



# Micronutrients and Chronic Kidney Disease

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Based on talk to ADHB staff October 2015



# Outline



- ▣ Chronic Kidney Disease (CKD) case and dialysis case
- ▣ Background information on micronutrients and CKD
- ▣ Evidence and recommendations for vitamin supplementation in CKD
- ▣ Clinicians Renal Vit manufacture, funding and implementation



# Case 1



## Relevant history

- 45 year old male
- Polycystic KD Stage 4 CKD
- NZ for 4½
- IT business
- lives on own
- mother giving diet advice
- works at night – best ideas

## Anthropometry

Wt 75 kg (usual wt) Ht 190 cm BMI 21

## Biochemistry

July 2015 eGFR 28 (Jan 2015 eGFR 15)

Most nutrition related bloods within acceptable limits

## Nutrition focussed physical findings

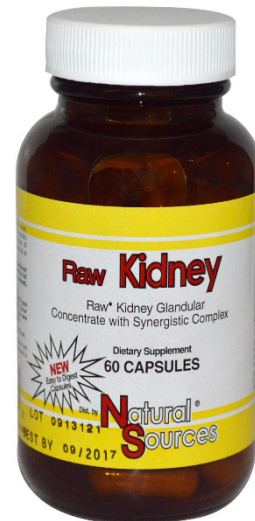
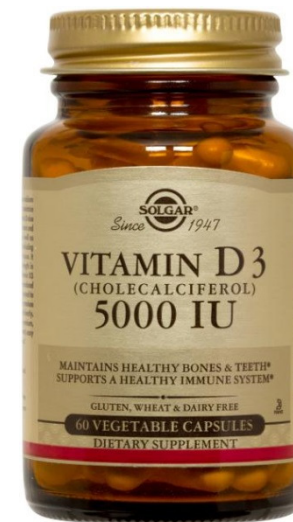
- low muscle mass
- low fat stores
- GI disturbances - lactose intolerance
- appetite good

## Food and nutrition related findings

- Erratic meal pattern
- Eats takeouts
- Rarely cooks
- Snacks on corn chips / nuts
- **Takes excessive OTC supplements**



# Taking these supplements



Daily Intake	Excessive, above RDI	
Vitamin A	3,450 $\mu$ g RE	5x
Vitamin C	1,100 mg	24x
Vitamin E	422 $\alpha$ TE	42x
Vitamin D Rec CKD	1,000 IU	6x
B vitamins range from		50 – 80x
Minerals Cu / Zn / Se above RDI		
Additional Ca, Mn, Mg, K, V, Cr and herbs		



# Case 2



## Relevant history

- 73 year old Tongan lady
- ESKD ,diabetic nephropathy
- haemodialysis 5yrs, 3x week, 4 hrs
- AV Fistula , adequate dialysis
- lives with daughter - main carer
- minimal English

## Anthropometry

Wt 102 kg (stable wt) BMI 39

## Biochemistry

K<sup>+</sup> 4.4mmol /l , Albumin 33mmol/l , PO<sub>4</sub> 1.66mmol/l  
Most nutrition related bloods within acceptable limits

## Nutrition focussed physical findings

- reduced muscle mass upper body and lower limb (thigh and calf)
- says appetite is “good”

**Physical activity** : Inactive , wheelchair



## Case 2



### Food and nutrition related findings

- Variable intake
- Convenience foods
  - nuggets/ toast and cheese/biscuits
- Main meal
  - few veg, likes potato and carrots
  - Likes roast chicken , fish, prefers sandwiches
- Doesn't like fruit
- Snacks if hungry
- Given Folic acid 5mg , Mvite after dialysis (3x/week)

### Estimated intake /requirements:

Mostly meets energy needs  
Protein intake inadequate on some days  
of the week

### Nutrition problem:

**Unbalanced diet** – no fruit, few veg  
variable protein, inadequate some  
days (↓HBV)

**Is she meeting her micronutrient requirements?**



# Micronutrients and chronic kidney disease



- ▣ Required for:
  - food metabolism
  - energy production
  - cell growth
  - immune functions
- ▣ Kidney disease alters:
  - biochemistry
  - metabolism
  - nutritional requirements
- ▣ Deficiencies and abnormally high levels occur
- ▣ Altered status may impact morbidity and mortality if untreated
- ▣ Uraemic symptoms and deficiency symptoms similar – identification may be delayed
- ▣ Careful assessment and appropriate interventions



# Stages of vitamin deficiency



interruption in source

reduction in body storage

impairments in biochemical functioning

alteration in function/morphology

result: clinical manifestations\*

**\*Clinical manifestations target every organ**





# What affects vitamin status?



## Intake

- Appetite
- Anorexia , nausea
- Altered taste
- Diet restrictions

Vitamins	Units	Recommended dietary intake	Daily protein intake g/day		
			40	60	80
Vitamin B <sub>1</sub>	mg	1.1 – 1.2	0.6	1.0	1.1
Vitamin B <sub>2</sub>	mg	1.1 – 1.6	0.8	1.2	1.8
Vitamin B <sub>6</sub>	mg	1.3 – 1.7	1.0	1.2	1.5
Vitamin B <sub>7</sub> (Biotin)	mcg	25-30	13.4	17.8	15.8
Vitamin B <sub>9</sub> (Folic acid)	mcg	400	260	290	320
Vitamin B <sub>12</sub>	mcg	3	2.3	3.2	5.1
Vitamin C	mg	45	86	87	88

As protein intake decreases so does B vitamins

Descombes E, Hanck AB, Fellay G. Kidney Int. 1993 Jun;43(6):1319-28.



# What affects vitamin status in CKD ?



## Intake

- appetite
- anorexia
- altered taste
- diet restrictions

## Dialysis losses

- water soluble vitamins
- time (B-2, B-3 B-6, C)
- type filter: > losses high flux and PD (B-1, C)

## Uraemia

- may alter metabolic pathway
- folic acid absorption impaired in late stage disease

## Age, Sex

- elderly (B6)
- female (B-1, B-3, B-6)

## Residual renal function

- water soluble vitamins (B-6 , B-3)

## Medications:

- can interfere with absorption
- omeprazole (B-6), diuretics (B-6)

## Comorbidities

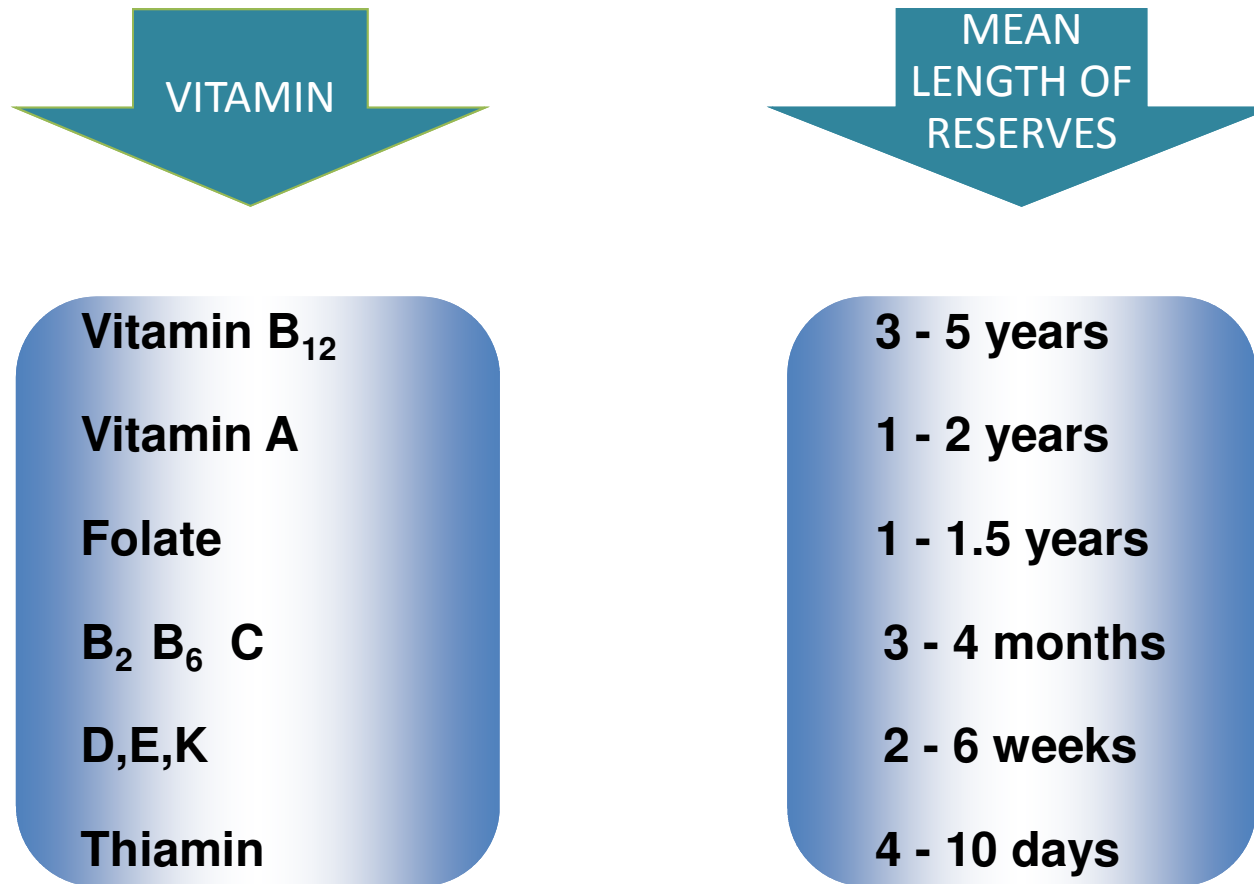
- diabetes

## Status body stores

- depends on intake in previous months or weeks



# Body reserves of various vitamins



Adapted from: Descombes ,Hanck , Fellay. Kidney Int. 1993 Jun;43(6):1319-28.  
Modern Nutrition in Health and Disease Text



# Micronutrient status – lab assay



- ▣ Limitations with laboratory assessment to determine micronutrient status
- ▣ Serum concentrations may be poor indicators of functional level , don't reflect body stores
- ▣ Unstable pattern in dialysis: serum levels high prior to dialysis, low after
- ▣ Individual monitoring expensive



## Analytical tests to assess status

TEST DESCRIPTION	External \$	Internal \$	Comment
Thiamin	63.26		Measurement of single vitamins is usually informative clinically since patients have multiple deficiencies
Vitamin B-2	88.55		
Vitamin B-6 Pyridoxine	75.90		
Vitamin B-12		5.23	Routine in most labs, approximation of biologically active B-12
RED CELL FOLATE		8.51	Best measure of folate status, additional cost over serum folate not usually justified
SERUM FOLATE		2.63	Routine in most labs, reasonable measure of folate status
Ascorbic Acid		36.82	Difficult to measure, rarely informative, no longer provided by Lab+
Vitamin Group (A & E)		16.42	Done occasionally (fat malabsorption)
Vitamin K	105.35		Very rarely tested, assessment of clotting status gives functional assessment
25 OH Vitamin D		14.87	Different assay methods used, difference of opinion re correct target concentrations
Zinc urine		15.00	
Zinc serum		15.00	Not a good nutritional marker as it is protein bound and levels can change widely in acute illness
Red Cell Selenium		18.04	Routine test, RBC Se avoids effect of acute illness on serum Se
Copper urine		24.33	Not a useful test of nutritional status
Copper serum		15.00	Influenced by acute phase response, limited usefulness

Thanks to Dr Steve Absalom Clinical Pathologist – ADHB August 2015



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# Determining micronutrient status- who is at risk?



## Look for 'red flags'

- anticipate clinically
- malnutrition
- eating disorders
- alcoholism

## Assessment of intake

- macronutrients
- food groups
- food sources
- dialysis day vs non-dialysis
- intake when unwell
- access to food
- cultural

## Physical findings

- SGA: muscle wasting..
- oral health :  
dentures, decay , sore  
mouth , taste
- integrity of : mouth,  
skin, eyes, hair, nails



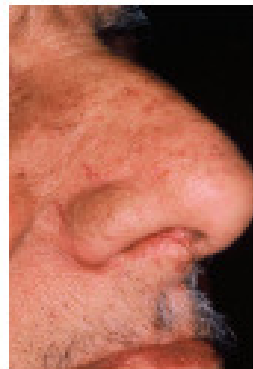
# Pyridoxine (B-6) deficiency



Hypertrophy of papilla - tongue



Tearing of eyes



Seborrheic – like dermatitis





# Zinc deficiency



▣ Hair loss



▣ Nail changes



▣ Skin lesions - glossitis



# Issues in addressing micronutrient recommendations

- ▣ Lack of data and knowledge in basic vitamin / trace mineral metabolism
- ▣ Limited evidence to support practice
- ▣ Few practice guidelines:
  - 2005 KDOQI-indicates routine supplementation for B-12, B-2, B-6 , folate
  - CARI- out of date
  - 2007 EBPG on Nutrition–specific micronutrients (NDT 2007)

There is evidence to support renal specific vitamin supplementation for dialysis patients – minimal risk

Regular multivitamin/mineral supplements (OTC) should be discouraged

# Evidence for supplementation



## Patient and Facility Associations Between Water-Soluble Vitamin Use and Relative Risk (RR) of Mortality and Hospitalization\*

Water Soluble Vitamin Use	RR	95% Confidence Interval	P-value
Patient level (water-soluble vitamins vs. no water-soluble vitamins) <sup>†</sup>	-	-	-
Mortality	0.84	0.76 – 0.94	<b>0.001</b>
Hospitalization	0.94	0.85 – 1.04	0.24
Facility level (per 10% patient use of water-soluble vitamins)	-	-	-
Mortality	0.98	0.95 – 1.00	<b>0.05</b>
Hospitalization	1.00	0.99 – 1.01	0.59

\*Adjusted for age, sex, race, comorbid conditions, albumin, time on end-stage renal disease, average facility dialysis dose (single-pool KtV), body mass index, average facility normalized protein catabolic rate, and average facility hemoglobin. Accounts for facility clustering. Stratified by country.



<sup>†</sup>Time-dependent Cox model; considers changes in multivitamin status over time in the study.  
Fissell RB et al. *Am J Kidney Dis* 44(2):293-299, 2004



## Recommendations for Vitamin Supplementation

Micronutrient		RDI Healthy Adult	Nephrotic Syndrome	CKD Stage 3 – 5 Non-Dialysis	HD / PD
Thiamin (B-1)	mg	1.1 – 1.2	Unknown	1.1 – 1.2	1.1 – 1.2 (RDI)
Riboflavin (B-2)	mg	1.1 – 1.3	1.1	Supplement if protein restricted	1.1 – 1.3 (RDI)
Niacin (equivalent)	mg	12 - 16	Unknown <sup>c</sup>	Up to RDI	14 – 16 (RDI)
Biotin	$\mu$ g	25 – 30 AI	Unknown <sup>c</sup>	Up to AI	30 (RDI)
Pantothenic Acid	mg	4 – 6 AI	Unknown <sup>c</sup>	Up to AI	5 (RDI)
Cobalamin (B-12)	$\mu$ g	2 – 2.4	2.4 RDI	2.4 RDI	2.4 (RDI)
Pyridoxine (B-6)	mg	1.1 – 1.7	5	5	10
Folate (DFE)	$\mu$ g	320 - 400	Unknown <sup>c</sup>	Up to RDI	1 mg
Ascorbic Acid	mg	45 (US 75 – 90)	75 - 90	30 - 60	75 - 90
Vitamin A (RE)	$\mu$ g	700 - 900	Up to RDI <sup>a</sup>	Up to RDI <sup>a</sup>	None <sup>b</sup>
Vitamin E ( $\alpha$ TE)	mg	7 – 10 AI	Up to AI <sup>a</sup>	Up to AI <sup>a, c</sup>	Up to AI
Vitamin K	$\mu$ g	60 – 70 AI	N/A	With antibiotics 10 mg/d	With antibiotics

**References:**

1. Nutrient Reference Values for Australia / New Zealand: Executive Summary NHMRC 2006
2. Kopple JD, Massry SG, Kalantar Zadeh K: Nutritional management of Renal Disease 3<sup>rd</sup> Edition, New York: Elsevier Academic Press; 2013
3. EBPG – Guideline on Nutrition: Dennis Fouque et al NDT Volume 22 Issue 2, 2007
4. Steiber AL, Kopple JD: Vitamin status and needs for people with Stages 3 – 5 Chronic Kidney Disease. J Renal Nutrition 2011; 21:355-368

<sup>a</sup> patients who are eating less than RDI

<sup>b</sup> recent Vitamin A and survival data question previous recommendations

<sup>c</sup> caution after analysis and extension of HOPE study

<sup>d</sup> insufficient data

AI = adequate intake  
RE = retinol equivalent  
TE =  $\alpha$  tocopherol



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Pantothenic Acid	mg	4 – 6 AI	Unknown <sup>c</sup>	Up to AI	5 RDI
Cobalamin (B-12)	μg	2 – 2.4	2.4 RDI	2.4 RDI	2.4 RDI
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Vitamin A (RE)	μg	700 - 900	Up to RDI <sup>a</sup>	Up to RDI <sup>a</sup>	None <sup>b</sup>
Vitamin E (αTE)	mg	7 – 10 AI	Up to AI <sup>a</sup>	Up to AI <sup>a, c</sup>	Up to AI
Vitamin K	μg	60 – 70 AI	N/A	With antibiotics 10 mg/d	With antibiotics

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TE = α tocopherol



# Vitamin B-6



- ▣ Recommendation: 5mg /d CKD, 10mg/d dialysis, Renal Vit contains 8.2 mg/capsule
- ▣ Kopple et al conducted diet and lab assessments CKD 3-5, ↓ B-6 consumed as GFR ↓, ↓ serum levels B-6 as GFR ↓
- ▣ Low body reserves: 3-4mths
- ▣ CKD losses: diuretics ↑ excretion , proteinuria
- ▣ Medications: ↑ needs omeprazole, thyroxine, penicillin
- ▣ Dialysis patients: high incidence deficiency , losses with extended hours, PD the PLP is bound to proteins → dialysate
- ▣ Linked to other nutrients : require sufficient riboflavin, niacin, Zn for B-6 metabolism

Corken & Porter Nephrol Sept 2011; Kopple et al KI 1981; Kalantar-Zadeh: Adv Renal Replace Ther 2003; Podda: Thromb Res 2007; Ross et al. KI 1989



# Folic acid



- ▣ Recommendation: CKD 400  $\mu\text{g}/\text{d}$ , Dialysis 1mg/d, Renal Vit contains 400  $\mu\text{g}$  /capsule
- ▣ Low intake in dialysis patients: food sources high K<sup>+</sup> (fresh green veg, liver, yeast), ↓ protein intake, NZ voluntary food fortification
- ▣ Low body reserves
- ▣ Dialysis: ↑ excretion (extended hours, high flux, losses PD)
- ▣ Altered metabolism in advanced stage CKD, impaired absorption THF, some medications inhibit absorption
- ▣ Since monitoring for the deficiency and giving regular folate – less hypo-responsiveness to EPO (folate routinely assessed in dialysis patients)

Johnson Nephrol August 2007; Drueke NDT 2001; Mydlik KI 1997; Chen J Nephrol 2013



# Vitamin C



- ▣ Recommendation: 30-60 mg/d CKD, 60-90mg/d dialysis (NZ RDI 45mg), Renal Vit contains 60mg/capsule
- ▣ Intake likely low – potassium restrictions (↓fruit and veg)
- ▣ Readily dialyzable -small, non-protein bound molecule
- ▣ Deficiency associated with decreased iron availability
- ▣ Consider deficiency in patients – if anaemia or fatigue is disproportionate, extended hours dialysis, poor diet pattern
- ▣ Deficiency prevalent in un-supplemented dialysis patients (plasma vitamin C associated with ↑CRP, ↓pre-albumin)
- ▣ Caution with high doses in oliguric patients – can ↑oxalate concentrations in plasma and possibly soft tissues (kidney stones)

Singer et al Nephrol 2008; Zhang BMC Nephrol 2011





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Biotin	$\mu$ g	25 – 30 AI	Unknown <sup>c</sup>	Up to AI	30 RDI
Pantothenic Acid	mg	4 – 6 AI	Unknown <sup>c</sup>	Up to AI	5 RDI
Cobalamin (B-12)	$\mu$ g	2 – 2.4	2.4 RDI	2.4 RDI	2.4 RDI
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# Minimising some vitamins



- ▣ Routine supplementation of fat soluble vitamins is not recommended
- ▣ Known to accumulate in uraemia
- ▣ Found in standard supplements and can build up in liver and cause toxicity
- ▣ **Vitamin E** occasionally recommended (antioxidant properties)
- ▣ **Vitamin K** deficiency can occur with long term antibiotic therapy
- ▣ **Vitamin A**
  - can accumulate, even small supplements can cause toxicity
  - may be supplemented in nephrotic syndrome (bound to protein excreted)

Nutrition Management of Renal Disease, Third edition, Editors : J Kopple, S Massry , K Kalantar-Zadeh



# Vitamin D



- ▣ High prevalence of deficiency/ insufficiency of 1,25(OH)<sub>2</sub>D (active D) and 25OH D (nutritional D) in CKD and dialysis
- ▣ Reduced activity of 1- α hydroxylase in kidneys – replace active D
- ▣ 1-α hydroxylase also extra-renal
- ▣ Nutritional D can be given safely with Active D
- ▣ Low vitamin D is associated - ↑ all cause mortality , CV mortality – supports correction of deficiency-improved survival is unproven
- ▣ Possible effects of Nutritional D supplementation: PTH suppression(RCT), reduction in albuminuria (RCT), reduction BP (RCT), progression KD(observ) , reduced risk infection(observ)

Horlick MN: New Eng J Med 2007 , Melamed & Thadhani : Vit D therapy in CKD & ESRD Clin J Am Soc Nephrol 2012  
Saab Nephron Clin Prac 2007, Tokmak et al NDT 2008, Pilz et al NDT 2011, Wolf et al KI 2007



# Trace minerals



- ▣ Trace minerals in body < 0.001% total body mass
  
- ▣ Physiological functions:
  - Oxygen binding and Fe transport (Fe)
  - Metabolic catalysis (Cu, Zn, Se)
  - Hormone effects (Se)
  
- ▣ Average blood concentrations of biologically important trace minerals are substantially different in dialysis patients than healthy controls



# Avoiding specific minerals



□ Potential risk for deficiency and excess – both harmful

	Probably accumulated in HD patients	May accumulate in HD Patients	Probably deficient in HD patients	Insufficient Information
Cadium	X			
Chromium	X			
Nickel	X			
Vanadium	X			
Copper		X		
Lead		X		
Manganese			X	
Selenium			X	
Zinc			X	
Antimony				X
Arsenic				X
Boron				X
Cobalt				X
Fluorine				X
Iodine				X
Mercury				X
Molybdenum				X
Tellurium				X
Thallium				X

Tonelli et al BMC Med 2009



# Zn, Se, Cu

Note how **plasma levels of Zn, Se Cu decline** with progression of CKD

**Table 2 . Comparisons of ADMA, FMD, Oxidative Marker, and Trace Element Levels in Patients With CKD According to GFR (mL/min)**

	Control (n = 30)	Stage 1 (>90) (n = 30)	Stage 2 (60-89) (n = 33)	Stage 3 (30-59) (n = 28)	Stage 4 (15-29) (n = 32)	Stage 5 (<15) (n = 36)	P
ADMA ( $\mu\text{mol/L}$ )	1.07 $\pm$ 0.15	1.44 $\pm$ 0.29	1.75 $\pm$ 0.37 $\dagger$	2.39 $\pm$ 0.69 $\dagger$	3.76 $\pm$ 1.30 $\dagger$	4.63 $\pm$ 1.33 $\dagger$	<0.001
<b>ECu</b> ( $\mu\text{g/mL}$ )	1.06 $\pm$ 0.14	0.90 $\pm$ 0.20 $\dagger$	0.61 $\pm$ 0.12 $\dagger$	0.46 $\pm$ 0.11 $\dagger$	0.36 $\pm$ 0.08 $\dagger$	0.24 $\pm$ 0.07 $\dagger$	<0.001
<b>EZn</b> ( $\mu\text{g/mL}$ )	22.02 $\pm$ 1.64	18.23 $\pm$ 1.28 $\dagger$	15.65 $\pm$ 1.10 $\dagger$	10.44 $\pm$ 1.09 $\dagger$	9.03 $\pm$ 1.09 $\dagger$	6.87 $\pm$ 1.44 $\dagger$	<0.001
<b>Se</b> (ng/mL)	71.29 $\pm$ 3.84	64.89 $\pm$ 4.89 $\dagger$	57.47 $\pm$ 5.38 $\dagger$	49.32 $\pm$ 5.11 $\dagger$	40.31 $\pm$ 5.00 $\dagger$	32.25 $\pm$ 4.23 $\dagger$	<0.001
FMD (%)	8.97 $\pm$ 1.36	8.26 $\pm$ 0.83 $\dagger$	7.23 $\pm$ 0.42 $\dagger$	6.71 $\pm$ 0.38 $\dagger$	5.97 $\pm$ 0.52 $\dagger$	4.75 $\pm$ 0.63 $\dagger$	<0.001

Yilmaz et al AKKD 2005

# Zinc, Copper



- ▣ **Recommendation Zn: RDI 8mg/day, Renal Vit contains 8 mg/capsule**
- ▣ Zn role - catalytic enzyme activity cofactor for antioxidant enzymes (with Cu and Se)
- ▣ **Zn deficiency:** EPO resistance, anxiety, depression, associated with delayed wound healing and immune deficiency
- ▣ Zn intake correlates with protein intake, NZ 2008 Nut survey– 39% males inadequate intakes
- ▣ Dialysis: low levels: reduced intake, ↓absorption and zinc →dialysate
- ▣ **96% anaemic dialysis** patients found to be Zn deficient- oral Zn improved anaemia and lowered EPO requirements<sup>24</sup>
- ▣ **Improved Zn status** is associated with alleviating oxidative stress, inflammation, dyslipidaemia and malnutrition in dialysis patients
- ▣ Cu deficiency can develop with excessive ingestion of Zn

Fukushima et al Apher Dial 2009; Chih-Hung Guo et al Nutrients 2013; Kasama Seminars in Dialysis vol 23 2010



# Selenium



- ▣ Recommendation Se : RDI 60-70  $\mu$ g Renal Vit contains 55  $\mu$ g
- ▣ Important for controlling oxidative stress, immune function and thyroid synthesis
- ▣ Se content plant foods is dependent on Se content of foods in which NZ low levels, prevalence in adequate Se intake in healthy adults
- ▣ CKD: Zachara et al. found whole blood and plasma concentration decreases in CKD compared to healthy controls . Yilmaz found selenium decreased and GFR decreased
- ▣ Dialysis : Se levels  $\downarrow$  MHD and correlate with nutrition status. Study of 1,040 MHD patients serum selenium levels were inversely associated with death risk
- ▣ Study MHD showed that 1 brazil nut per day corrected Se deficiency

Fukishma et al NDT 2011; Yilmaz et al AJKD 2015; Stockler-Pinto et al Nutrition 2009





# Why OTC supplements not suitable for CKD?

## Multivitamin & Mineral Boost also contains :

- Vitamin A (from retinol acetate) (75mcg) ,250IU
- Vitamin E (from d-alpha-tocopheryl acetate) 25mg
- Betaine (from betaine hydrochloride) 12.5mg
- Boron (from boron citrate) 250mcg
- Calcium (from calcium lactate) 25mg
- Choline (from choline bitartrate) 6.2mg
- Chromium (from chromium amino acid chelate) 25mcg
- Citric Acid 50mg
- Citrus Bioflavonoid Complex 50mg
- Co-enzyme Q10 1.2mg
- Inositol 6.2mg
- Iodine (from potassium iodide) 25mcg
- L-Glutamine 6.2mg
- Magnesium (from magnesium carbonate) 12.5mg
- Manganese (from manganese amino acid chelate) 0.5mg
- Molybdenum (from molybdenum amino acid chelate) 12.5mcg
- PABA (para amino benzoic acid) 3.7mg
- Potassium (from potassium citrate) 5mg
- **Total calcium 33mg per capsule.** No added: *gluten, yeast, artificial colours or preservatives.*

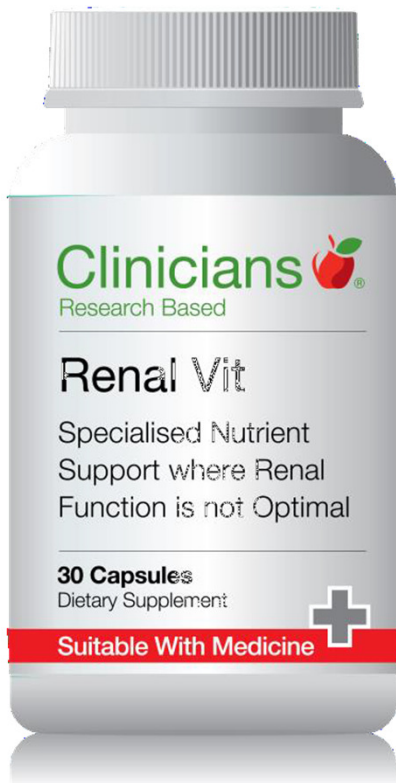
Contains some vitamins, minerals and compounds which in excess may cause harm in CKD



Contains inadequate B-3, B-6, Biotin and D-3



# Clinicians Renal Vit



- ▣ Formulated to provide essential water soluble vitamins and specific trace minerals in appropriate doses
- ▣ Developed in collaboration with New Zealand nephrologists and renal dietitian
- ▣ Convenient single daily tablet
- ▣ Omits or limits nutrients that could be harmful
- ▣ Unique – no other comparable product currently available in New Zealand
- ▣ Funded by Pharmac for Stage 5 CKD and on dialysis
- ▣ Available OTC for all stages CKD at low cost



# What is in Clinicians Renal Vit?



Clinicians RenalVit		CKD 3-5 not on dialysis	HD, PD
Active ingredients: (per gelatin capsule)			
Vitamin B-1 (thiamine)	1.5 mg	1.1 – 1.2 mg	1.1 – 1.2 mg RDI
Vitamin B-2 (riboflavin)	2.0 mg	If protein restricted	1.1 – 1.3 mg RDI
Vitamin B-3 (nicotinamide)	20 mg	Up to RDI	14 – 16 mg RDI
Vitamin B-5 (pantothenic acid)	5.0 mg	Up to AI	5 mg RDI
Vitamin B-6 (pyridoxine)	8.2 mg	5 mg	10 mg
Vitamin B-7 (biotin)	30 mcg	Up to RDI	30 mcg RDI
Vitamin B-9 (folic acid)	400 mcg	Up to RDI	1 mg
Vitamin B-12 (cyanocobalamin)	2.4 mcg	2.4 mcg RDI	2.4 mcg RDI
Vitamin C (ascorbic acid)	60 mg	30 – 60 mg	75 – 90 mg
Vitamin D (cholecalciferol)	25 mcg (1000 IU)	Supplement if deficient	Supplement if deficient
Copper (copper gluconate)	120 mcg	1.2 – 1.7 mg AI	1.2 – 1.7 mg AI
Iron (ferrous fumarate)	8 mg	5 – 8 mg RDI	5 – 8 mg RDI
Selenium (L-selenomethionine)	55 mcg	60 – 70 mcg RDI	60 – 70 mcg RDI
Zinc (zinc amino acid chelate)	6.4 mg	8 – 14 mg RDI	8 – 14 mg RDI
<b>Additional information:</b>			
Also contains:	Maltodextrin, magnesium stearate and silicon dioxide		
Contains no added:	Gluten, dairy, yeast, sugar, artificial colours, sweeteners, flavours or preservatives		
Adult Dose:	Take 1 capsule daily or as directed		



# Comparison with currently prescribed supplements?



Active ingredients: (per gelatin capsule)	Clinicians Renal Vit	Bplex	Mvite	CVite	Apo-folic	Cal.D.Forte
Vitamin B-1 (thiamine)	1.5 mg	5	1			
Vitamin B-2 (riboflavin)	2.0 mg	2	0.5			
Vitamin B-3 (nicotinamide)	20 mg	20	7.5			
Vitamin B-5 (pantothenic acid)	5.0 mg					
Vitamin B-6 (pyridoxine)	8.2 mg	2				
Vitamin B-7 (biotin)	30 mcg					
Vitamin B-9 (folic acid)	400mcg				800/5 mg	
Vitamin B-12 (cyanocobalamin)	2.4 mcg					
Vitamin C (ascorbic acid)	60 mg		15	100		
Vitamin D (cholecalciferol)	1000 IU		300			50,000 /mth
Copper (copper gluconate)	120 mcg					
Iron (ferrous fumarate)	8 mg					
Selenium (L-selenomethionine)	55 mcg					
Zinc (zinc amino acid chelate)	6.4 mg					
Vitamin A (retinyl acetate)			2500 IU			
<b>Additional information:</b>						
<b>Also contains:</b>	Maltodextrin, magnesium stearate and silicon dioxide					
<b>Contains no added:</b>	Gluten, dairy, yeast, sugar, artificial colours, sweeteners, flavours or preservatives					
<b>Adult Dose:</b>	Take 1 capsule daily or as directed					



# Clinicians Renal Vit development



Very similar formulations



ProRenal - developed in the USA by nephrologists and dietitian who are global leaders in renal nutrition

Distributed in Australia by Kidney Health Australia under name of KidneyVital

Renal Vit is manufactured in NZ by Clinicians in association with NZ nephrologists and dietitians and funded by PHARMAC



The team:

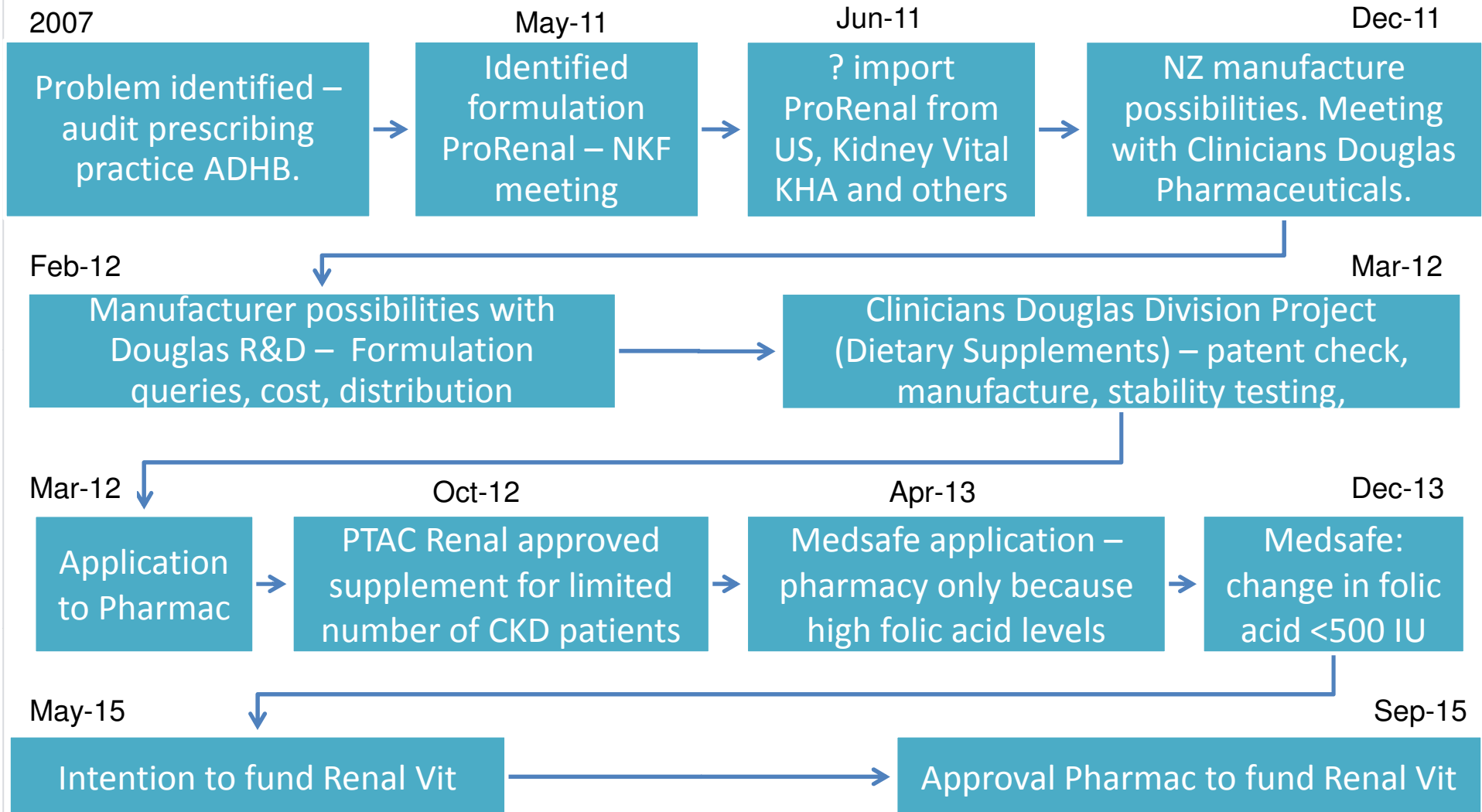
Prof Ian Simpson

Dr David Voss

Lyn Lloyd

Douglas Pharmaceuticals

# Clinicians Renal Vit development



# Pharmac funded: dietitians and physicians can prescribe



## Pharmaceutical Details

*Chemical/Brand Description:* Multivitamin renal - Cap <Clinicians Renal Vit>

*Special Authority Description:* Multivitamin renal

If you need assistance with your online application, please contact the Ministry Online Helpdesk on 0800 505 125.

## Criteria Details - Please enter relevant application criteria:

**FORM SA1546 - Application for subsidy**

**Initial application from any relevant practitioner**

Term: patient's lifetime

Application details:

- The patient has chronic kidney disease and is receiving either peritoneal dialysis or haemodialysis **or**
- The patient has chronic kidney disease grade 5, defined as patient with an estimated glomerular filtration rate of < 15 ml/min/1.73 m body surface area (BSA)



# Implementation



- ▣ **Micronutrient education pre-launch:** medical staff, pharmacists, nurses, technicians, dietitians, nephrology organisations (adks, KHNZ), Douglas Pharmaceuticals sales and medical staff
  
- ▣ **Patient education:**
  - high interest in taking supplements
  - lack of knowledge about risks of OTC supplements, herbals
  - lack of awareness about what is an appropriate micronutrient supplement
  - confusion about the 'umbrella term' vitamin D
  - recognition it is Medsafe approved
  - provided information 'handout' to all patients
  
- ▣ **Dietitian prescribing:** Clinicians Renal Vit is within dietitian scope of practice on list of what dietitians can prescribe
  
- ▣ **Nephrology is supportive of Clinicians Renal Vit:**
  - renal dietitians taken the lead for changing to Renal Vit in Renal Services
  - available OTC at low cost (\$17.50 or less on line )for those not funded





# The future



- ▣ Clinicians Renal Vit being a single tablet with renal specific formulation will help support the nutrient needs of people with CKD, particularly dialysis patients, in NZ
- ▣ Supplementation of micronutrients may improve their outcomes

