

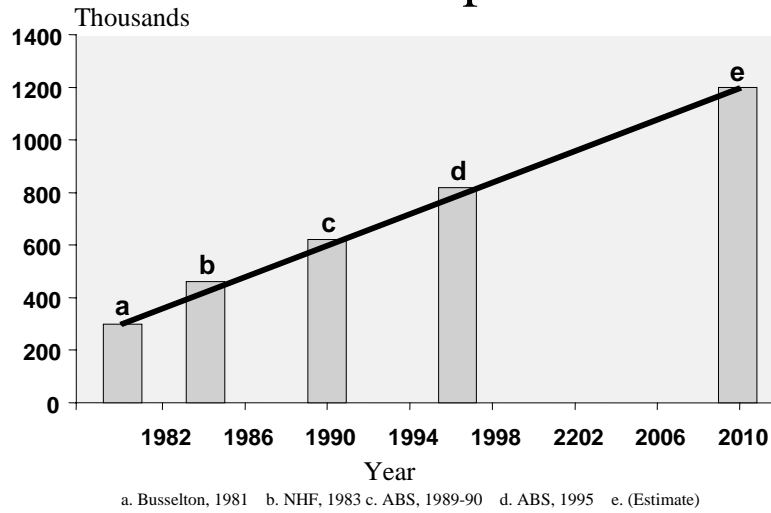
IMSANZ Annual Scientific Meeting, Alice Springs, September 2005

# Prevention programmes for Type 2 diabetes

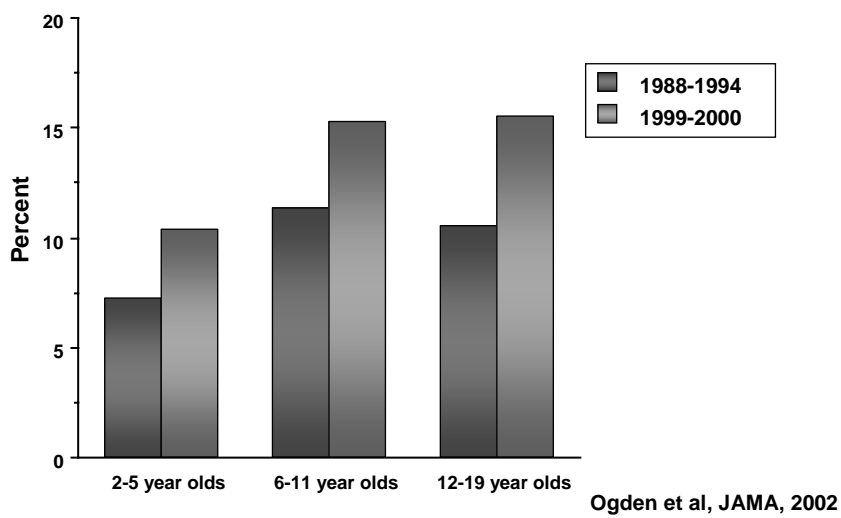
David Simmons

Professor of Medicine  
Waikato Clinical School  
University of Auckland

## Estimated diabetes cases in Australia: Number of persons



## Overweight in Adolescents: > 95% BMI for age



## **IT'S NOT ALL IN THE GENES**

---

The environment you grow up in is as important as your DNA in determining the person you ultimately become. BY ROBERT SAPOLSKY

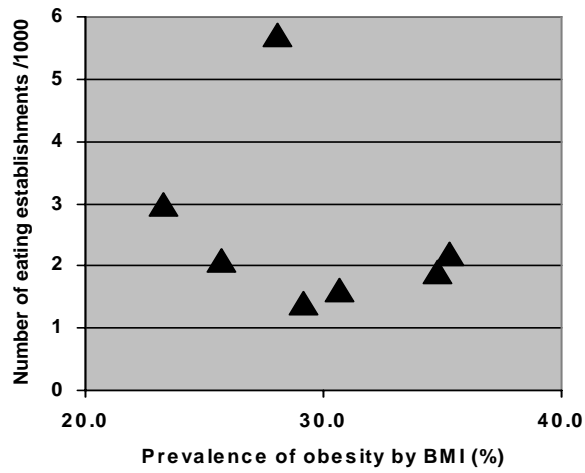
### Aborigines and impact of traditional diet O'Dea 1994

10 full blooded urban Aborigines:  
7 weeks traditional living  
(eg kangaroo, fish, yams, honey, figs,  
hunting/collecting)

	Pre	Post
BMI (kg/m/m)	27.2	24.5
Trigs (mmol/l)	4.0	1.2
FBG (mmol/l)	11.6	6.6
Fins (mu/l)	23	12

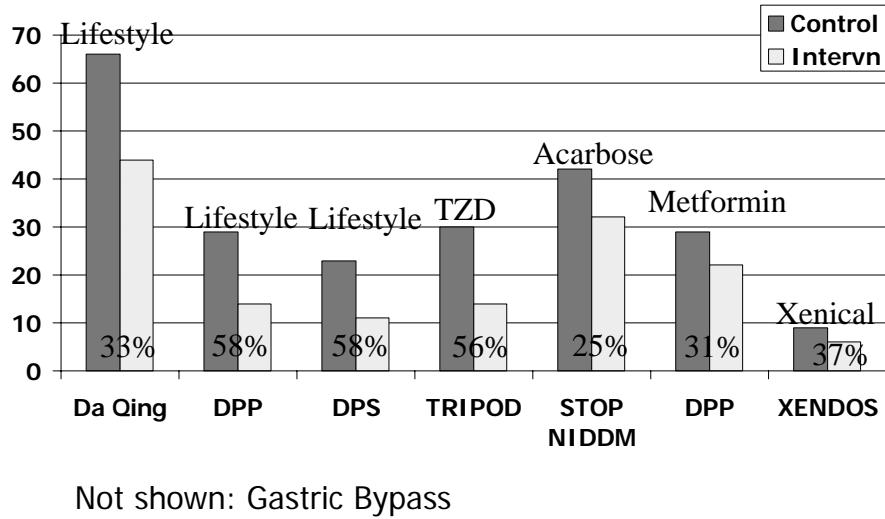


### Prevalence of obesity and access to takeaways in rural Victoria

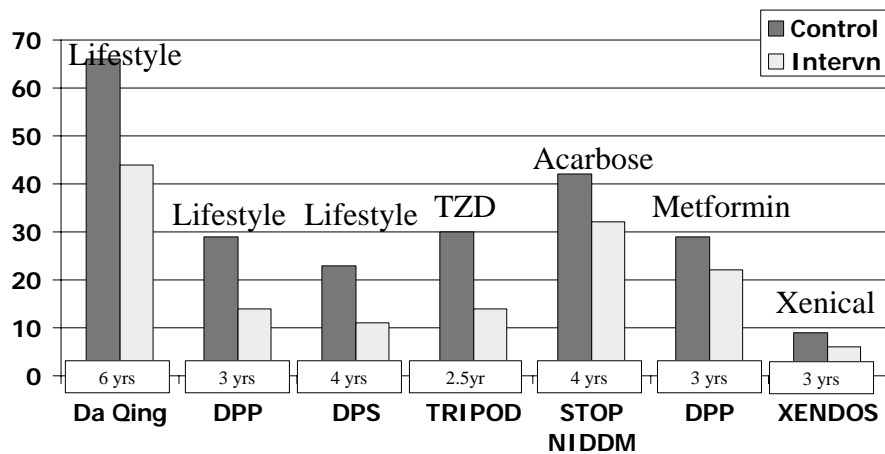


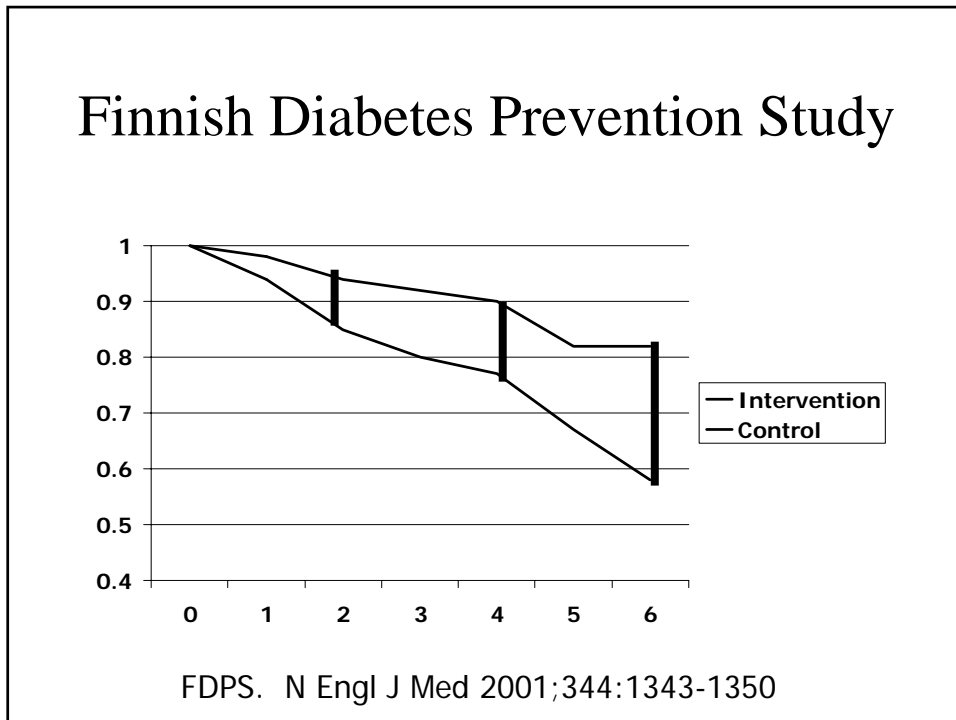
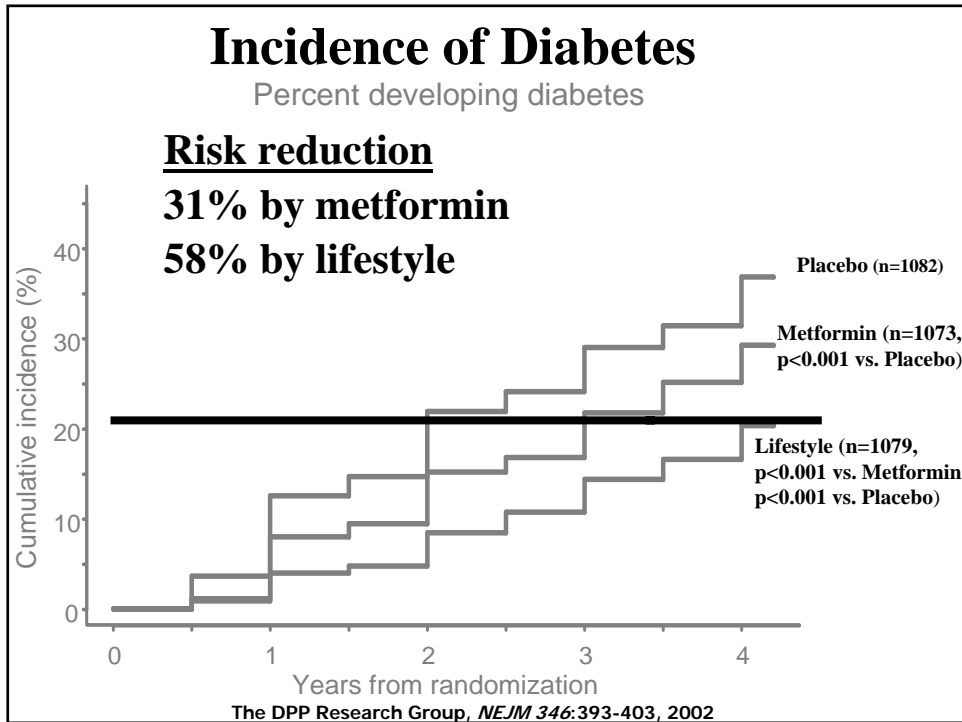
Simmons et al IJO 2005

## Can we prevent progression from IGT to Type 2 diabetes?



## Is it prevention or delay of T2DM from IGT?





## Lifestyle Intervention Structure

### DPP

- $\geq 7\%$  loss of body weight and maintenance of weight loss
- $<25\%$  calories from fat
- 1200-1800 kcal/day
- 150+ mins physical activity/week

### FDPS

- $\geq 5\%$  loss of body weight and maintenance of weight loss
- $<30\%$  calories from fat
- $<10\%$  of calories from sat fat
- Fibre 15g/1000 kcal
- Exercise 30+ mins/day

## Lifestyle Intervention Structure

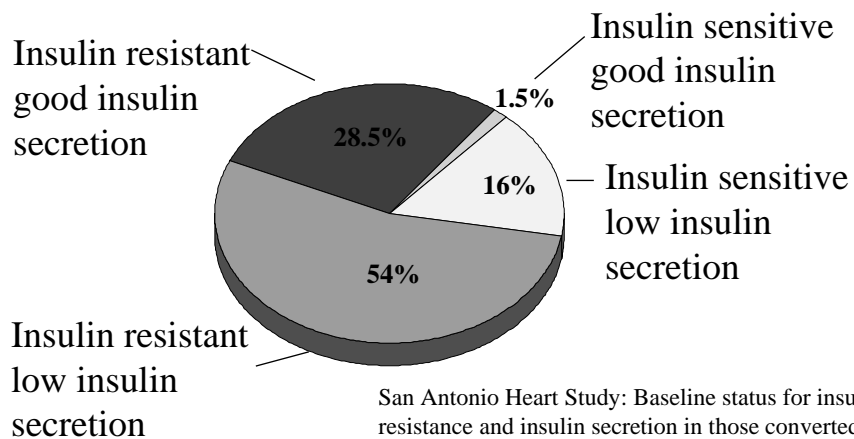
### DPP

- 16 session core curriculum (over 24 weeks)
- Long-term maintenance program
- Supervised by a case manager
- Access to lifestyle support staff
  - Dietitian
  - Behavior counselor
  - Exercise specialist

### FDPS

- 7 session core curriculum (over 52 weeks)
- Long-term maintenance program
- Supervised physical activity
- Access to lifestyle support staff
  - Dietitian
  - Exercise specialist

## Conversion to type 2 diabetes stratified by baseline insulin resistance and insulin secretion



San Antonio Heart Study: Baseline status for insulin resistance and insulin secretion in those converted to type 2 diabetes during 7-year follow up; n = 195

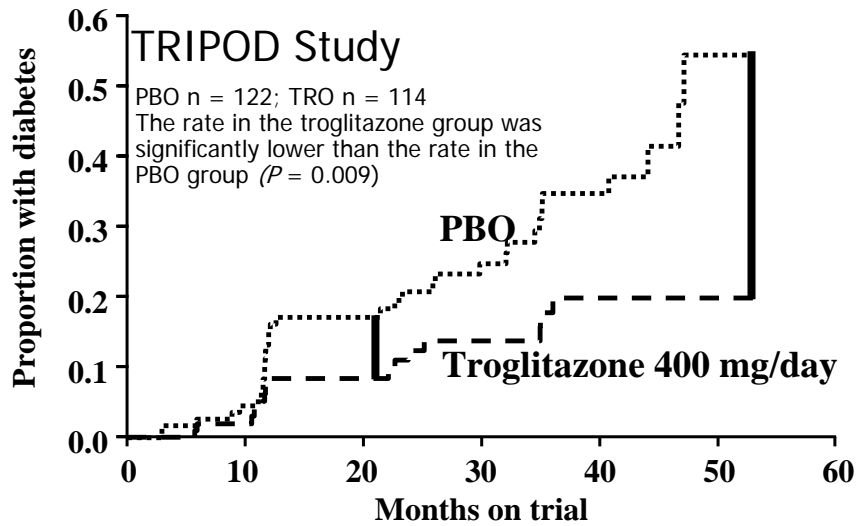
Adapted from Haffner SM, et al. *Circulation* 2000; 101:975-980.

## Finnish Diabetes Prevention Study: Genotyping

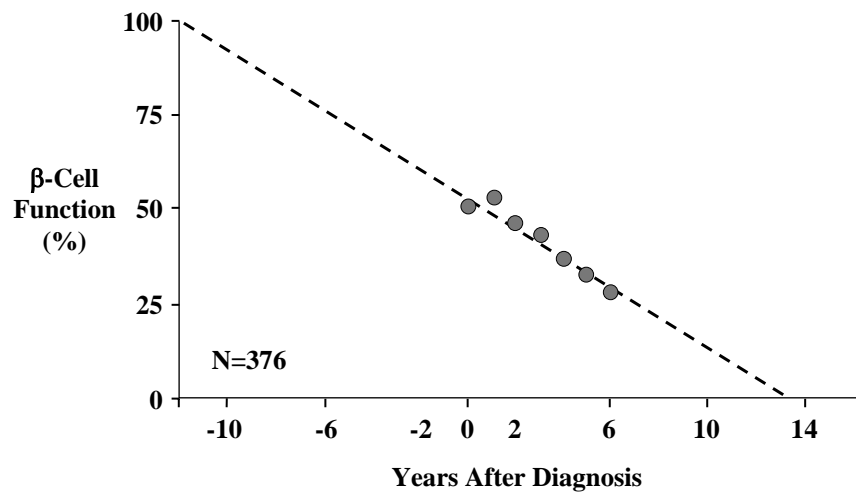
- Polymorphisms in IGF-1R, IRS-1, IRS-2 associated with less weight loss
- Polymorphisms in IGF-1R may regulate risk of developing T2DM
- Polymorphism in TNF alpha interact with IL6 polymorphism to increase risk of progression to T2DM

Diabetes 2003; 52:1872-1876; Diabetologia  
2004;47:871-877

## TZDs have the potential to prevent progression to type 2 diabetes



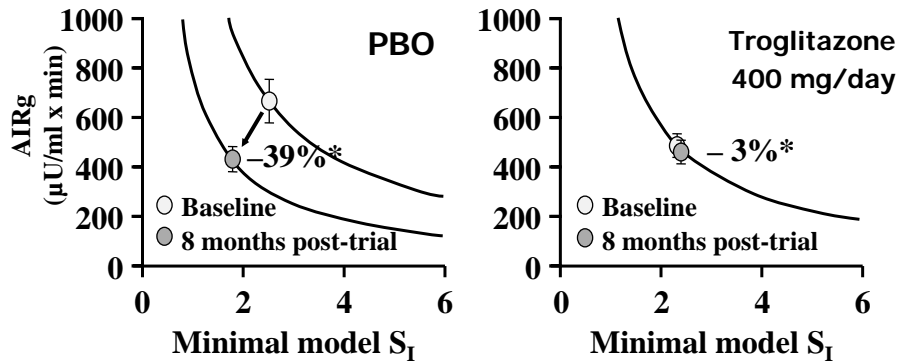
## UKPDS: $\beta$ -Cell Function For The Patients Remaining On Diet For 6 Years



UKPDS Group. *Diabetes*. 1995; 44:1249.

## TZDs have the potential to preserve $\beta$ -cell function

TRIPOD study



Female subjects at high risk of type 2 diabetes

Acute insulin response to glucose (AIRg) calculated from intravenous glucose tolerance test.

\*  $P = 0.01$  between groups

PBO  $n = 40$ , TRO  $n = 44$

Buchanan TA, et al. *Diabetes* 2002; 51:2796–2803.

## Can progression from IGT to T2DM be prevented

- Yes over a finite period of time
- Lifestyle, ?TZD more effective than metformin, acarbose, xenical
- Significant heterogeneity in response
- TZDs, FDPS no decline in insulin secretion over time
- FDPS, TRIPOD look like true prevention

## Tablets vs Lifestyle

- Cost and supply
  - (DPP MF \$2542, LS \$2780)
- Children? Intra-uterine effects of any medication
- Treating side effects
- Adherence
  - Hypertension: 50%

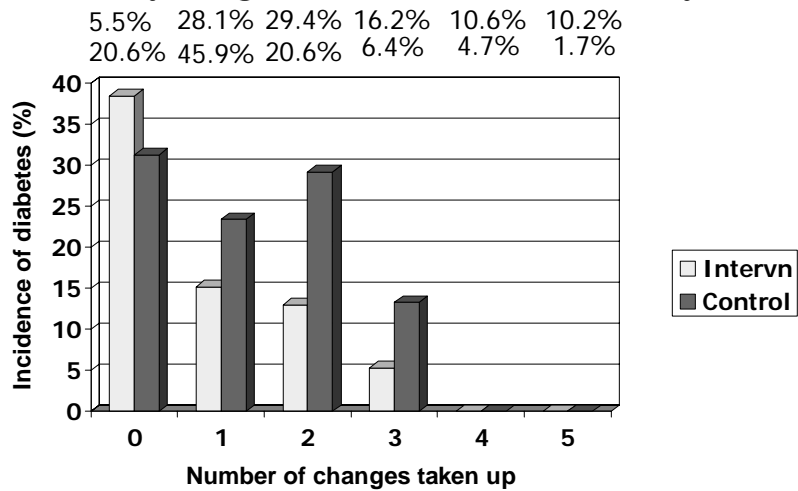
## Adverse Events (rates per 100 person years)

	<u>Placebo</u>	<u>Metformin</u>	<u>Lifestyle</u>
Death	0.16	0.20	0.10
Hospitalization	7.9	8.4	8.0
GI Symptoms	30.7	77.8 *	12.9*
Musculoskeletal Symptoms	21.1	20.0	24.1*

\* significantly different from placebo

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

## Incidence of diabetes by number of lifestyle goals achieved at 1yr

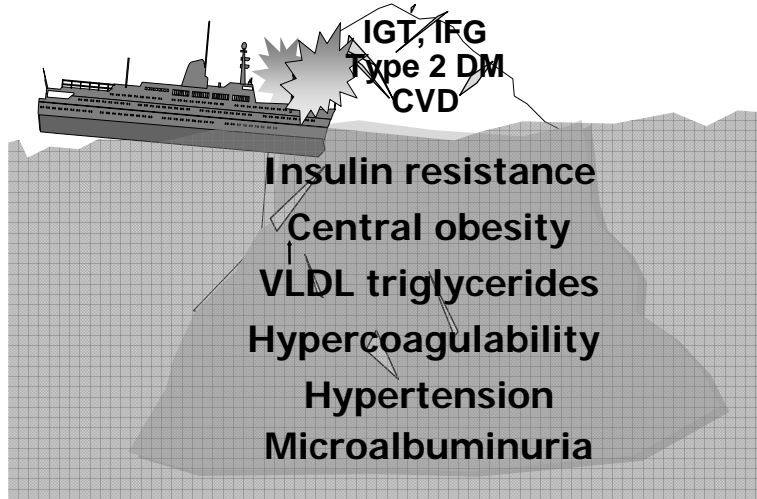


FDPS. N Engl J Med 2001;344:1343-1350

## Tablets vs Lifestyle

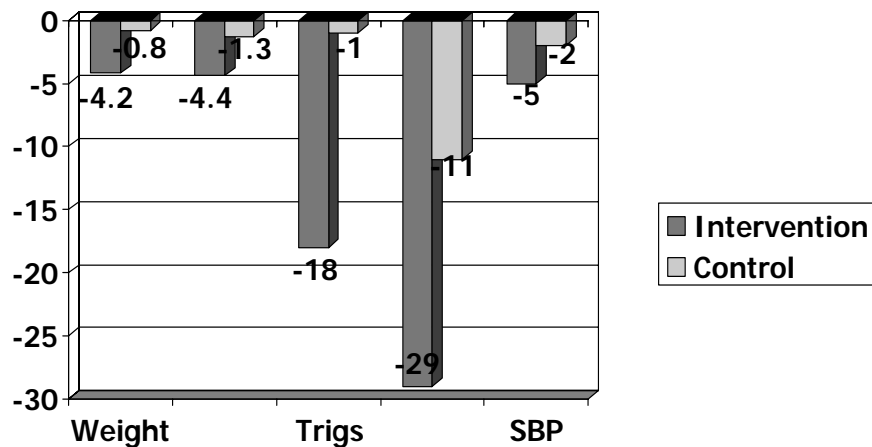
- Cost and supply
- Treating side effects
- Children? Intra-uterine effects of any medication
- Adherence
- Lack of collateral "health" benefits

## The Metabolic Syndrome



*Adapted from slide courtesy of Professor Paul Zimmet*

## Finnish Diabetes Prevention Study: 58% reduction in diabetes in those with IGT



Tuomilehto N Engl J Med 2001; 344:1343-50

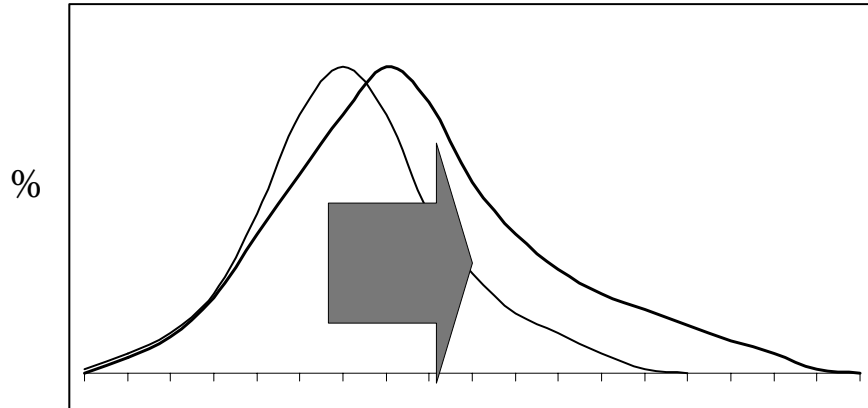
## DPP: Metabolic syndrome effects

(Y3 effects)	Placebo	Metformin	Lifestyle
Blood Pressure	-0.6/-1.9	-0.3*/-1.6*	-3.3*/3.8*
Triglyceride	-0.1	-0.1	-0.3*
HDL	-0.00	+0.01	+0.03*
AntiHT Rx	31%	32%	17%*
Antilipid Rx	16%	16%	12%

Diab Care 2005;28:888-894

High risk or  
whole population?

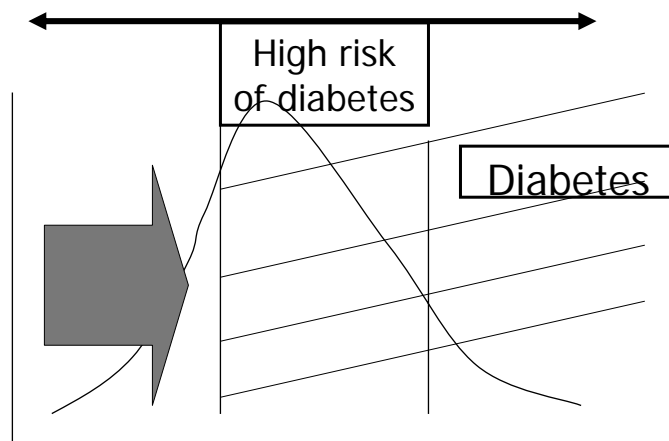
## Secular trends



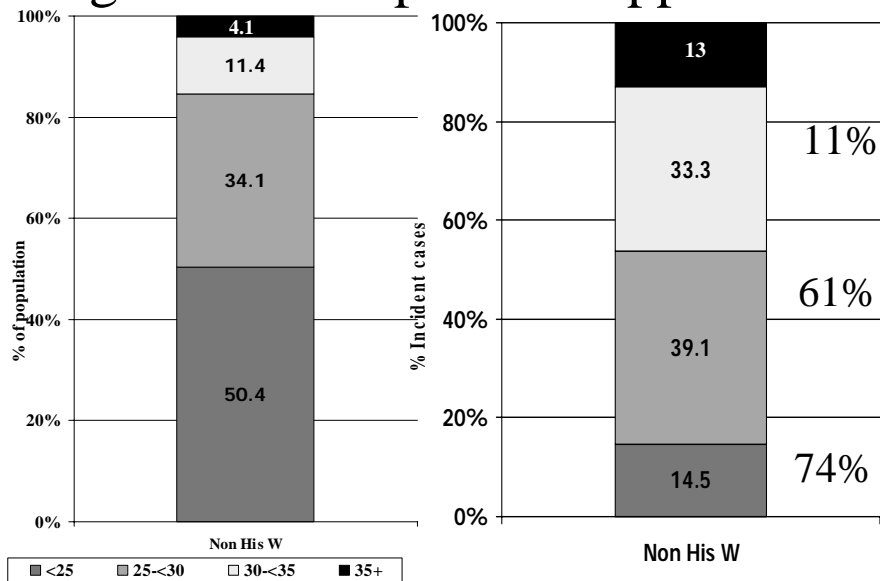
Obesity, Physical inactivity, Unhealthy lifestyles

(Excuse my free hand illustration - BMI was never normally distributed - has always had skewed tail out to right  
Over time the mean or median BMI has increased and the right tail has increased at an even greater rate increasing the skew)

## High risk vs community approach



## High risk vs Population approach



## Effectiveness of ecological approaches for increasing physical activity

### Informational approaches:

- Point-of decision prompts to use the stairs
  - 6 reports: 6-129% ↑ use; Shopping malls, stations, library
  - Barriers-difficulty in finding, some locked, some unsafe
- Community wide campaigns-highly visible, broad based,+other
  - 10 reports: 4.2% ↑ active people; 16.3% ↑ energy expenditure
  - Net decrease in weight=0.6%
  - Barriers=expertise, coordination, community buy-in, resources
- Mass media alone, School Classroom based health education-insufficient evidence

Kahn et al. Am J Prev Med 2002;22(4S):73-107

## Effectiveness of ecological approaches for increasing physical activity

### Individually adapted health behaviour change

- Tailored to persons readiness to change, specific interests and preferences->specific behavioural skills
- Goal setting, self monitoring, social support, rewards, problem solving skills, relapse prevention
- 20 studies-workplaces, community settings, schools/universities
  - 35.4% ↑ in physical activity
  - 6.3% ↑ VO2max; 64.3% ↑ energy expenditure
  - -3.9% ↓ body weight; 4.1% ↓ body fat

Kahn et al. Am J Prev Med 2002;22(4S):73-107

## Okanagan Diabetes Project

- Objective: to reduce weight, increase activity
  - Initiated by community and run by the community
  - Intervention community (475) vs 2 control communities (212,238)
- 24 months-assessments at 0, 8 and 24 months
- Intervention-changing behaviours & environments
  - Precede-Proceed model->change process
  - Social Learning Theory->foundation for intervention prog
  - Concepts also used from Theory of Reasoned Action, Health Belief model, community change models

Daniel et al. Soc Sci Med 1999;48:815-832

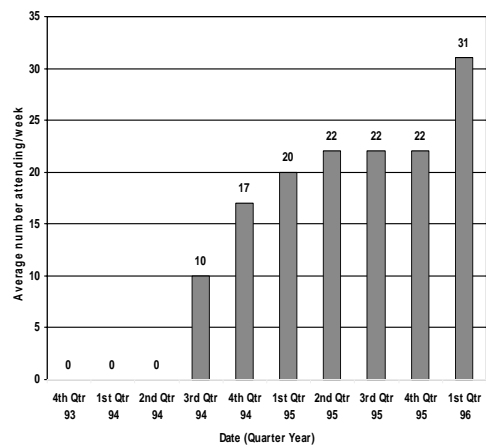
## Okanagan Diabetes Project

• Cohort	p	0	8	End
– BMI-intervention	.017	30.8	31.0	30.4
– BMI-control		27.5	27.8	28.6
• Cross sectional				
– Activity-I (% 1+d/wk)	.018	52.1		79.2
– Activity-Control		48.0		49.3

Daniel et al. Soc Sci Med 1999;48:815-832

## Evaluation of SADP church programme

- Introductory talk 93%
- Results session 95%
- Diabetes aware 98%
- Lifestyle advice 96%
- Video session 18%
- Cooking session 38%
- Exercise 84%



## Evaluation of church programme

- **Intensive vs control**

T=0

- n=78 vs 144
- 1st ass-86% vs 80%
- 2nd ass 96% vs 99%
- Screen 75% vs 79%
- OGTT 67% vs 15%

- (Diabetic Medicine

- **Intensive vs control**

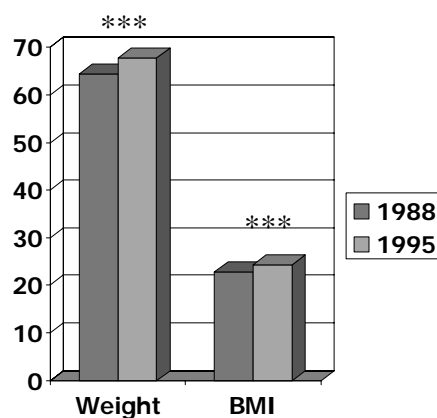
T=2y

- Weight  $\Delta$ : 0 vs 3.1 kg
- Waist  $\Delta$ : -4 vs +2 cm
- Knowl  $\Delta$ : +46 vs +4%
- Activity $\Delta$ : +22 vs -8%
- Fat intake $\Delta$ : -14 vs +3%

- 1998; 15: 136-142)

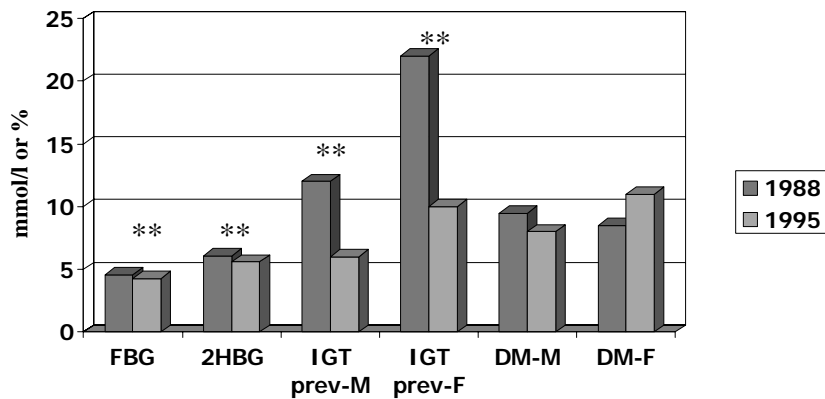
## Central Australian intervention

- 189 men, 248 women (1988); 184 men, 240 women (1995)
- Education: traditional foods, physical activity
- Feedback on screening to individuals and to communities
- Health Educator placed



Rowley. Diab Care 2000;23:898-904

## Changes in Glucose tolerance



Rowley. Diab Care 2000;23:898-904

## Te Wai o Rona: Diabetes Prevention Strategy

- Aims to reduce the incidence of Type 2 diabetes by 35% through increased activity, reduced calorie consumption and increased fibre intake
- 4 year strategy with lead into wide-scale implementation when successful-cluster RCT
- All adult Maori aged 28+years in Waikato and southern Lakeland invited-28,000 invited, 5,000 target (4,500)
- Intervention includes:
  - Community based co-ordination
  - Group activities
  - Community improvements in access to activity and healthy food
  - Regular personal counseling by Maori Community health workers supported by other services
  - Support tools

## Summary

- Lifestyle more effective than all medications except TZDs
- Lifestyle more collateral benefits and less side effects
- Personal trainer approach to lifestyle not cheap
- High risk approach will not prevent people becoming high risk ie the epidemic will continue
- Preventing the normal weight from becoming overweight and the overweight becoming obese would reverse the epidemic
- Can whole populations changes be effected? At what cost?