fat, have a heart attack or even die.
By: Maria Cheng
The Baltimore Sun

Those with a desk job, please stand up
By Michael S. Rosenwald
Washington Post

Are you sitting down? It's slowly killing you
Regular workouts don't decrease death risk if you're also a couch potato
LifeScience Staff
MSNBC.COM

DPP: TV watching assessed by MAQ (n=3035)

Mean change from baseline in minutes/day of TV watching over follow-up (average 3.2 yrs.) by study arm



ALSO…Each hour per day of sitting watching TV was associated with a 3.4% increased risk of developing diabetes over the follow-up period ($p < 0.05$). This risk was attenuated to 2.1% (ns.) when controlling for weight.

Adapted from Rockette-Wagner et al., *Diabetalogia*, in press

Gaps in Knowledge Leading to Next Steps

What about sedentary behavior?

Specifically, what if we (initially) replaced the goal of increasing moderate PA levels with sitting less in community lifestyle intervention programs in diverse settings?

Would we still see significant changes in weight loss and diabetes and cardiovascular disease risk factors?

GROUP LIFESTYLE BALANCE

DPP-GLB Translation Team

Vincent Arena, PhD
Yvonne Eaglehouse, PhD
Kaye Kramer, DrPH
Andrea Kriska, PhD
Rachel Miller, MS
Bonny Rockette-Wagner, PhD

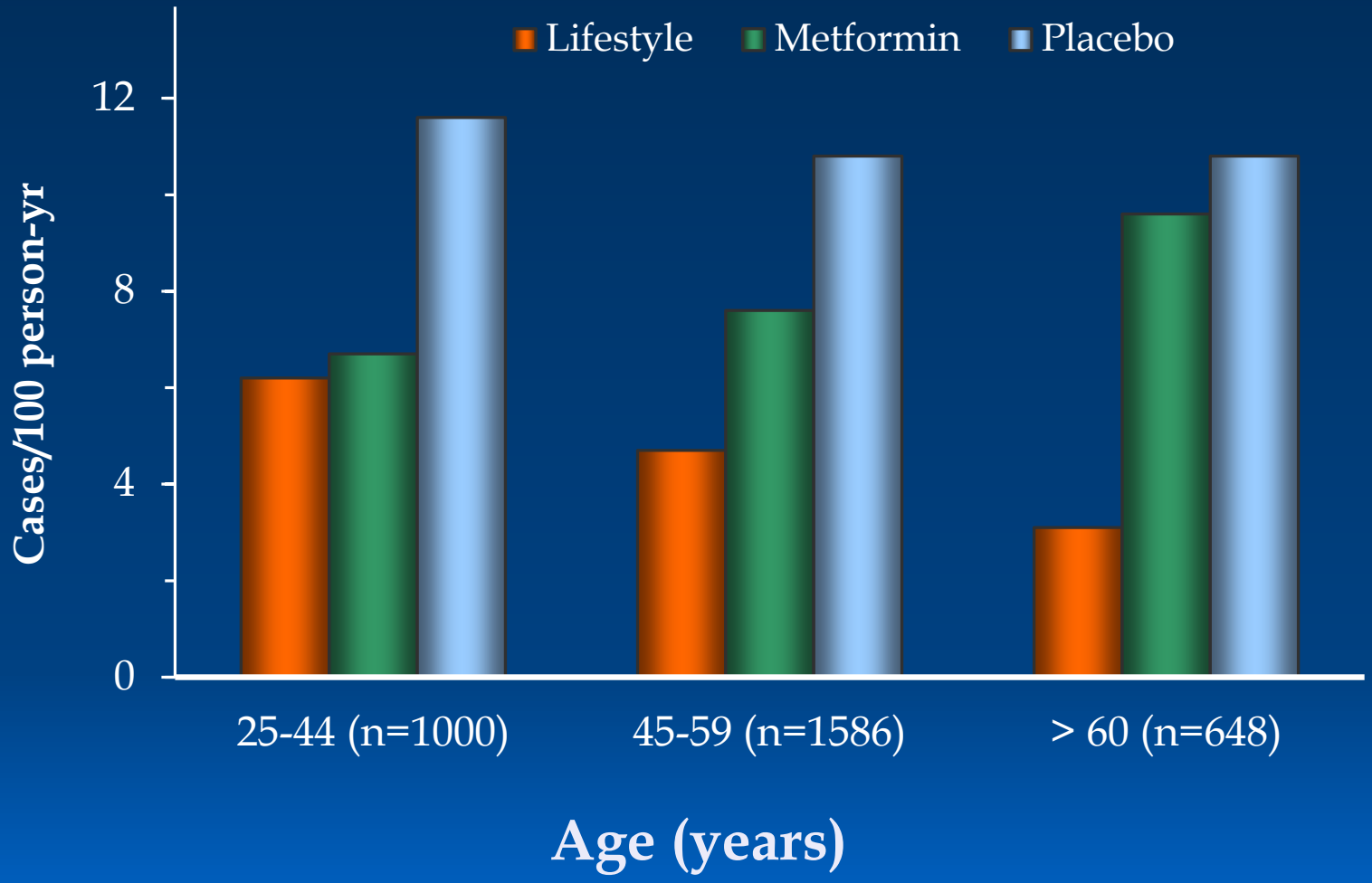
Katie Benchoff, MA
Becky Meehan, MS, RD, LDN
Trevor Orchard, MD
Linda Semler, MS, RD, LDN
Rafal Slowik, MPH
Tom Songer, PhD
Kathleen Stewart, BA
Darcy Underwood, BS
Beth Venditti, PhD

Thank you for your kind attention!

And thanks again to the NIH for their kind funding!

DPPOS U01 DK048412,
Healthy Lifestyle R18 DK081323
Accelerometer R01 DK091345
Sedentary R18 DK100933

Diabetes Incidence Rates by Age



The DPP Research Group, *NEJM 346*:393-403, 2002

Typical PA Intensity Break-down During a 24 Hour Time Period