Ontario
MINISTRY OF HEALTH AND LONG-TERM CARE

# DIABETES RISK REDUCTION IN PRIMARY CARE: EVALUATION OF THE ONTARIO PRIMARY CARE DIABETES PREVENTION PROGRAM

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May 26, 2015

# Diabetes continues to be a global concern



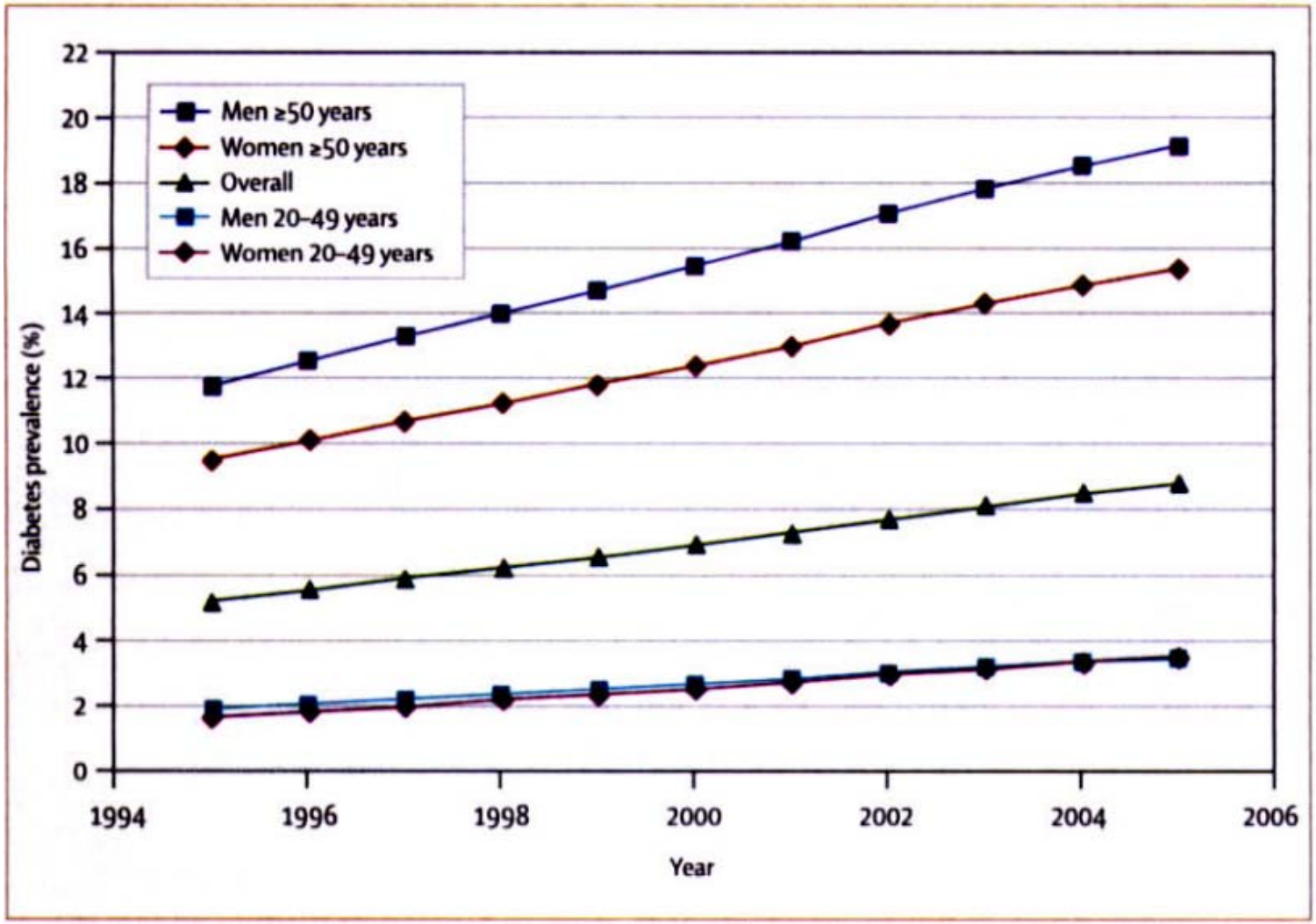
- Diabetes is a major and growing health concern internationally

- The disease and its complications cause extensive morbidity, mortality and health system costs.

- Type 2 diabetes, approximately 90% of diabetes cases in Ontario, often stems from potentially modifiable lifestyle factors (e.g. physical inactivity and obesity)

# Diabetes prevalence is rising dramatically in Ontario






Lipscombe and Hux, 2007

http://www.thelancet.com/journals/lancet/article/PIIS0140673607603614/abstract

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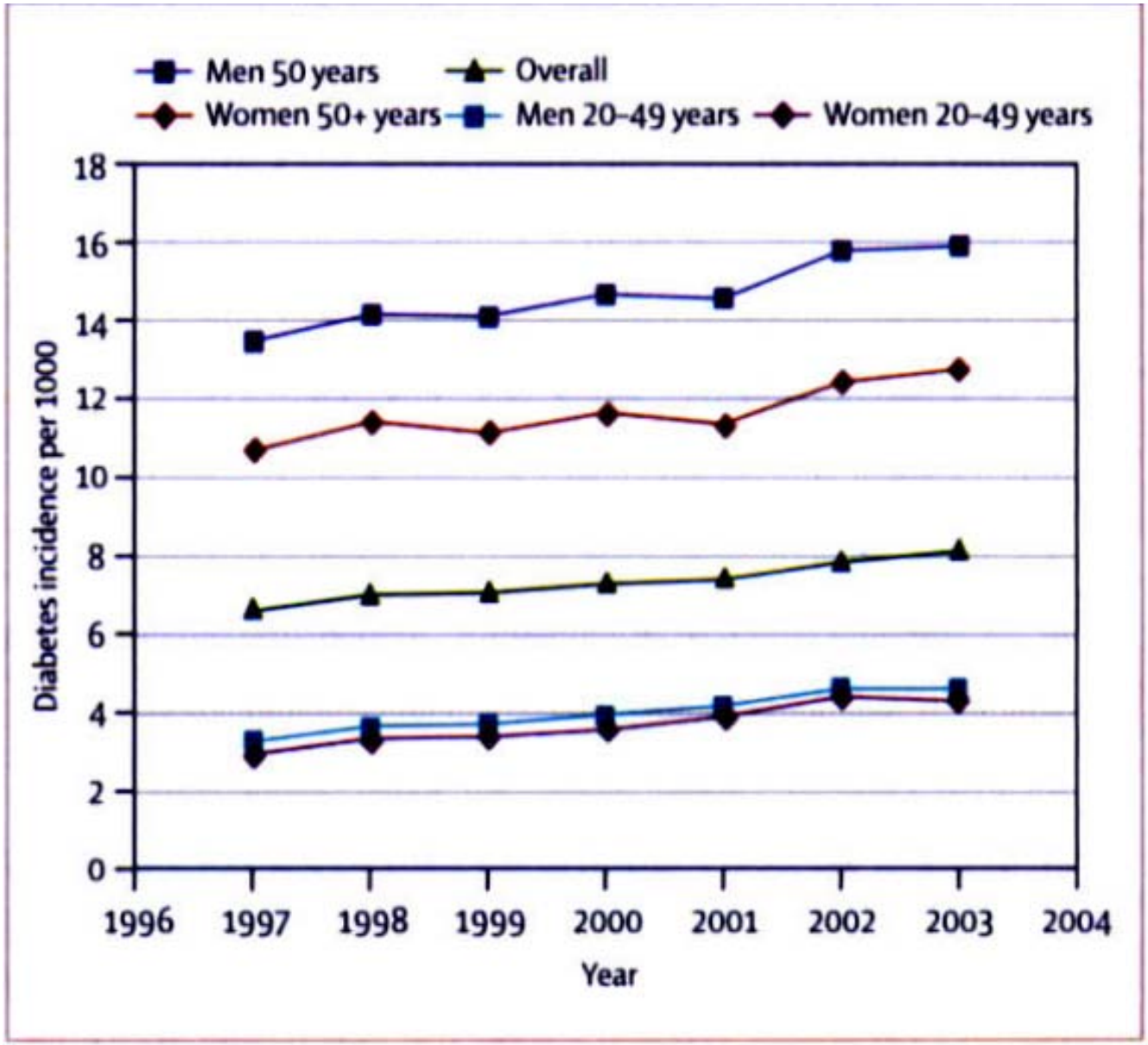
# Diabetes incidence rates in Ontario are also on the rise.






Lipscombe and Hux, 2007

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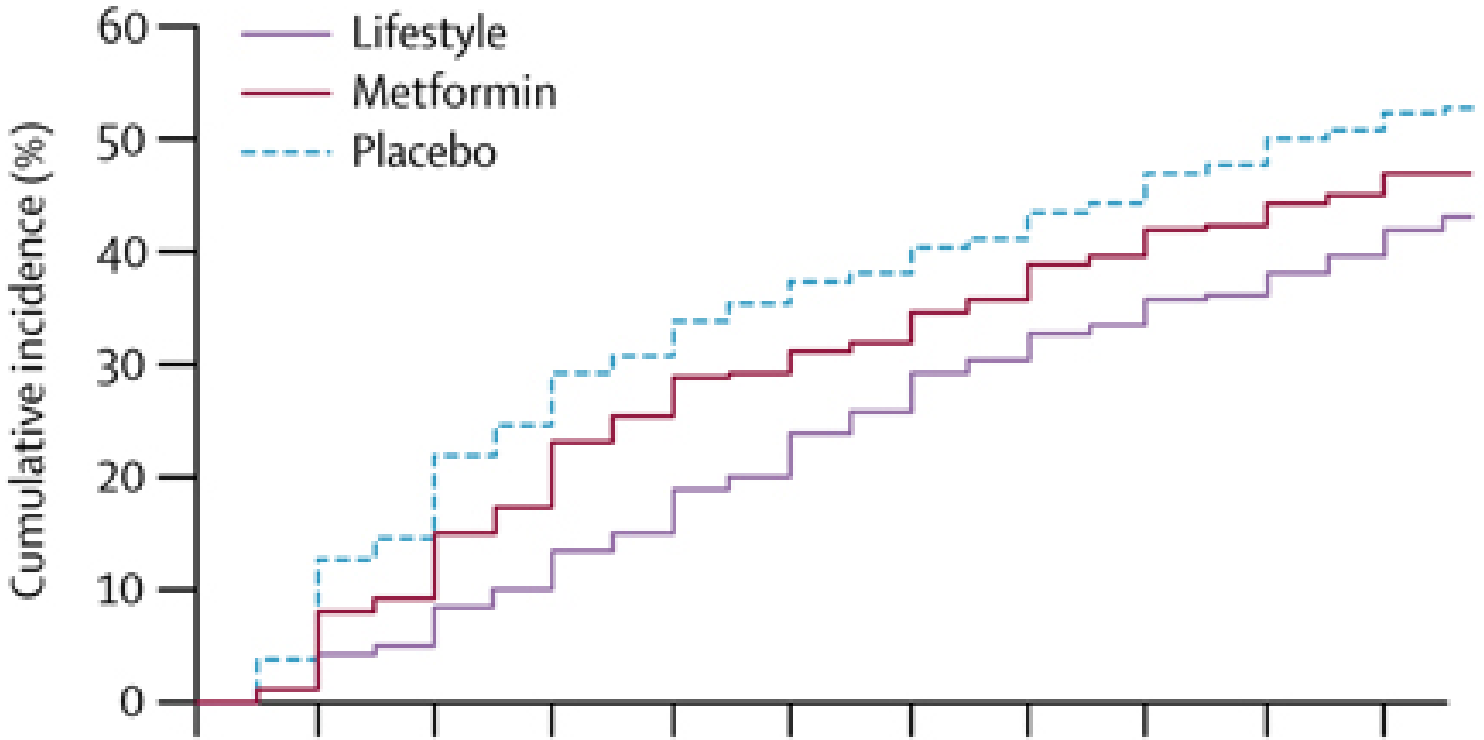
# Type 2 diabetes can be delayed/prevented



- Individuals with prediabetes have been estimated to have a 23% risk of developing diabetes over four years
- Multiple trials show the risk of progression from prediabetes to diabetes can be reduced through intensive lifestyle interventions

10 YEAR FOLLOW-UP
Development of diabetes since Diabetes Prevention Program (DPP) randomisation




DPP Research Group, 2009
http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3135022/

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## The Ontario Diabetes Strategy



- The Ontario Ministry of Health and Long-Term Care (MOHLTC) launched the Ontario Diabetes Strategy (ODS) in 2008

- The ODS included a two-year diabetes prevention pilot program called the Primary Care Diabetes Prevention Program (PCDPP), modeled on the DPP

## Study Objectives

1. Evaluate the real-world effectiveness of the PCDPP
2. Use a validated diabetes risk modeling tool to estimate the impact of scaling up the program

# Ontario's Primary Care Diabetes Program



**Goals:**

- The PCDPP demonstration period ran from January 2011 to March 31, 2013 in six Family Health Teams (FHTs), a multidisciplinary primary care setting. PCDPP goals were for participants to:
  1) Achieve a 7% weight loss;
  2) Engage in ≥ 150 minutes/week of moderate physical activity; and
  3) Increase and retain knowledge about healthy lifestyle practices

Inclusion

- ≥18 years of age
- Diagnosis of prediabetes or metabolic syndrome, and physician approval

Exclusion

- Existing diabetes diagnosis
- Pregnancy or planned pregnancy within six months
- Any condition preventing the participant from committing to program curriculum (e.g. terminal illness).

- Criteria were broadly similar to the original US DPP trial.

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# INTERVENTION



- Lifestyle coaches delivered a standardized behavioural lifestyle intervention

Group Lifestyle Balance™


Weekly classes (up to 20 participants). Topics included healthy eating, physical activity, and obesity health risks.

Focus was on supporting self-management, reinforcing education content, and skills.

Monthly follow-up with lifestyle coach.

- Enrollment occurred between January 2011 to March 2013
- Lifestyle coaches entered weight into evaluation database at each visit

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# ANALYSIS METHODS



- **Multilevel mixed-effects linear regression models** were used to estimate the effect of the intervention on weight loss
- Four time periods were used to evaluate PCDPP (intervention) effectiveness: baseline, 3, 6, and 9 months

- Missing weight values replaced with value on record
- Sensitivity analyses were conducted with the original missing values
- Analyses grouped participants by sex (male or female) and age (over/under 65 years of age)

- Statistical analysis was performed using STATA, version IC 12.1 (StataCorp LP, Texas, USA)
- Ethics approval received from the University of Toronto

# CHARACTERISTICS OF PARTICIPANTS



| Variable | Total (N=1,916) | | Female (N=1,338) | | Male (N=566) | |
|---|---|---|---|---|---|---|
| | Mean (SD) | N | Mean (SD) | N | Mean (SD) | N |
| **Weight (baseline)** | 91.0 (20.7) | 1,846 | 87.0 (19.7) | 1,301 | 100.1 (20.1) | 540 |
| **Age** | 58.1 (12.4) | 1,852 | 56.7 (12.5) | 1,298 | 61.2 (11.7) | 552 |
| **Visible Minority (census Sub-Division, CDS)** | 9.5% (20.4%) | 1,625 | 7.6% (18.1%) | 1,132 | 13.8% (24.4%) | 490 |
| **Income (Avg. Household Income, CAN$ in CSD)** | 67,313 (16,324) | 1,625 | 66,065 (14,821) | 1,132 | 70,163 (19,038) | 490 |
| **Education (% of pop. With Cert./Degree in CSD** | 53.4% (8.5%) | 1,625 | 52.7% (8.3%) | 1,132 | 55.0% (8.6%) | 490 |
| **Gender** | 0.5% (n=12) missing | | 70.0% | 1,338 | 29.5% | 566 |

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# CHARACTERISTICS OF PARTICIPANTS

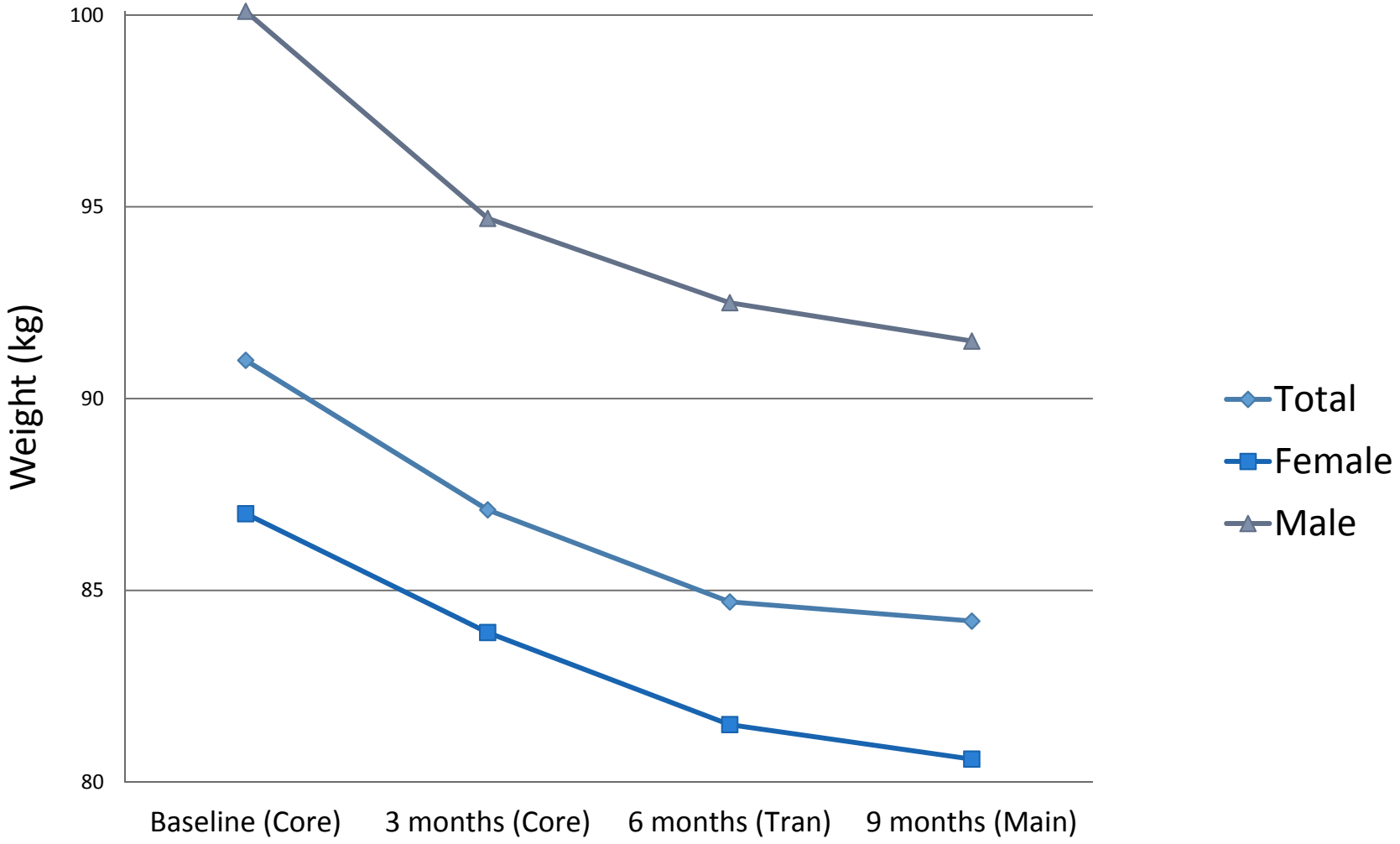


| Phase | N | Drop Out Rate (%) |
|---|---|---|
| Baseline | 1846 | |
| Core (3 months) | 1290 | 30.1 |
| Transition (6 months) | 867 | 53.0 |
| Maintenance (9 months) | 581 | 68.5 |

# RESULTS: IMPACT OF PCDPP ON BODY WEIGHT



**All Participants**

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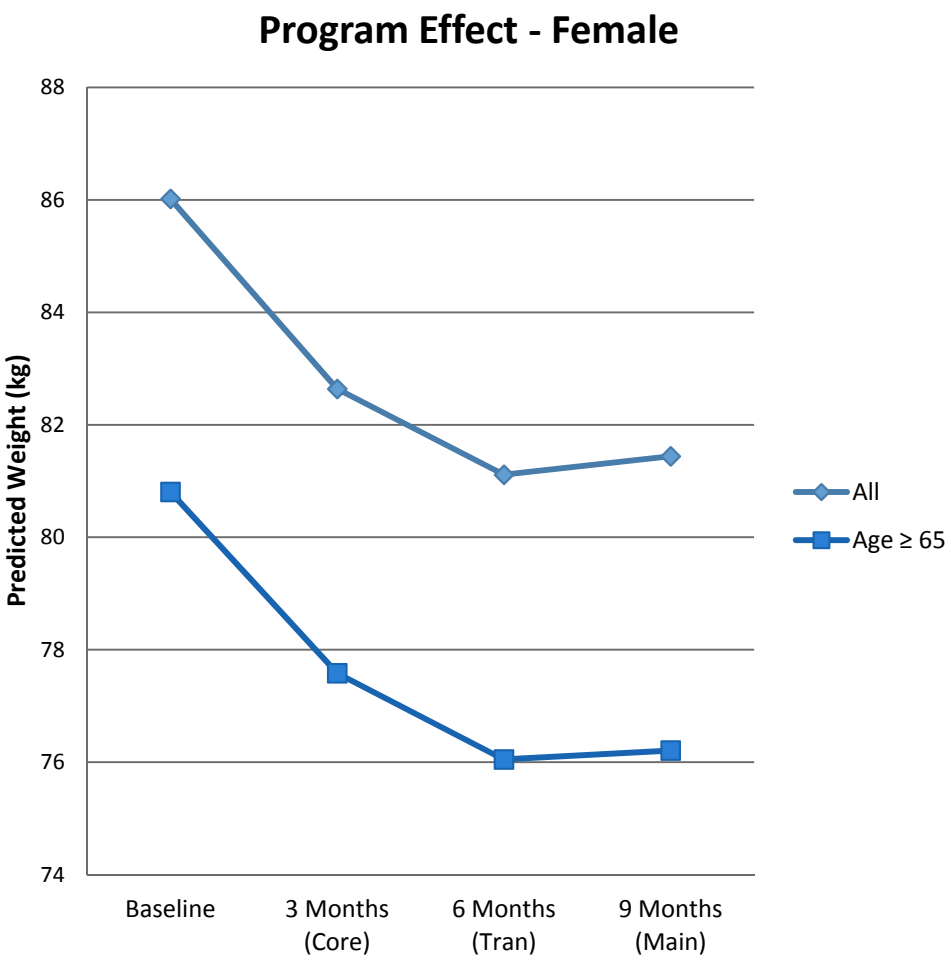
# RESULTS: IMPACT OF PCDPP ON BODY WEIGHT

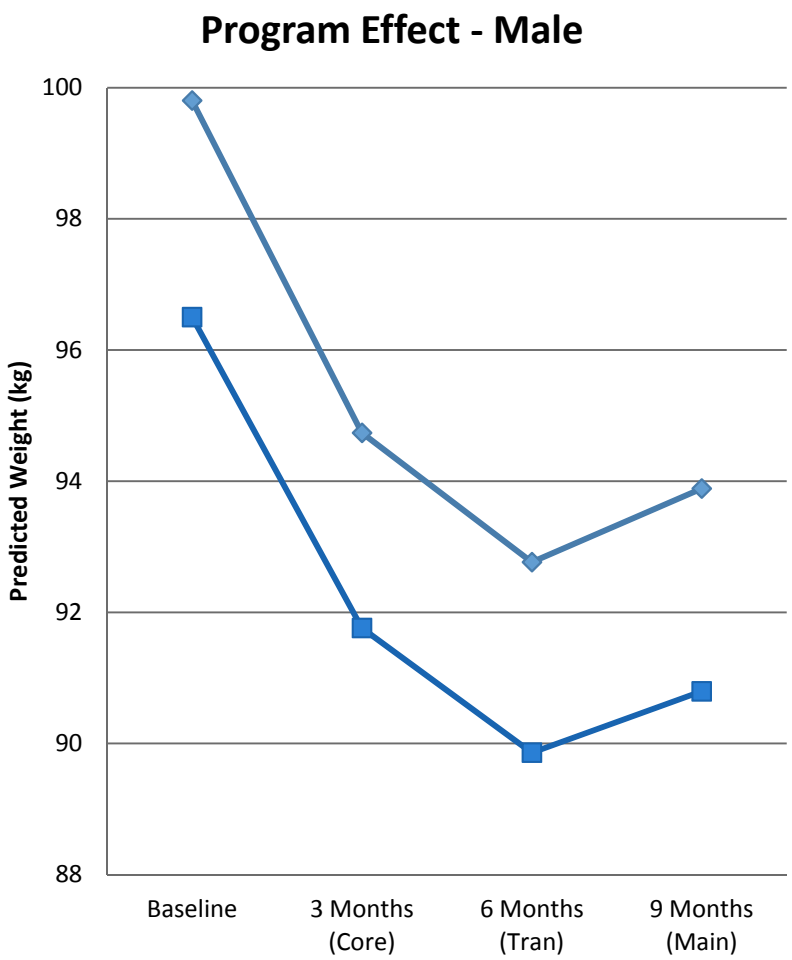


| Average weight loss (%) | 3 months | | 6 months | | 9 months | |
|---|---|---|---|---|---|---|
| | **All** | **≥65 y.o.** | **All** | **≥65 y.o.** | **All** | **≥65 y.o.** |
| Total | 4.3 | 4.9 | 6.9 | 6.5 | 7.5 | 6.3 |
| Female | 3.6 | 4.4 | 6.3 | 5.4 | 7.4 | 6.1 |
| Male | 5.4 | 4.9 | 7.6 | 7.4 | 8.6 | 7.5 |

# RESULTS: REGRESSION MODEL TO PREDICT WEIGHT LOSS






Total predicted weight loss was 5.3% and 5.9% in females and males, respectively.

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# PREDICTING IMPACT OF SCALING UP THE PROGRAM



- The Diabetes Population Risk Tool (DPoRT) was used to estimate the impact of scaling up the PCDPP to the entire province of Ontario
  - DPoRT uses population data from the Canadian Community Health Survey (CCHS) on diabetes risk factors (e.g. BMI) to estimate the future burden of diabetes within a population
- The tool predicts future risk of diabetes by providing absolute risk reduction and the absolute number of diabetes cases averted

# RESULTS: PREDICTED IMPACT OF PROVINCE-WIDE PROGRAM



| | | Interventions | |
|---|---|---|---|
| | | Percent weight loss | |
| Coverage | Impact | 4.6% | 7.0% |
| 50% | Number Needed to Treat | 39 | 28 |
| 75% | | 40 | 29 |
| 100% | | 41 | 29 |
| 50% | Cases Averted | 7,569 | 10,405 |
| 75% | | 10,324 | 14,059 |
| 100% | | 13,492 | 18,666 |

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# LIMITATIONS

- Drop out rate
- Missing data
- Other potential improvements to cardiovascular health, mortality, and quality of life
- Short follow-up period
- Comparability of sites

# INTERPRETATION AND IMPLICATIONS



- Total predicted average weight loss over 9 months was 5.3% in females and 5.9% in males
- With some variation, the intervention was effective in all 6 sites , where total predicted average weight loss varied from 3.9% to 9.6% (data not shown)
- The program was also equally effective across participants with different education and income levels  Canadian context
- Results suggest a proportionally larger number of participants over 65 lost weight with the program

# INTERPRETATION AND IMPLICATIONS



- Large number of participants is a key strength of this study
- The PCDPP is perhaps the largest study of its kind in Canadian history
- The PCDPP utilized multiple sites hundreds of kilometers apart, and worked with quite different populations (e.g. urban vs rural)

The PCDPP demonstrates that a primary-care based diabetes prevention approach appears to have significantly reduced diabetes risk in enrolled participants and could be a successful program to reduce population-level risk of diabetes.

# ACKNOWLEDGMENTS



Ministry of Health and Long-Term Care

- Guillermo A. Sandoval, PhD
- James A. Elliott, MSc
- Meera Jain, PhD
- Tiffany Barker, RN, MPH
- Amy Prisniak, MSc
- Stoni Astley

University of Toronto

- Laura Rosella, PhD

- We would also like to thank all participants and staff who participated in and contributed to the PCDPP program.

# APPENDICIES

# ANALYSIS METHODS



- **Multilevel mixed-effects linear regression models** were used to estimate the effect of the intervention on weight loss.
- Weight was the primary dependent outcome variable.
  - Weight was modeled as a function of participants' height, age, income, education, ethnicity, program site and time.
- Four time periods were used to evaluate PCDPP (intervention) effectiveness: baseline, 3, 6, and 9 months. Time was modelled linearly, i.e. 0 for baseline, and 1, 2, and 3 for each program phase, and included a squared term to capture the curvilinear nature of typical weight loss trajectories observed in the DPP
  - The number of weight measurements dropped off in later time periods, due to participants who dropped out in the core phase or were enrolled in the program late in 2012. To compensate, missing weight values for each participant in any given period were replaced with the closest weight value on record (i.e. the week/month before or after). Sensitivity analyses were conducted with the original missing values.
- Analyses grouped participants by sex (male or female) and age (over/under 65 years of age).
  - Observations per participant in each model varied from 2.5 to 2.7 (range: 1-4) on average.
- The model included both random intercept and random slopes (coefficients) for time and time square, and robust standard errors. Statistical analysis was performed using STATA, version IC 12.1 (StataCorp LP, Texas, USA).

# Appendix 1: Descriptive Statistics of Study Participants



| Variable | Total | | Female | | Male | |
|---|---|---|---|---|---|---|
| | Mean (SD) | N | Mean (SD) | N | Mean (SD) | N |
| Weight (baseline) | 91.0 (20.7) | 1,846 | 87.0 (19.7) | 1,301 | 100.1 (20.1) | 540 |
| Age | 58.1 (12.4) | 1,852 | 56.7 (12.5) | 1,298 | 61.2 (11.7) | 552 |
| Visible Minority (census Sub-Division, CDS) | 9.5% (20.4%) | 1,625 | 7.6% (18.1%) | 1,132 | 13.8% (24.4%) | 490 |
| Income (Avg. Household Income, CAN$ in CSD) | 67,313 (16,324) | 1,625 | 66,065 (14,821) | 1,132 | 70,163 (19,038) | 490 |
| Education (% of pop. With Cert./Degree in CSD | 53.4% (8.5%) | 1,625 | 52.7% (8.3%) | 1,132 | 55.0% (8.6%) | 490 |
| FHT1 | 25.8% | 494 | 27.3% | 365 | 23.2% | 129 |
| FHT2 | 10.2% | 195 | 8.0% | 107 | 15.6% | 87 |
| FHT3 | 14.8% | 283 | 16.8% | 225 | 10.1% | 56 |
| FHT4 | 14.8% | 284 | 11.5% | 154 | 22.5% | 125 |
| FHT5 | 19.3% | 370 | 24.1% | 323 | 8.3% | 46 |
| FHT6 | 15.1% | 290 | 12.2% | 164 | 22.1% | 123 |
| Gender | 0.5% (n=12) missing | | 70.0% | 1,338 | 29.5% | 566 |

# Appendix 2: Descriptive Statistics of Study Participants, age ≥ 65



| Variable | Total | | Female | | Male | |
|---|---|---|---|---|---|---|
| | Mean (SD) | N | Mean (%) | N | Mean (%) | N |
| Weight (baseline) | 87.0 (17.5) | 608 | 81.6 (16.6) | 375 | 95.2 (15.5) | 231 |
| Age | 70.9 (4.9) | 621 | 70.5 (4.8) | 381 | 71.5 (4.9) | 238 |
| Visible Minority (census Sub-Division, CDS) | 9.3% (20.5%) | 524 | 7.9% (18.9%) | 315 | 11.6% (22.6%) | 207 |
| Income (Avg. Household Income, CAN$ in CSD) | 67,207 (16,563) | 524 | 66,372 (15,068) | 315 | 68,564 (18,621) | 207 |
| Education (% of pop. With Cert./Degree in CSD | 53.6% (8.3%) | 524 | 53.3% (8.0%) | 315 | 54.1% (8.8%) | 207 |
| FHT1 | 31.4% | 195 | 34.6% | 132 | 26.5% | 63 |
| FHT2 | 12.4% | 77 | 9.4% | 36 | 16.8% | 40 |
| FHT3 | 15.1% | 94 | 16.8% | 64 | 12.2% | 29 |
| FHT4 | 12.9% | 80 | 10.0% | 38 | 17.6% | 42 |
| FHT5 | 12.6% | 78 | 16.5% | 63 | 6.3% | 15 |
| FHT6 | 15.6% | 97 | 12.6% | 48 | 20.6% | 49 |
| Gender | 0.3% (n=2) missing | | 61.4% | 381 | 38.3% | 238 |