Kidney Disease and Diabetes
What matters – Place or Race?

THE WESTERN DESERT KIDNEY HEALTH PROJECT
Western Desert Kidney Health Project

- Mulga Queen
- Leonora
- Menzies
- Kurrawang
- Coolgardie
- Kalgoorlie
- Coonana
- Norseman
- Laverton
- Mount Margaret
- Tjuntjuntjara
- Perth
The aims of the WDKHP were

To review community strategies to reduce the prevalence of T2DM and kidney disease, using a community arts for community development model.

To determine the prevalence of type 2 diabetes (T2DM), kidney disease and the risk factors for these diseases in a remote area of Western Australia

To compare with prevalence rates for non-Aboriginal adults and children living in the same locations

To compare those prevalence rates with national rates
To determine the age at which the risk factors are appearing
National Comparisons from:

Australian Bureau of Statistics. Australian Aboriginal and Torres Strait Islander people Health Survey First results, Australia, 2012-13.

Australian Bureau of Statistics. 4727.0.55.003 - Australian Aboriginal and Torres Strait Islander Health Survey: Biomedical Results, 2012-13 2014 11:30 AM (CANBERRA TIME) 10/09/2014 First Issue

Haysom, L., et al., Natural history of chronic kidney disease in Australian Indigenous and non-Indigenous children:
A 4-year population-based follow-up study.

There was no significant difference in BMI for the children or for men.
All adults had higher rates of known diabetes than the standard population. This was particularly so for Aboriginal adults who also had higher rates of newly diagnosed diabetes.
All adults had higher rates of hypertension than the standard population.
WDKHP Haematuria - Initial Health Assessment

Women

Men

National

Children

Aboriginal women

Non Aboriginal women

Aboriginal men

Non Aboriginal men

Aboriginal Adults

Non Aboriginal Adults

Aboriginal Children

Non Aboriginal children

National Children

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Negative Trace Small Large

National figures combine “Small” and “Large”
Aboriginal men and women had high ACR similar to national figures but the non Aboriginal participants also had higher rates than the standard population. There were no significant differences for children.
There was no difference between Aboriginal and non-Aboriginal children for the risk factors for kidney disease and diabetes.

The difference between Aboriginal and non-Aboriginal adults was much less than expected.

There was NO significant difference between people living in towns compared to those living in remote communities.
Urine pH

- In the towns and communities in the WDKHP between 60% and 84% of people had urine pH of 6 or lower on dipstick testing, suggesting a renal response to metabolic acidosis.

- This testing occurred over a very large geographical area, during winter and summer, in towns as well as remote communities.

- There was no difference between Aboriginal and non-Aboriginal people.
What causes low urine pH

Acid Load

- Not enough Vegetables
- Acidic Foods
  - Preserved foods
  - Proteins
  - Soft Drinks
  - Fruit Juices
- Nitrates
  - Water
  - Food
- Water pH <8

Diabetes

Stress

Diet
  - High sugar and Carbohydrates

Illness and Infections

Buffers exhausted

Relative Metabolic acidosis

Low Urine pH

Gut Bacteria
  - Lactose Intolerance
  - ??Helicobacter Ammonia Producing
Why does it matter?

• Metabolic acidosis results in depletion of potassium. Systemic potassium depletion increases insulin secretion.

• Metabolic acidosis also contributes to insulin resistance independent of the effect on potassium.

Effects of acid load

Relative Metabolic Acidosis
- Urine pH Falls
  - Acidosis inhibits protein synthesis and increases insulin like growth factor contributing to insulin resistance

Shortened Mitochondrial Life
- Fall in Buffers
  - Falling K+
  - Increased Insulin secretion
    - Type 2 Diabetes
    - Increased Cancer Risk
    - Shortened Renal Cell life

Shortened cell life
- Accelerated Aging

Renal Failure
### Table 10: Health related variables

<table>
<thead>
<tr>
<th>Locality</th>
<th>Samples Taken</th>
<th>Concentration (mg/L)</th>
<th>Nitrate</th>
<th>Guideline Met</th>
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</table>

(1) No samples were required in this 12 month period. (2) Samples has been granted an exemption from compliance with the nitrate guideline by the Department of Health. The water supplied is safe for adults and children over the age of 3 months. Cansers of infants younger than 3 months should seek advice from the Community Health Nurse regarding the use of alternative water sources for the preparation of bottle feeds. The Water Corporation provides bottled water free of charge for this purpose.
Figure 5: Nitrate test results for communities with unsafe levels in drinking water 2013-14

Source: OAG analysis, data from Housing
Nitrates

Blood

Methaemoglobinaemia

Protein and Heat or Acid

Nitrosamines

Group 1 Carcinogen

Uranium

Uranyl Nitrate

Renal Damage
Uranium

- Is carcinogenic
- Can cause kidney inflammation.
- Leaches naturally from soils, rocks and natural deposits
- Also released through mining processes.

- In the last two years, three communities have exceeded the safe limit of 0.017 mg/L about half the time, while Tjuntjuntjara in the Goldfields failed 18 out of 22 tests. Some of these results were up to double the safe level.
The incidence of end stage kidney disease among Indigenous Australians is highest in the remote regions of Tennant Creek, Aputula and Jabiru in the Northern Territory, Warburton and Kalgoorlie in Western Australia, and Ceduna in South Australia.

So ....

- Acidic urine suggests chronic metabolic acidosis which can contribute to shortened mitochondrial life so shortening cell life - in kidneys especially, but also generally

- Haematuria suggests there is inflammation of the urinary tract (kidneys, ureter and bladder)

- Chronic ingestion of nitrate and ammonia may be a cause of metabolic acidosis

- Ammonia and nitrate and can contribute to the development of insulin resistance, type 2 diabetes, thyroid disease, cancer, adverse birth outcomes and are generally not good

- Nitrate in the water makes uranium, arsenic and other heavy metals in rock more soluble

- Where there are high nitrate levels Uranyl Nitrate will form. This is very toxic to kidneys
Are our remote towns and communities experiencing a “Perfect Storm”?  

Water

Processed foods

“Fresh” Meats

Nitrates

Heat, acid, protein

Nitrosamines

Cancer

? Thyroid Disease
? Thyroid Cancer

? Birth Defects

Methaemoglobinaemia
“Blue Baby Syndrome”

Kidney Disease

Type 2 Diabetes
Fatty Liver
Alzheimer’s disease
Hypertension
Cardiovascular disease

Arsenic
Nickel
Chromium

Uranium

? Microbiome