

DIABETES PREVENTION AND TUBERCULOSIS







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THE NATURE OF THE PROBLEM

A continuum of metabolic impairment

Types	Stages	Hyperglycemia		
	Normoglycemia	Impaired Glucose Tolerance or Impaired Fasting Glucose (Pre-Diabetes)	Diabetes Mellitus	
Normal glucose regulation	Not insulin requiring		Insulin requiring for control	Insulin requiring for survival
Type 1*				
Type 2				
Other Specific Types**				
Gestational Diabetes **				



Increasing risk of complications

THE SIZE OF THE PROBLEM

Ratio of **diabetes** to **AIDS**

Globally **14:1**

In US **22:1**

THE ISSUE IS NUMBERS AND EXPOSURE

- The threat of diabetes to tuberculosis control is much higher than that of AIDS
- This is because of the sheer number of people with diabetes far outstrips those with AIDS

The Population Attributable Fractions (PAF)* globally are:

Diabetes **14.4%**

AIDS **6.4%**

WE NEED SOME IDEAS AND SOME DATA.....??????.....

CDC Diabetes Prevention Program (DPP)

- **Lifestyle change program with coaching in person or on line over 12 months, 6 months intense program followed by 6 months reinforcement.**
- **Evaluation of participants progress**

Early Results of DPP

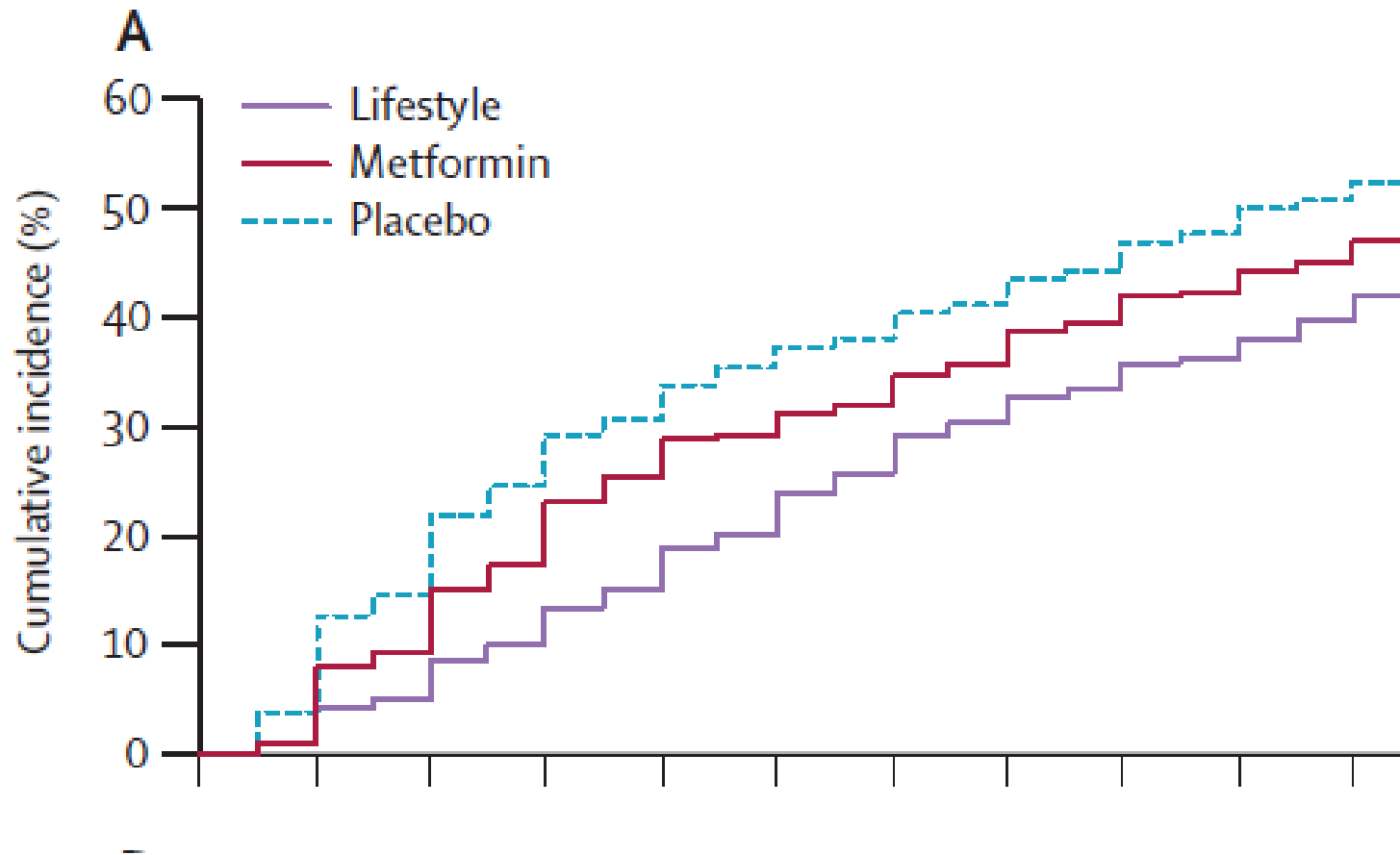
Randomized Trial of 3,800 subjects with impaired glucose tolerance :

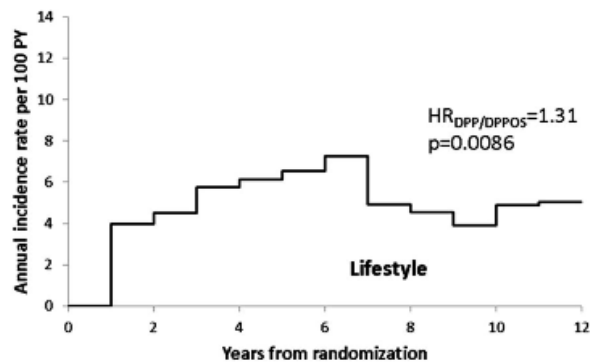
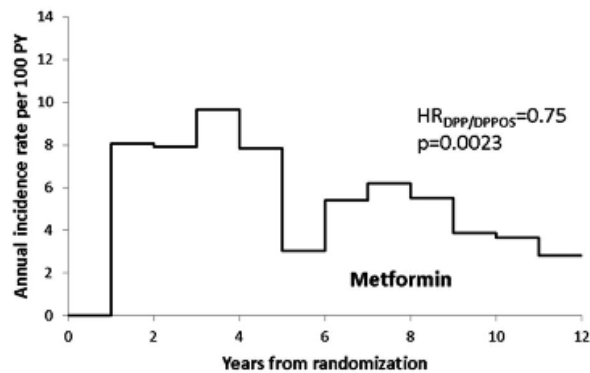
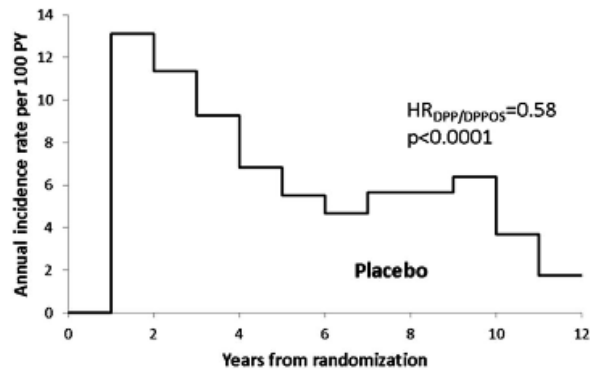
- **Intensive lifestyle adjustments 31% reduction**
- **Standard lifestyle adjustment plus:**
 - ❖ **Placebo or**
 - ❖ **Metformin 58% reduction**

Study terminated after a mean of 2.8 years follow up 1996-1999 because of clear benefits of lifestyle and metformin.

**Diabetes prevention Program Outcomes Study
10 year outcomes 1996-2006
Diabetes Prevention Program, Lancet, 2009**

Conclusion: Prevention or delay of diabetes can persist for 10 years





DPPOS Long term follow up (1996-2008)

End points, annual incidence of diabetes.

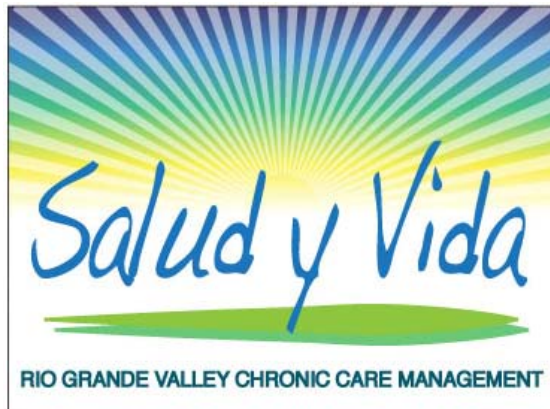
Conclusions

- No evidence that effective intervention led to decline in rates of diabetes
- Support for 'exhaustion of susceptibles' hypothesis
- Weight loss was effective in lowering rates
- Long term effects though significant were reduced over time.

Hamman RF et al. Diabetes 2015 64:3:989-998

WE NEED TAILORED INTERVENTION STUDIES

Implemented diabetes treatment and control services

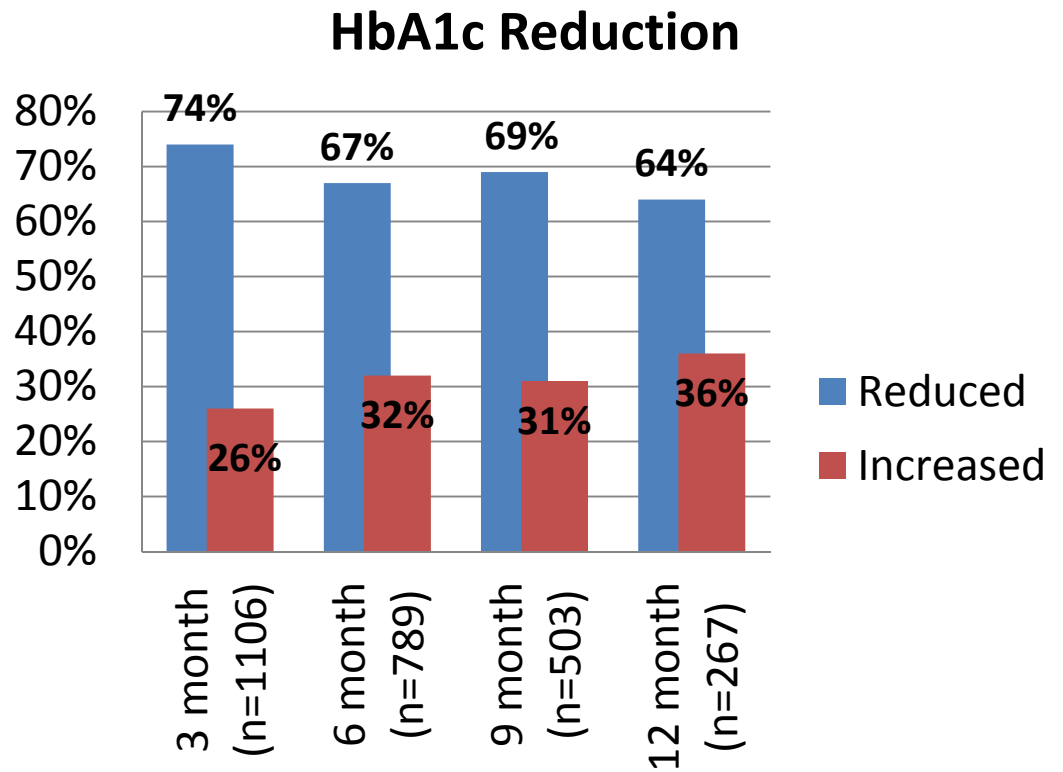
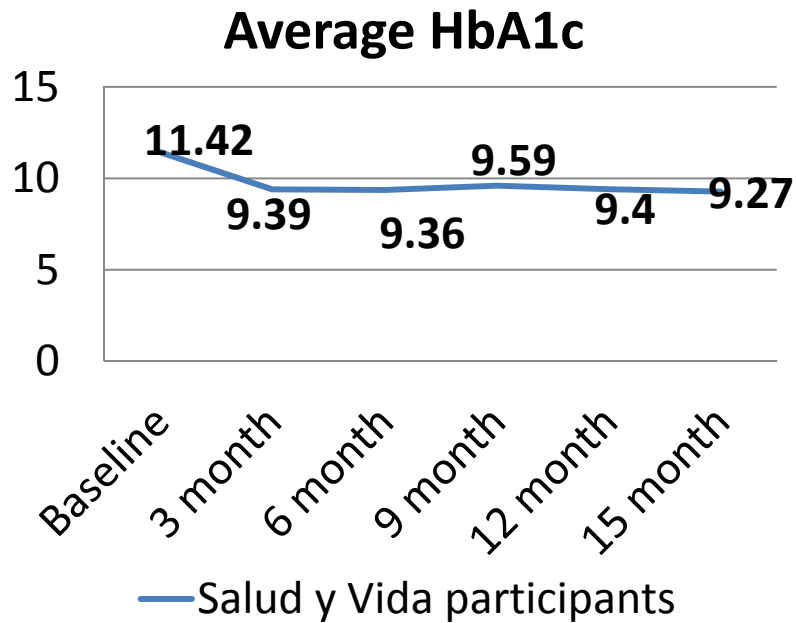


- Evidence based Wagner CCM model
- Regional partnerships for implementation
- Diabetes management program funded by 1115 waiver
- Served over 2500 clients
- Free DSME education
- CHW home visits
- Case management review
- Re-engagement with medical home
- Referrals and services for behavioral health
- Results show average A1c decreasing



HbA1C Metrics post intervention

B. Reiningger and J McCormick

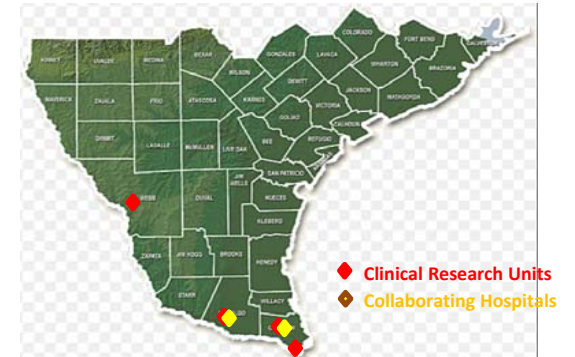


Another approach: data

CAMERON COUNTY HISPANIC COHORT

N=5000

'Framingham-like' cohort of Mexican Americans
Community-based population
Recruited from randomly selected households

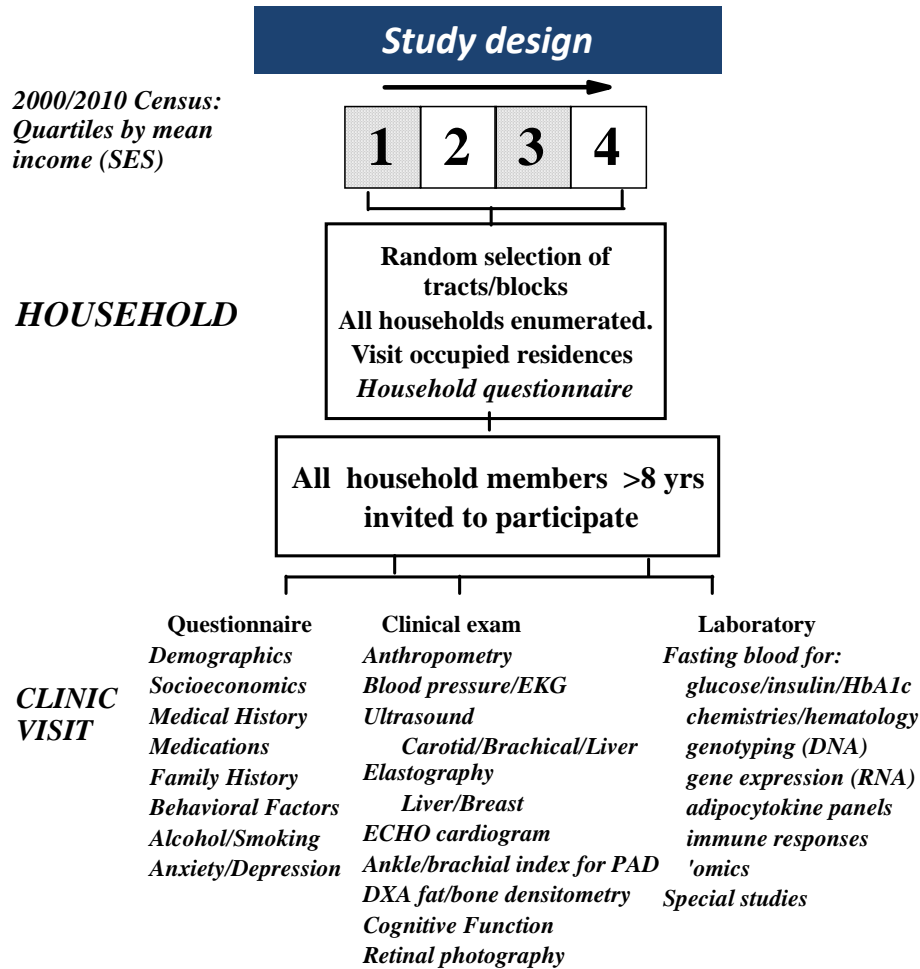


census block unit in a specific census tract) mapped and

Cameron County Hispanic Cohort (CCHC)

A 'Framingham-like' cohort

N=4000



- Current activity**
- Extensive phenotyping
 - Ongoing recruitment
 - Pediatric cohort 5/10 year follow up
 - Diabetes Risk Study
 - Cardiovascular disease
 - Liver disease
 - Cancers (liver/cervical/breast)
 - Mental Health
 - Intervention studies
 - Genetics
 - Immunology
 - Imaging
 - Clinical trials
 - Economics

Now expanded to
Harlingen and Laredo
Clinical Research Units
with plans for Hidalgo

Prevalence of Chronic Disease Conditions Cameron County Hispanic Cohort

Chronic Condition	Numbers with condition	Weighted Prevalence	Proportion undiagnosed
Diabetes	795	27.6%	43.3%
Prediabetes	889	32.0%	
Hypertension	858	31.0%	14.9%
Hypercholesterolemia	1313	50.1%	44.7%
Proportion with 1 or more condition	1815	68.3%	
Hepatitis C antibody		2.3%	100%
Advanced fibrosis		3.54%	100%
Cirrhosis		0.94%	100%

Fisher-Hoch, Vatcheva, Hanis, McCormick et al 2012 PCD

Fisher-Hoch, Vatcheva, Rahbar, McCormick 2015, PlosOne

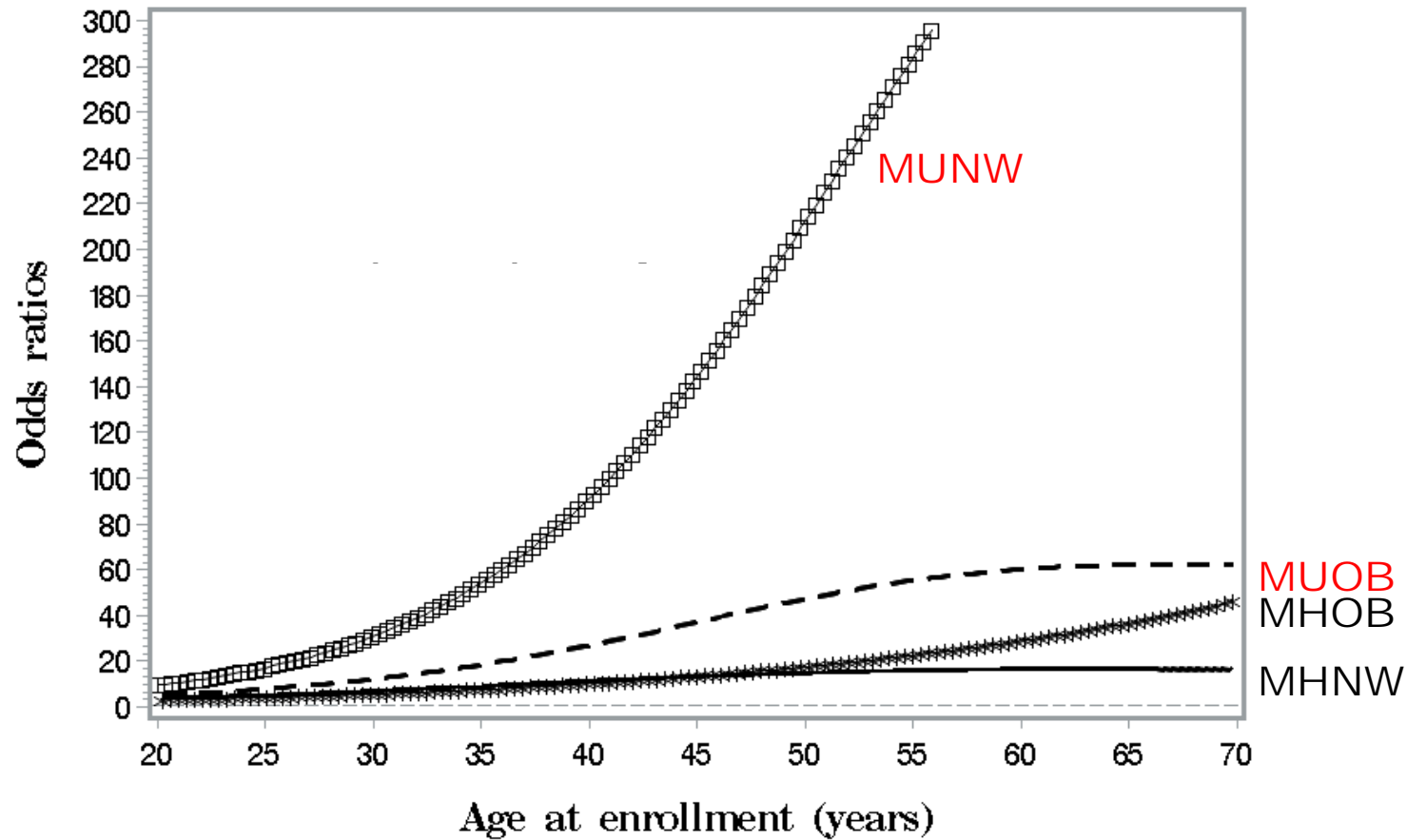
Jiao, Beretta, Fisher-Hoch, McCormick, Fallon et al, 2016 Plos One

INTERVENTIONS NEED TO BE ETHNICITY AND GENETICALLY SPECIFIC

Thanikachalam et al. PURSE-HIS cohort: n=8000
Cohort of South Indians from Chennai

Fisher-Hoch et al. Cameron County Hispanic Cohort (CCHC) n=4000
Cohort of Mexican Americans from South Texas

	CCHC	PURSE-HIS	p-value
Diabetes prevalence	27.3%	27.3%	0.992
	<i>Means</i>	<i>Means</i>	
BMI (kg/m ²)	31.0	24.7	<0.0001
Waist circumference (cm)	101.9	83.3	<0.0001
Blood glucose (mg/dl)	111.1	107.7	<0.0001
Insulin (mg/dl)	12.1	7.0	<0.0001
HOMA-IR	3.1	1.8	<0.0001
Triglycerides (mg/dl)	162.7	133.6	<0.0001
HDL (mg/dl)	47.2	32.6	<0.0001
LDL (mg/dl)	109.0	115.5	<0.0001
AST	33.4	24.3	<0.0001



MUNW Metabolically unhealthy normal weight

MUOB Metabolically unhealthy overweight/obese

MUNW Metabolically unhealthy normal weight

MUOB Metabolically healthy overweight/obese

Odds ratio for developing diabetes: Cameron County Hispanic Cohort
Wu et al. 2015

What ideas do we have

- Educate Health Care Personnel in Diabetes and other Clinics
- **Empower** Diabetes Patients: help them understand their risk
- TB patients may have relatives with diabetes!!!! Particularly those with diabetes. Diabetes runs in families.
- **Community Engagement**
 - **Inform communities, get their trust and then partner with them**
 - **Get them to do much of the work – v cost effective!!**
 - **Use this approach to address the vast pool of undiagnosed diabetes**
- Engage the media. Create stories and get them to work with you.
- Use modern social media to communicate messages.
- Address the issues of low nutrient high calorie foods

What do we need

- Prevention is easier than control, so start with pre-diabetes
- Understanding of key biology of diabetes in different ethnic groups
- Understanding of key socioeconomic and cultural drivers in different communities.
- Intervention methods tailored to these needs
- Novel approaches, imaginative new ideas, new tools
- Well designed evaluation of prevention approaches
- Involvement of the patient and larger community in these efforts

IF YOU THINK TB CONTROL IS DIFFICULT...

TRY DIABETES