NUTRITION AND MENTAL HEALTH

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UNIVERSITY OF CALGARY

Alberta Children's HOSPITAL RESEARCH INSTITUTE FOR CHILD AND MATERNAL HEALTH

WHAT DO THESE SOUND LIKE?

- ✓ Depression
- ✓ Hysteria
- ✓ Irritability
- ✓ Self-mutilation
- ✓ Apathy, lethargy
- ✓ Social withdrawal
- ✓ Inability to concentrate

SIGNS OF SUBOPTIMAL NUTRITION

UNIVERSITY OF MINNESOTA
STARVATION EXPERIMENTS, 1950

6 months of nutrient deprivation, 50% of normal caloric/nutrient intake, in 36 normal healthy men

- ✓ Depression
- ✓ Hysteria
- ✓ Irritability
- ✓ Self-mutilation
- ✓ Apathy, lethargy
- ✓ Social withdrawal
- ✓ Inability to concentrate

Disclosure

No commercial interest in any company or sale of any product

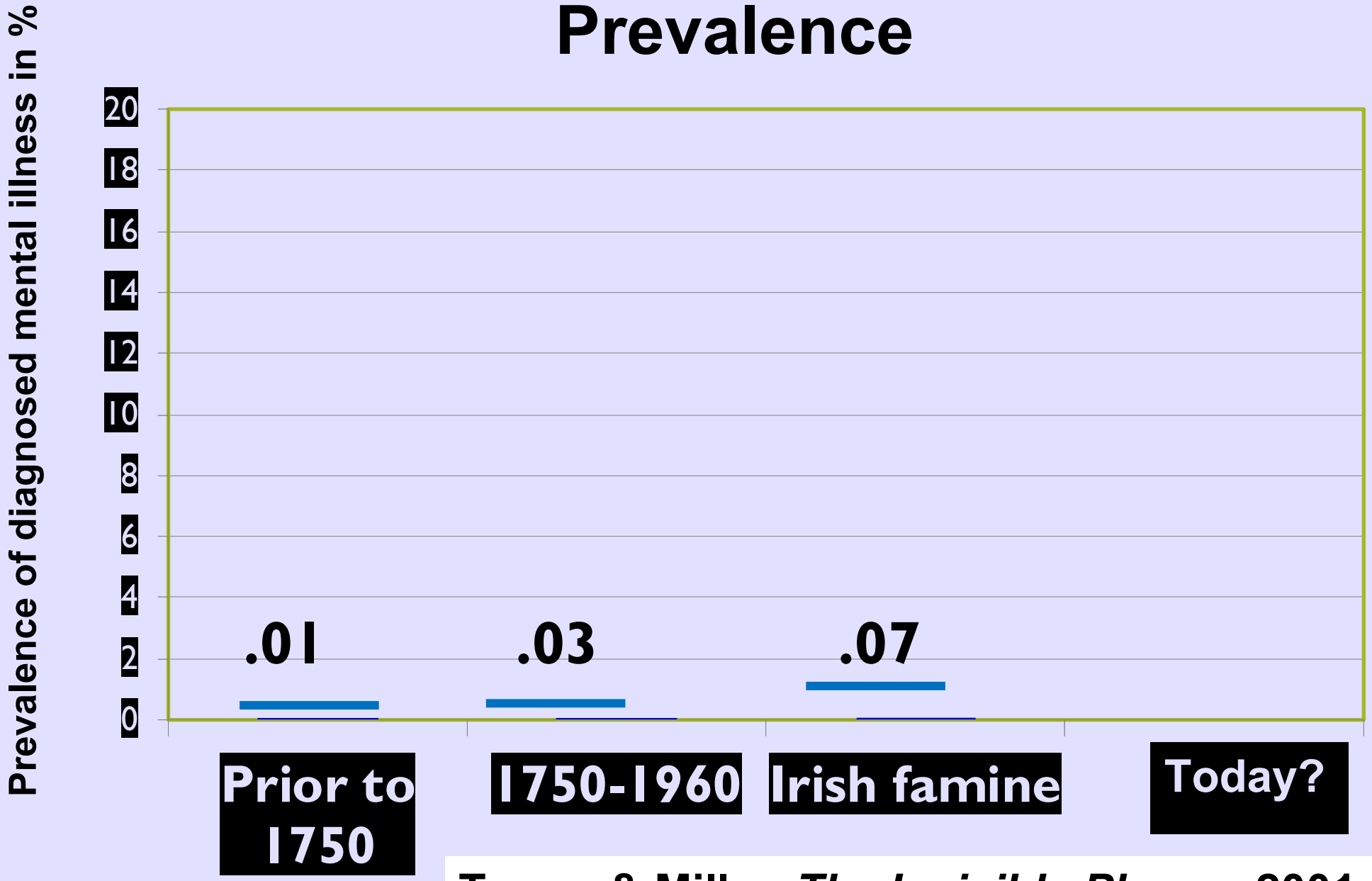
and

There are many causes of mental disorders….

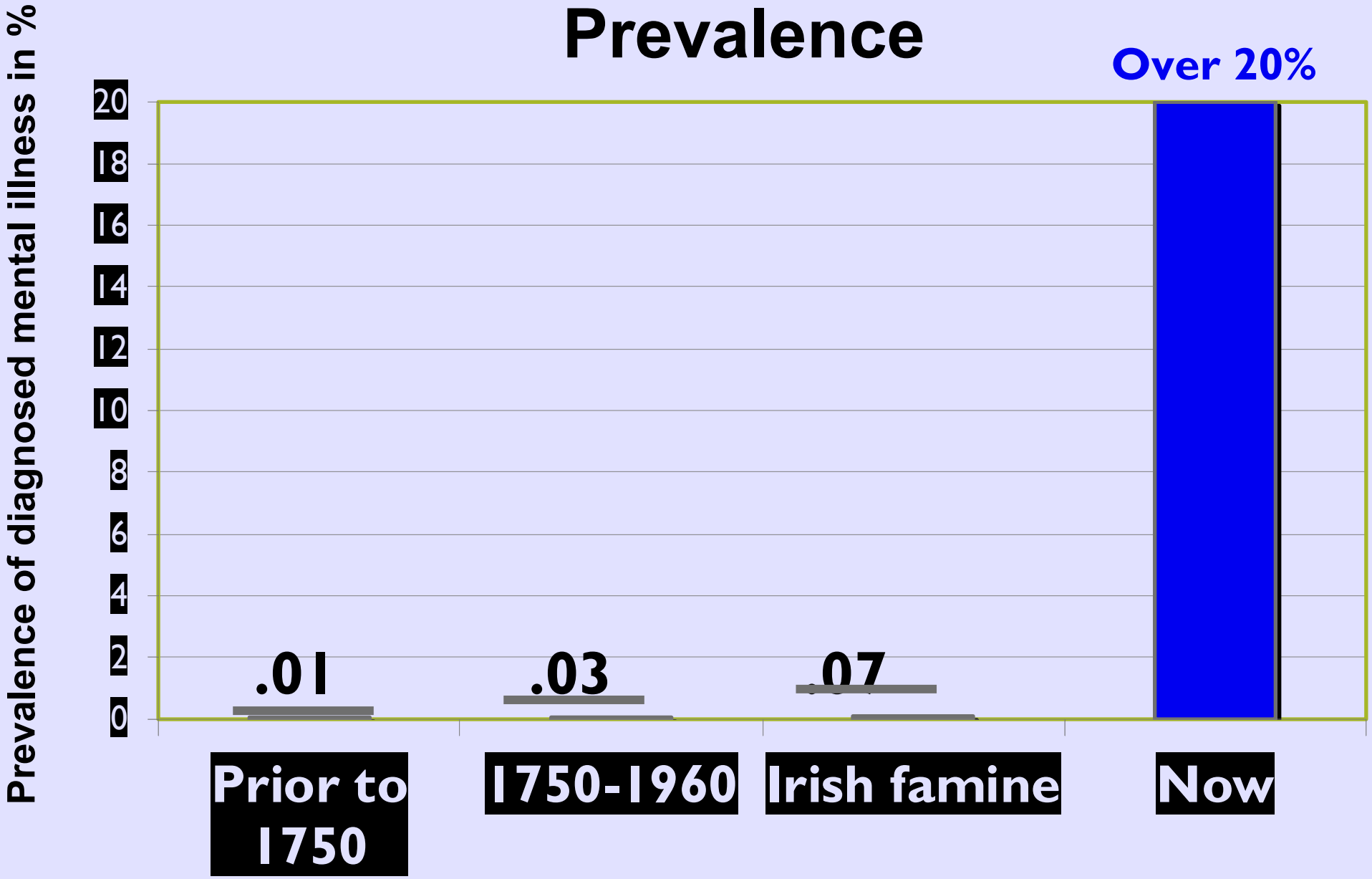
Overview

1. Magnitude of the mental health problem
2. Role of nutrition

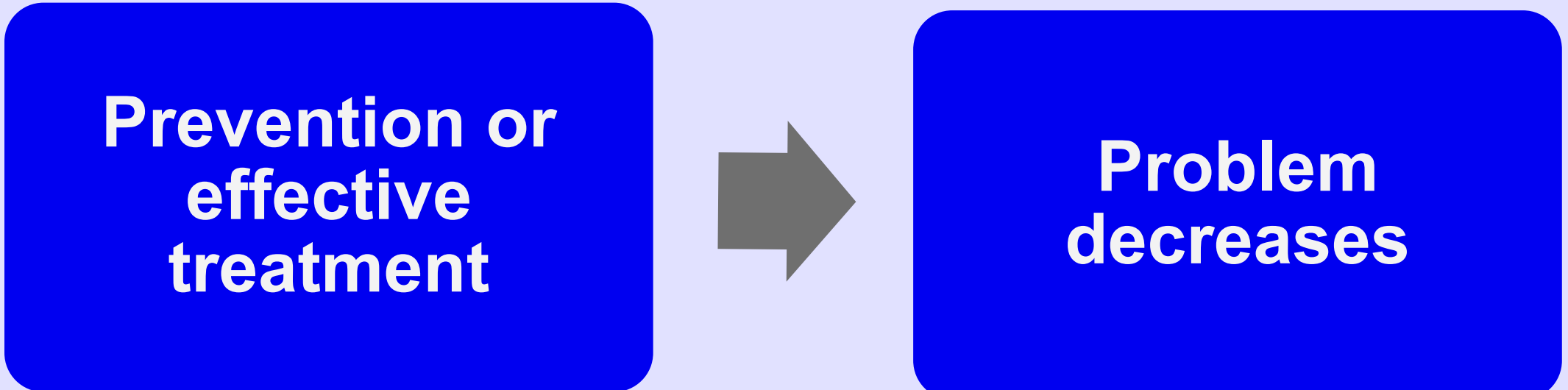
Prevalence



Torrey & Miller, *The Invisible Plague*, 2001


Prevalence
Prevalence of diagnosed mental illness in %
0
2
4
6
8
10
12
14
16
18
20
.01
.03
.07
Over 20%
Prior to 1750
1750-1960
Irish famine
Now

- **Conventional treatments are not helping much; if they were, the rates would be going down**



UTILITY OF PSYCHIATRIC MEDS?

- Distinction between acute and chronic use
- Many valid uses for psych meds in acute crises
- Long term data is not so positive – people who get off the meds do better in the long term

ROLE OF NUTRITION IN THE BRAIN?

Empirical support for

- **mental illness,**
- **cognitive function,**
- **dementia**

Nutrients feed your brain

accounts for
≈ 2% of your
body weight
but,

represents
20-50% of your
metabolic
demands

- **Each of us has 4-6** liters **of blood inside us**
- **~1 liter passes through our brain <u>every minute</u>**

Why have we evolved to require so much blood every minute?

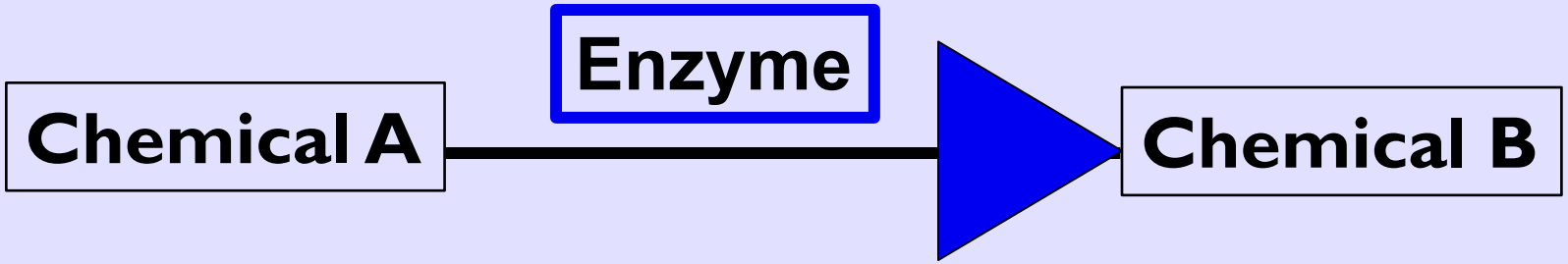
BRINGING OXYGEN

AND

NUTRIENTS FOR BRAIN

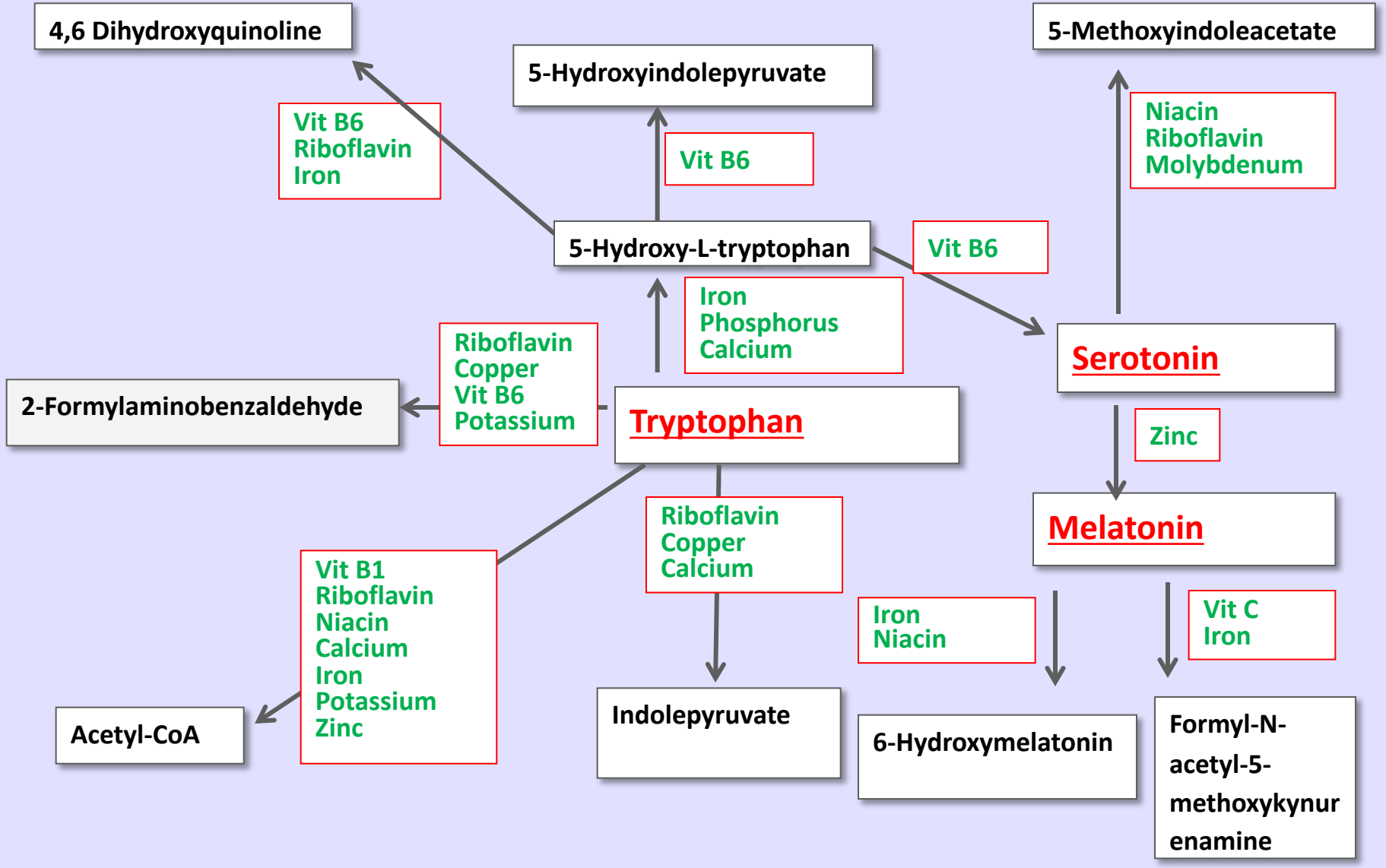
METABOLISM……

BRAIN METABOLISM
THE TRANSFORMATION OF ONE COMPOUND TO ANOTHER



Cofactors
Minerals and Vitamins

Abridged Tryptophan Metabolism



SOME OF THE DOPAMINE PATHWAY

Vit B1 | Vit B6 | Zinc

Stomach acid

L-Phenylalanine

Vit B3 | Vit B6 | Vit C | Folate | Iron

Phenylalanine hydroxylase

L-Tryosine

Folate | Iron | Vit B2 | Vit B3 | Vit C

Tyrosine hydroxylase

L-Dopa

Mg | Vit C | Zinc | Vit B6

Dopamine decarboxylase

Dopamine

Vit C | Copper

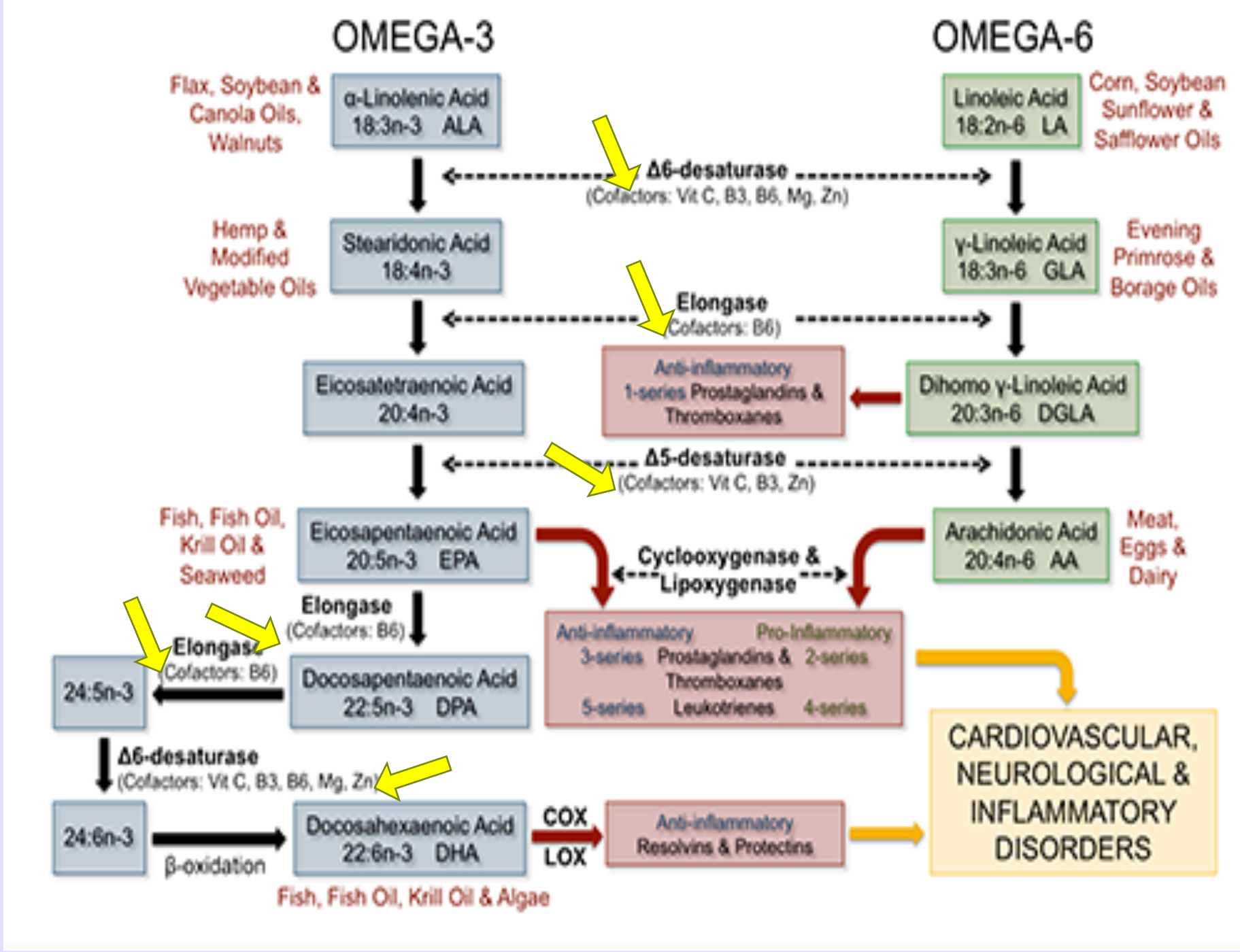
Dopamine B hydroxylase

Noradrenalin

Folate | Mn | Vit B5

Phenylethanolamine N-methyl transferase

Adrenalin


OMEGA-3
OMEGA-6
Flax, Soybean & Canola Oils, Walnuts
α-Linolenic Acid 18:3n-3 ALA
Linoleic Acid 18:2n-6 LA
Corn, Soybean Sunflower & Safflower Oils
Δ6-desaturase
(Cofactors: Vit C, B3, B6, Mg, Zn)
Hemp & Modified Vegetable Oils
Stearidonic Acid 18:4n-3
γ-Linoleic Acid 18:3n-6 GLA
Evening Primrose & Borage Oils
Elongase
(Cofactors: B6)
Eicosatetraenoic Acid 20:4n-3
Anti-inflammatory 1-series Prostaglandins & Thromboxanes
Dihomo γ-Linoleic Acid 20:3n-6 DGLA
Δ5-desaturase
(Cofactors: Vit C, B3, Zn)
Fish, Fish Oil, Krill Oil & Seaweed
Eicosapentaenoic Acid 20:5n-3 EPA
Arachidonic Acid 20:4n-6 AA
Meat, Eggs & Dairy
Cyclooxygenase & Lipoxygenase
Elongase
(Cofactors: B6)
Elongase
(Cofactors: B6)
24:5n-3
Docosapentaenoic Acid 22:5n-3 DPA
Anti-inflammatory 3-series Prostaglandins & Thromboxanes 5-series Leukotrienes
Pro-Inflammatory 2-series 4-series
CARDIOVASCULAR, NEUROLOGICAL & INFLAMMATORY DISORDERS
Δ6-desaturase
(Cofactors: Vit C, B3, B6, Mg, Zn)
24:6n-3
β-oxidation
Docosahexaenoic Acid 22:6n-3 DHA
COX
LOX
Anti-inflammatory Resolvins & Protectins
Fish, Fish Oil, Krill Oil & Algae

The role of nutrients in the brain is not a mystery

***This should be taught in elementary school*. ….Or at least in medical school**

48% of the caloric intake of all Canadians

Moubarac et al, *Appetite*, 2017

REMEMBER? THESE ARE SIGNS OF SUBOPTIMAL NUTRITION

UNIV MINNESOTA STARVATION EXPERIMENTS, 1950

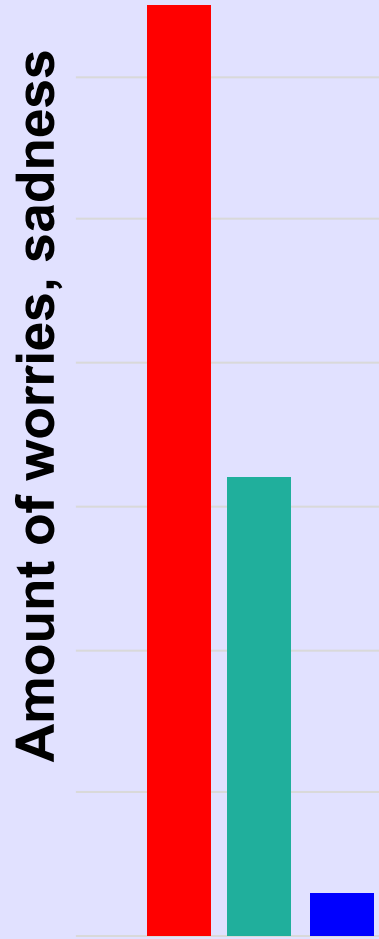
6 months of nutrient deprivation, 50% of normal caloric/nutrient intake, in 36 normal healthy men

- ✓ Depression
- ✓ Hysteria
- ✓ Irritability
- ✓ Self-mutilation
- ✓ Apathy, lethargy
- ✓ Social withdrawal
- ✓ Inability to concentrate

TYPES OF DATA PROVING THE IMPORTANCE OF NUTRITION TO MENTAL HEALTH

- **Correlational**
- **Prospective**
- **Treatment**

YOUNG CHILDREN: 6,528 GRADE 5 ALBERTANS, MEASURED HEALTHY EATING SCORE



Red bar – lowest healthy eating score, highest levels of feeling worried or sad

Green Bar – medium healthy eating scores, medium amount of sadness and depression

Blue Bar --healthy eaters, fewer feelings of sadness and depression

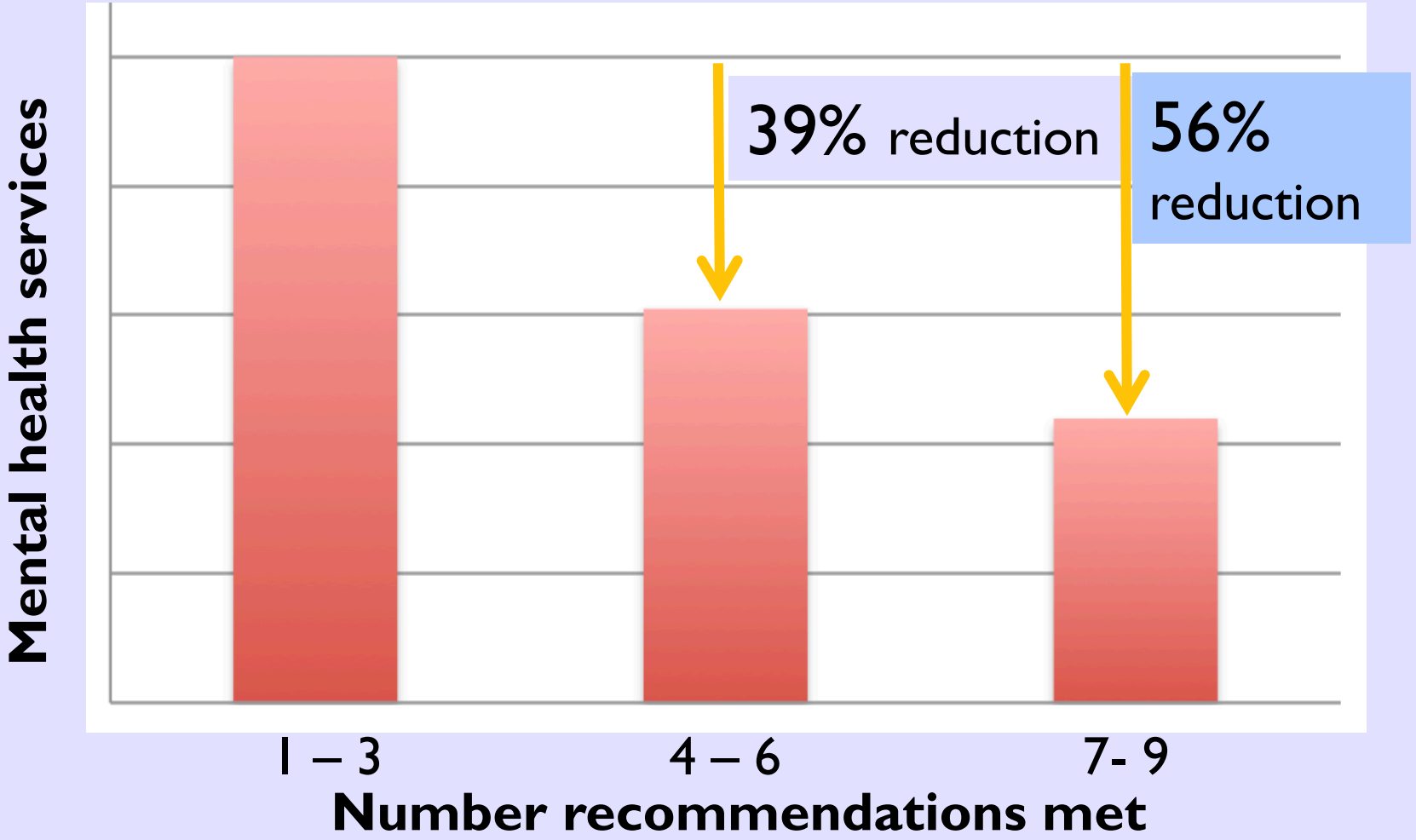
McMartin et al., 2013,
Can J Public Health

LIFESTYLE BEHAVIOR AND MENTAL HEALTH IN EARLY ADOLESCENCE

LOEWEN ET AL., *PEDIATRICS*, 2019

- 3,436 children aged 10-11 yrs
- 2011: dietary intake, screen time, physical activity
- Children were divided according to how many of the 9 health recommendations were met
- 2011-14: Administrative health data provided physician-diagnosed mental health conditions

LIFESTYLE RECOMMENDATIONS AND MENTAL HEALTH



Every additional recommendation met was associated with 15% fewer physician visits for mental disorders

TREATMENT: THE SMILES STUDY AND THE HELFIMED STUDY OF A WHOLE DIET APPROACH

- Adults with Major Depressive Disorder and a poor diet (67 in SMILES; 152 in HELFIMED)
- Randomized to receive 12 wks **dietary counseling or peer support**/counseling

Jacka et al., *BMC Med*. 2017 Jan 30;15(1):23

Parletta et al., *Nutr Neurosci*, 2017 Dec 7;7:1-4


Beans
&
Legumes


KRAFT


Coca-Cola
Spicy Sweet
Cheetos
Crunchy
Pringles
SOUR CREAM
Ruffles
Trans Fat
Ruffles Have Ridges
Hostess
Twinkies
Milk's Favorite Cookie
OREO
Chips Ahoy!
CHEWY

COMBINED RESULTS OF BOTH STUDIES

- Lots of people got significantly better
- **Remission!**
  - **8%** of those who received peer counseling
  - **32%** of those who received dietary counseling
- Those whose diets improved the most: they showed the most improvement in mood

Is it also important to consider nutrients in pill form?

Individual differences:

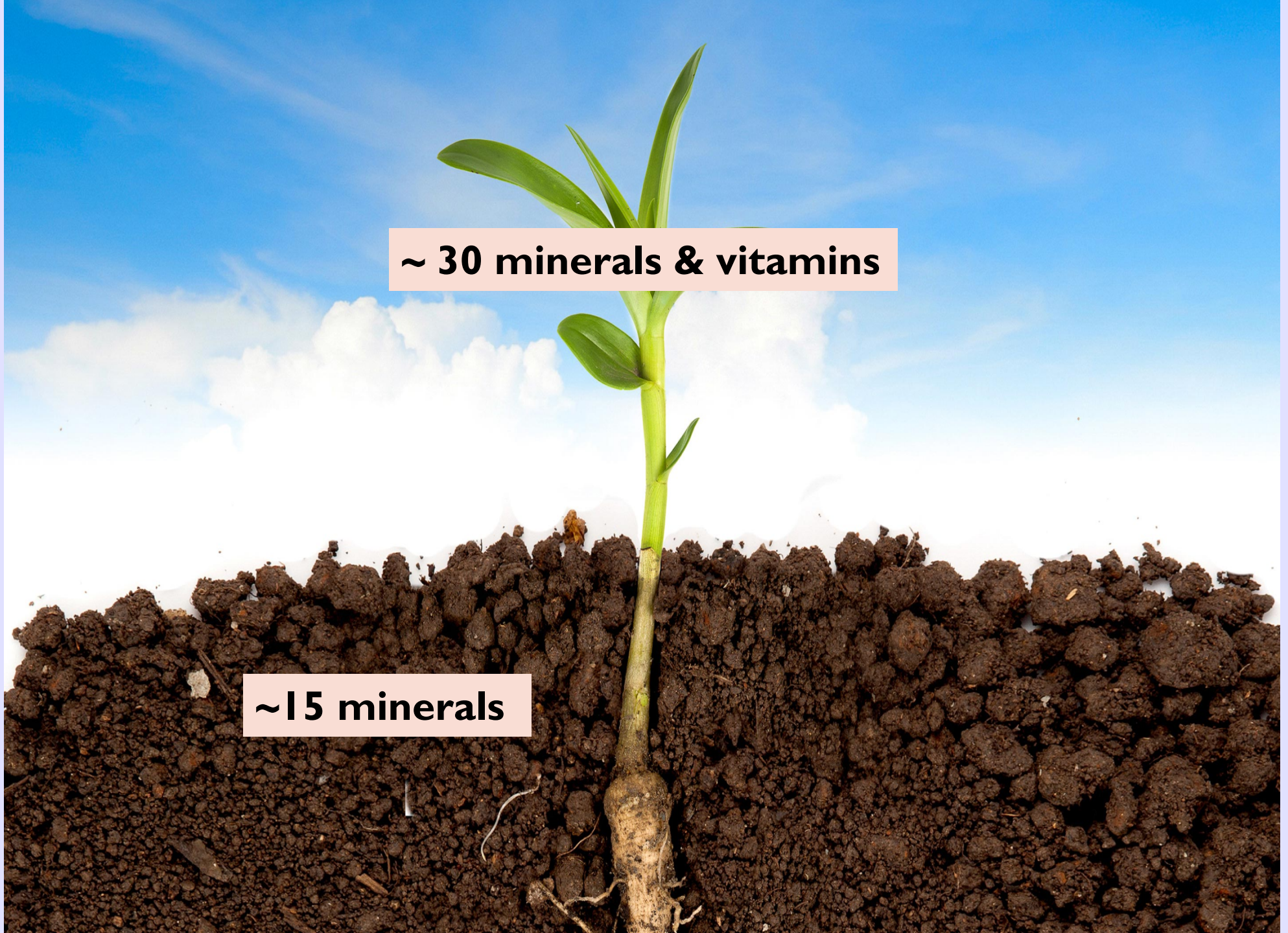
A good diet might not be

sufficient

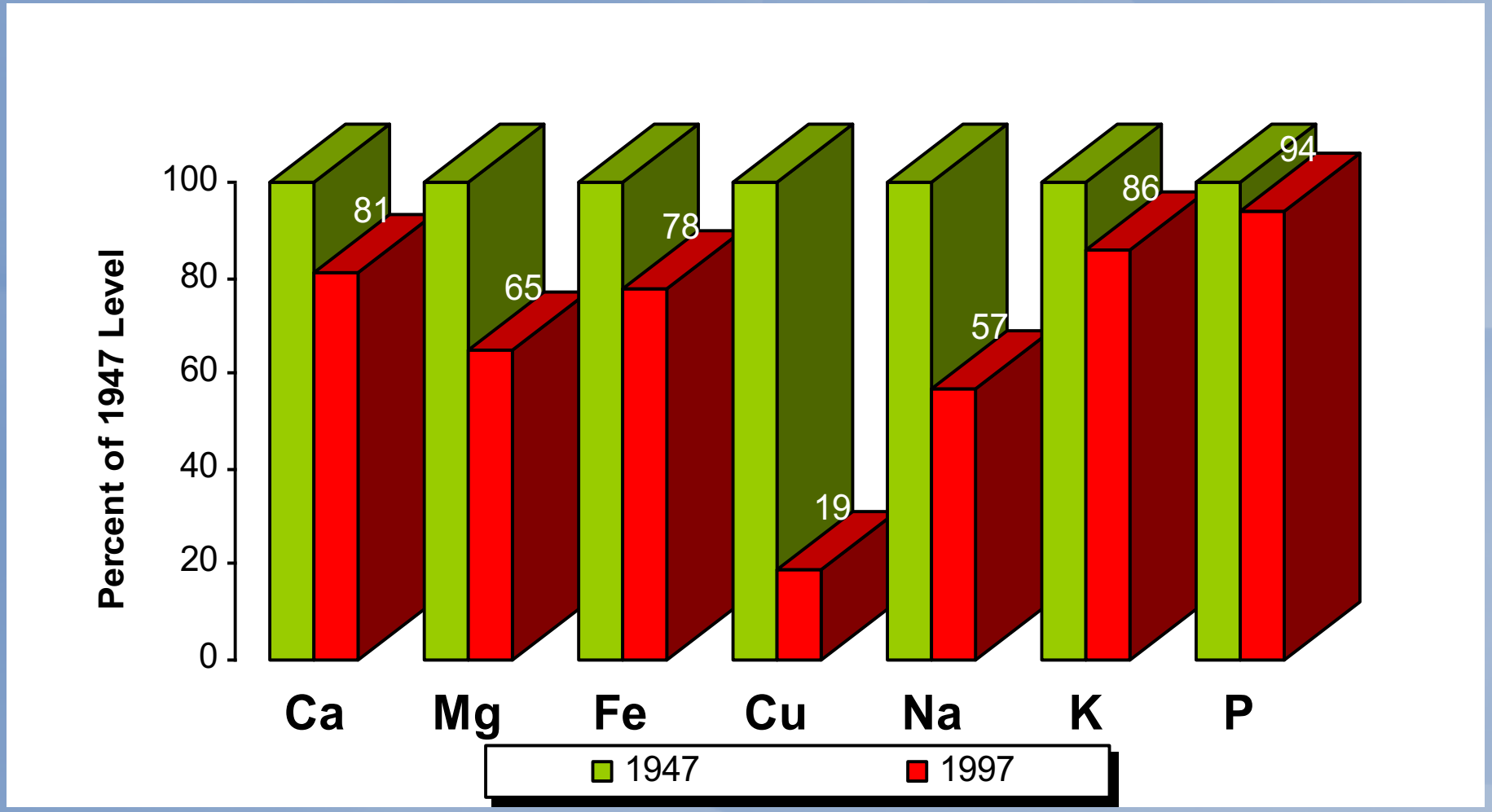
for optimal brain function

for some people

And of course the 'good diet'
may not be as nutritious
as we think it is


~ 30 minerals & vitamins
~15 minerals

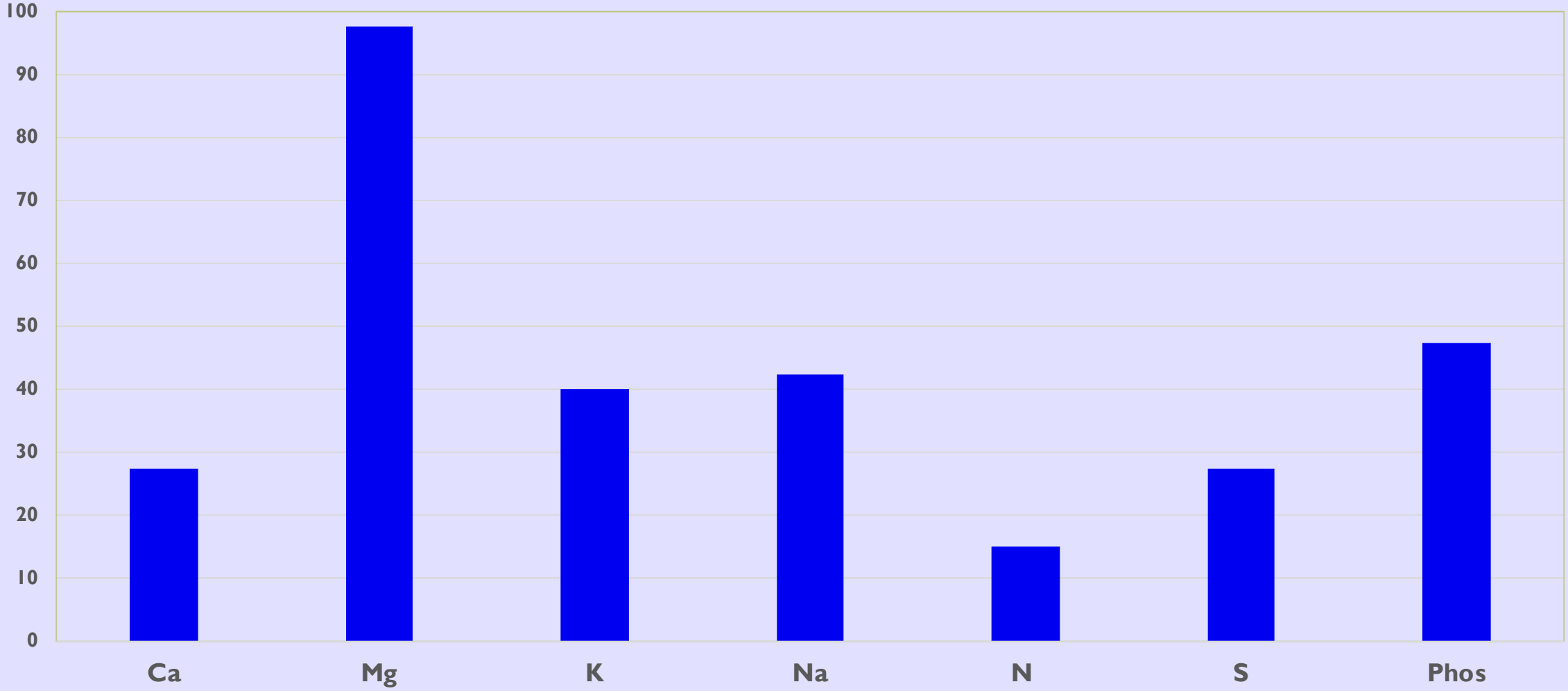
Decrease in Mineral Content In Vegetables Over a 50 Year Period in the U.K.



Mayer, A B. Historical Changes in the Mineral Content of Fruit and Vegetables. *British Food Journal* 99(6). 1997. 207- 211.

MACROS

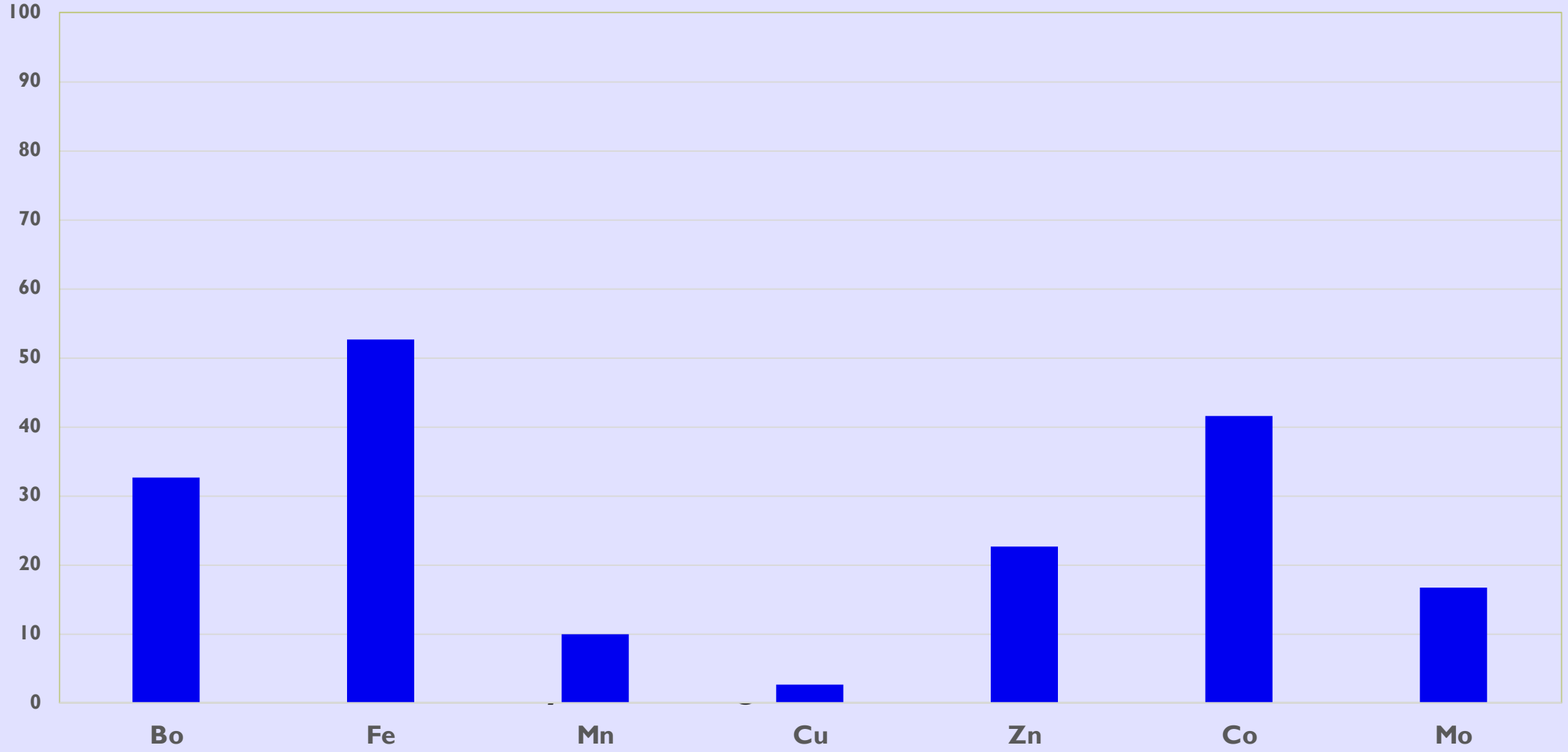
% of 40 fields where nutrient reached
at least the lowest level of the ideal range



All soil assays done using the Albrecht method

MICROS

% of 40 fields where nutrient reached
at least the lowest level of the ideal range



Kaplan et al., Vitamins, minerals and mood. *Psychol. Bull.,* 2007

- **Overall: modest effects in single nutrient studies**
- ***Better clinical efficacy from multi-ingredient treatments***
- **Since 2000: ~35-40 RCTs with EITHER broad-spectrum formulas, OR formulas with several nutrients, especially B complex**

TREATMENT WITH *MULTIPLE* NUTRIENTS

1. B complex: improved resilience shown in ~10 clinical trials worldwide…..in people who are not clinical patients

2. broad-spectrum (~all 30+ minerals & vitamins)…..

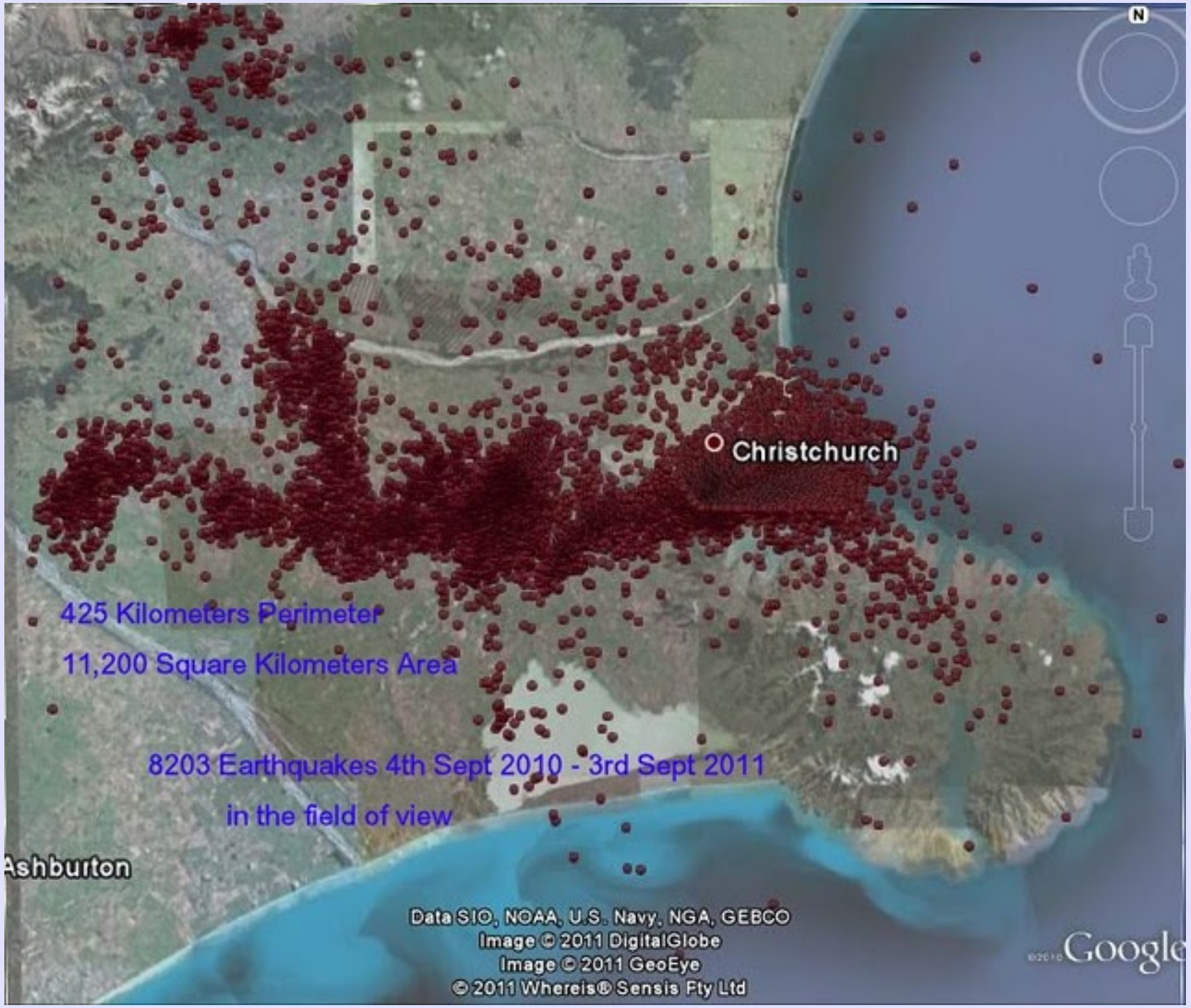
Two Alberta Broad-Spectrum Formulas

- EMPowerplus (www.Truehope.com)
- Daily Essential Minerals [DEN] (www.HardyNutritionals.com)
- Studied by independent scientists: from Canada, New Zealand, USA
- Companies never fund any scientist or any study

- **Both formulas have about 30 minerals and vitamins above RDA, below tolerable UL**
- **Because of ethics committee requirements, the formulas have been reviewed by FDA and by Health Canada**
- **For information and clinician guidance, please go to their websites.**
- **Both companies provide education and support to clinicians, as well as families**

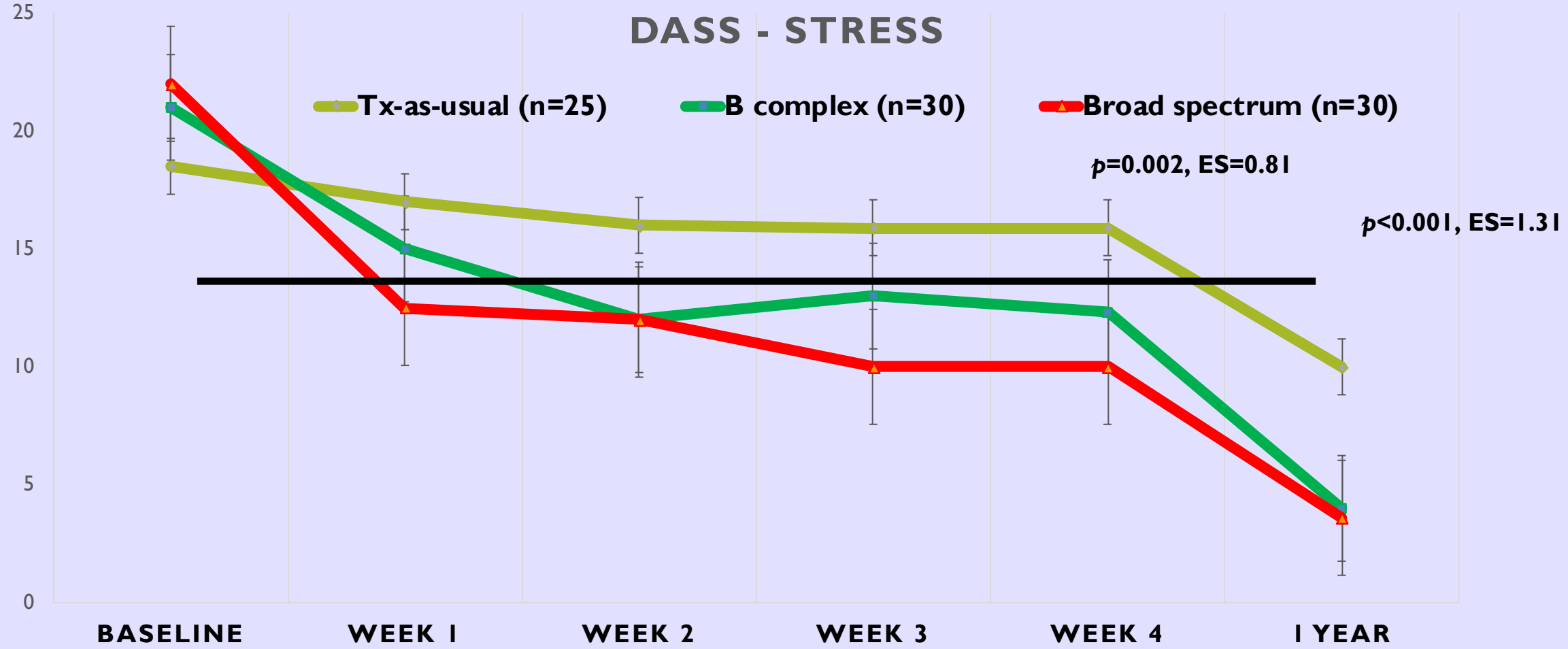
BROAD-SPECTRUM FORMULAS BENEFIT PEOPLE WITH CLINICAL DIAGNOSES

- More than **40 peer-reviewed studies** have shown benefit
  - Depression/bipolar disorder
  - ADHD
  - Anxiety
  - Psychosis
  - Explosive rage, sleep disturbance, recovery from head injury, irritability


N
Christchurch
425 Kilometers Perimeter
11,200 Square Kilometers Area
8203 Earthquakes 4th Sept 2010 - 3rd Sept 2011
in the field of view
Ashburton
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2011 DigitalGlobe
Image © 2011 GeoEye
© 2011 Whereis® Sensis Pty Ltd
Google

REDUCTION IN STRESS AFTER EARTHQUAKES

RUCKLIDGE ET AL., 2012 & 2014, *HUMAN PSYCHOPHARMACOLOGY*

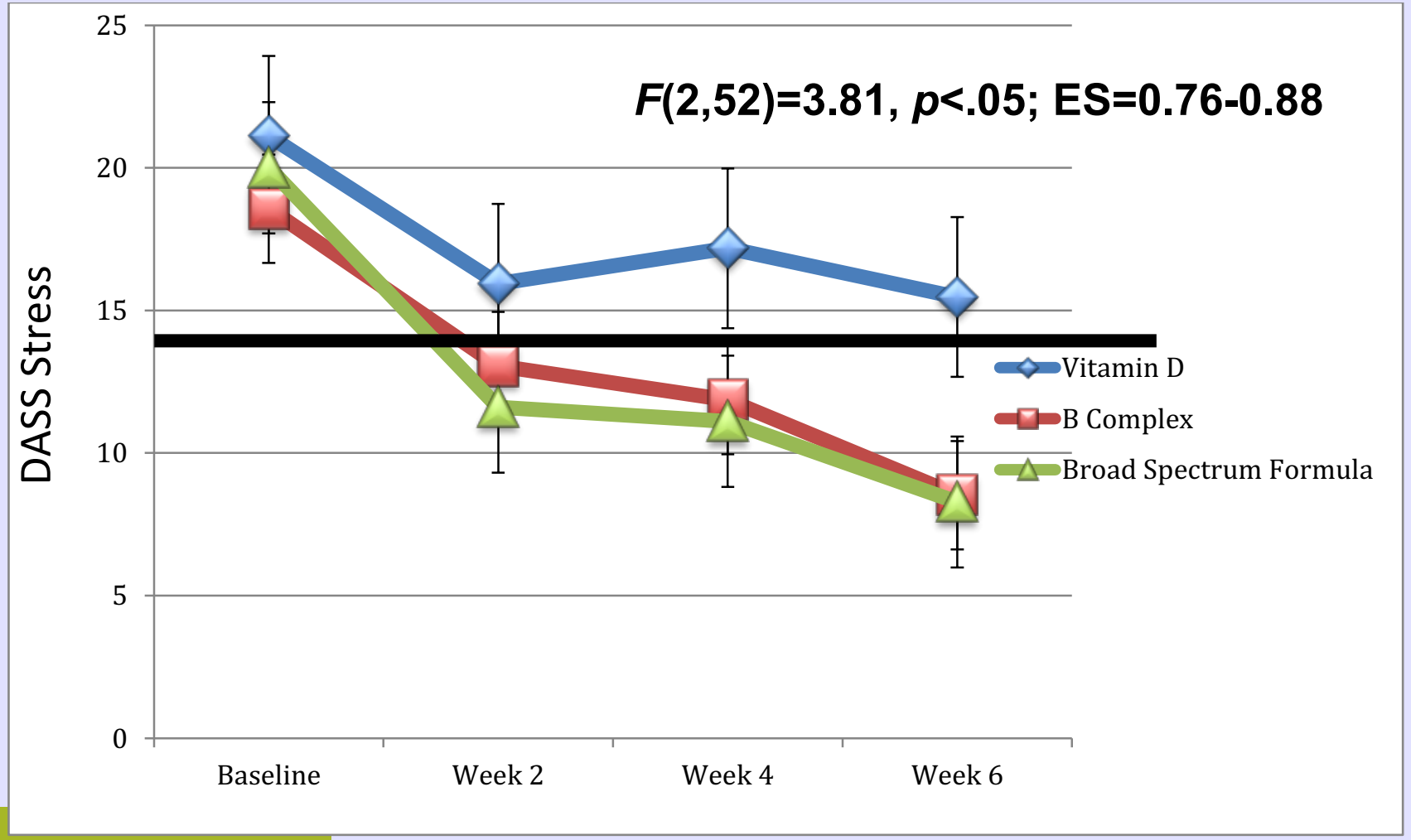


Opportunity for replication

SOUTHERN ALBERTA FLOOD, HIGH RIVER, JUNE 13TH 2013

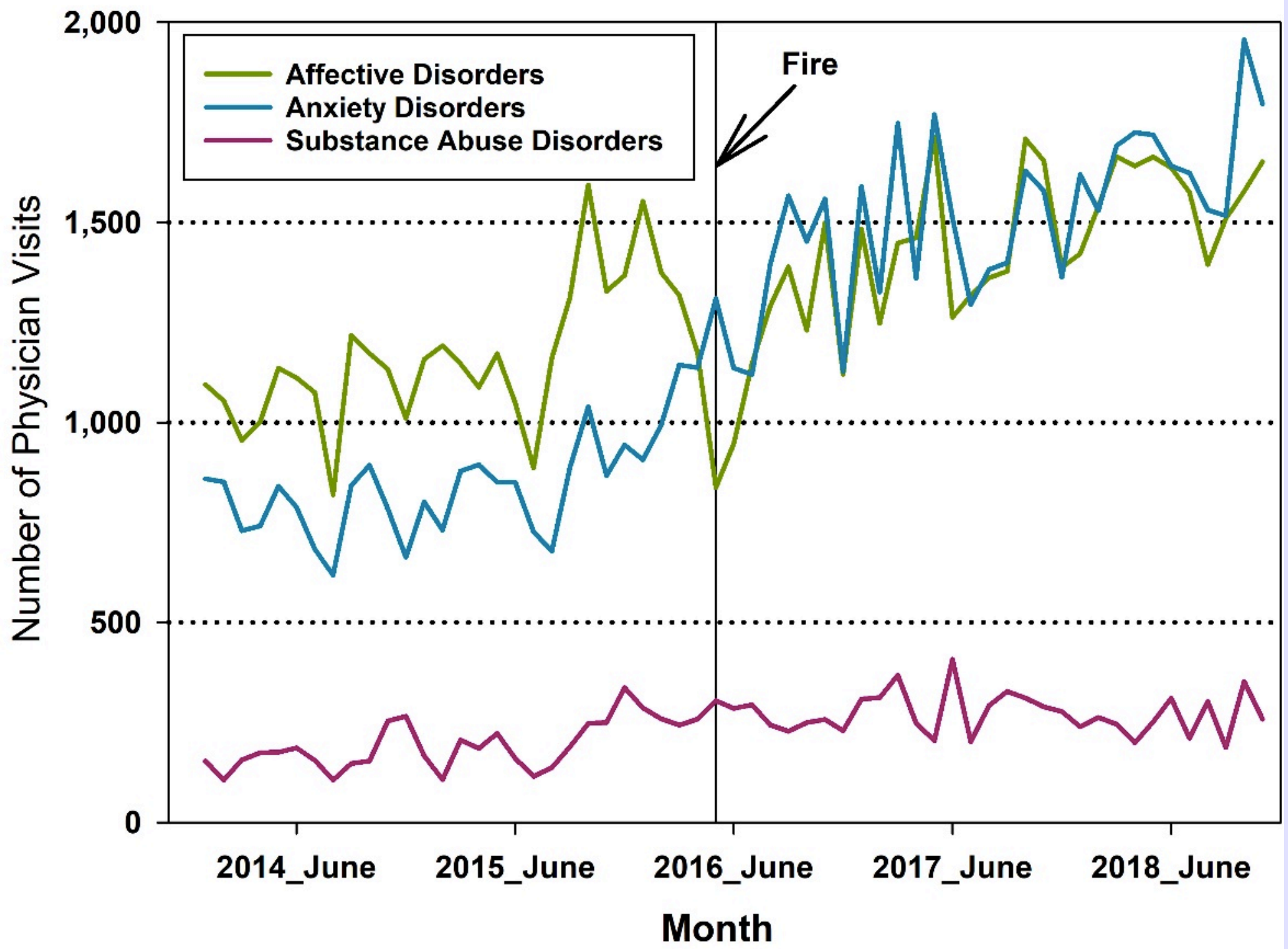
FLOOD STUDY, ALBERTA, 2013

KAPLAN ET AL., 2015, *PSYCHIATRY RESEARCH*



WHAT IS THE ALTERNATIVE?
FIRES OF FORT MCMURRAY, ALBERTA, CANADA, MAY 2016

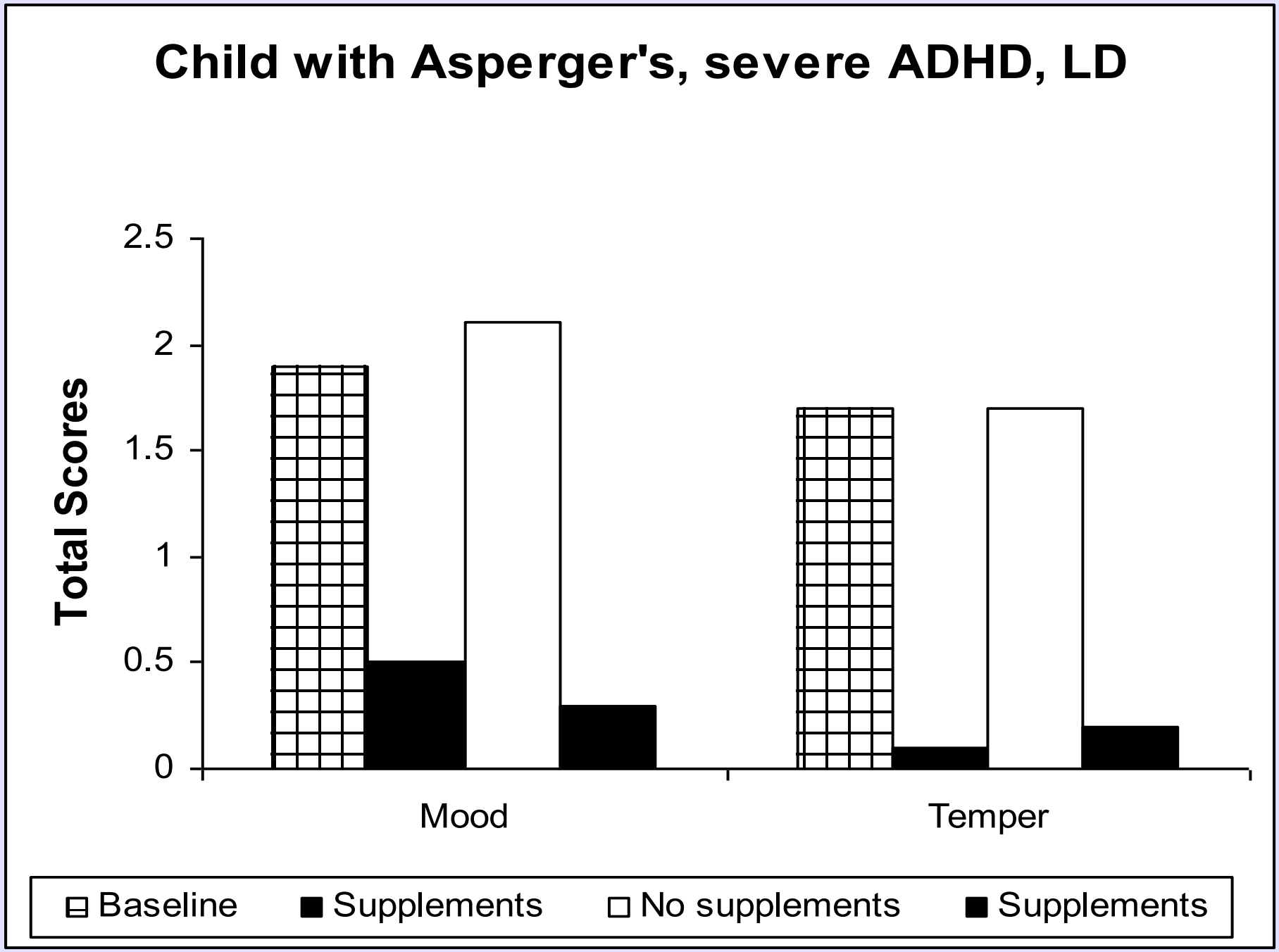
Fort McMurray Fires of 2016



WITHIN-SUBJECT CROSSOVER

KAPLAN ET AL (2002). *J CHILD ADOLESC PSYCHOPHARMACOL*

- 2 children studied serendipitously in reversal designs with an early version of EMPowerplus
- Boy, age 12
  - PDD (Asperger's)
  - Severe ADHD, severe LD, severe mood problem, negative, anxious
  - Required full time teacher's aide
  - Also changed schools --- reversal
  - Followed now for >15 yrs informally


Child with Asperger's, severe ADHD, LD
Total Scores
2.5
2
1.5
1
0.5
0
Mood
Temper
Baseline
Supplements
No supplements
Supplements

RCT in adults with ADHD

BJPsych The British Journal of Psychiatry
1–10. doi: 10.1192/bjp.bp.113.132126

Vitamin–mineral treatment of attention-deficit hyperactivity disorder in adults: double-blind randomised placebo-controlled trial

Julia J. Rucklidge, Chris M. Frampton, Brigette Gorman and Anna Boggis

Background
The role of nutrition in the treatment of attention-deficit hyperactivity disorder (ADHD) is gaining international attention; however, treatments have generally focused only on diet restriction or supplementing with one nutrient at a time.

Aims
To investigate the efficacy and safety of a broad-based micronutrient formula consisting mainly of vitamins and minerals, without omega fatty acids, in the treatment of ADHD in adults.

Method
This double-blind randomised controlled trial assigned 80 adults with ADHD in a 1:1 ratio to either micronutrients ($n = 42$) or placebo ($n = 38$) for 8 weeks (trial registered with the Australian New Zealand Clinical Trials Registry: ACTRN12609000308291).

Results
Intent-to-treat analyses showed significant between-group differences favouring active treatment on self- and observer- but not clinician-ADHD rating scales. However, clinicians rated those receiving micronutrients as more improved than those on placebo both globally and on ADHD symptoms. *Post hoc* analyses showed that for those with moderate/severe depression at baseline, there was a greater change in mood favouring active treatment over placebo. There were no group differences in adverse events.

Conclusions
This study provides preliminary evidence of efficacy for micronutrients in the treatment of ADHD symptoms in adults, with a reassuring safety profile.

Declaration of interest
None.

RCT IN CHILDREN WITH ADHD

The Journal of Child Psychology and Psychiatry

Journal of Child Psychology and Psychiatry **:* (2017), pp **–** doi:10.1111/jcpp.12817

Vitamin-mineral treatment improves aggression and emotional regulation in children with ADHD: a fully blinded, randomized, placebo-controlled trial

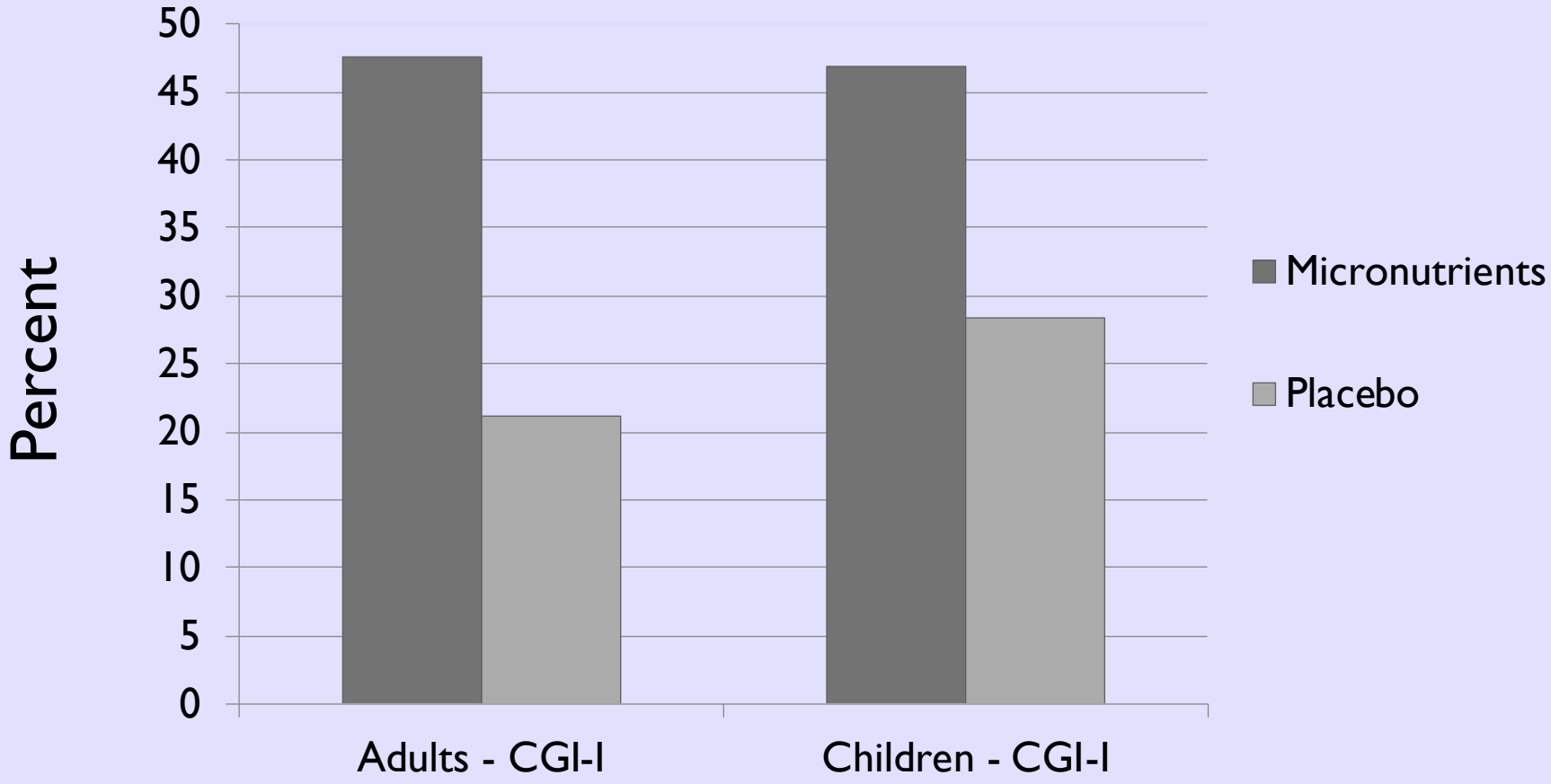
Julia J. Rucklidge,[1] Matthew J.F. Eggleston,[2] Jeanette M. Johnstone,[3] Kathryn Darling,[1] and Chris M. Frampton[4]

[1]Department of Psychology, University of Canterbury, Christchurch; [2]Canterbury District Health Board, Christchurch, New Zealand; [3]Child and Adolescent Psychiatry, Oregon Health & Science University, Portland, OR, USA; [4]Department of Psychological Medicine, University of Otago, Christchurch, New Zealand

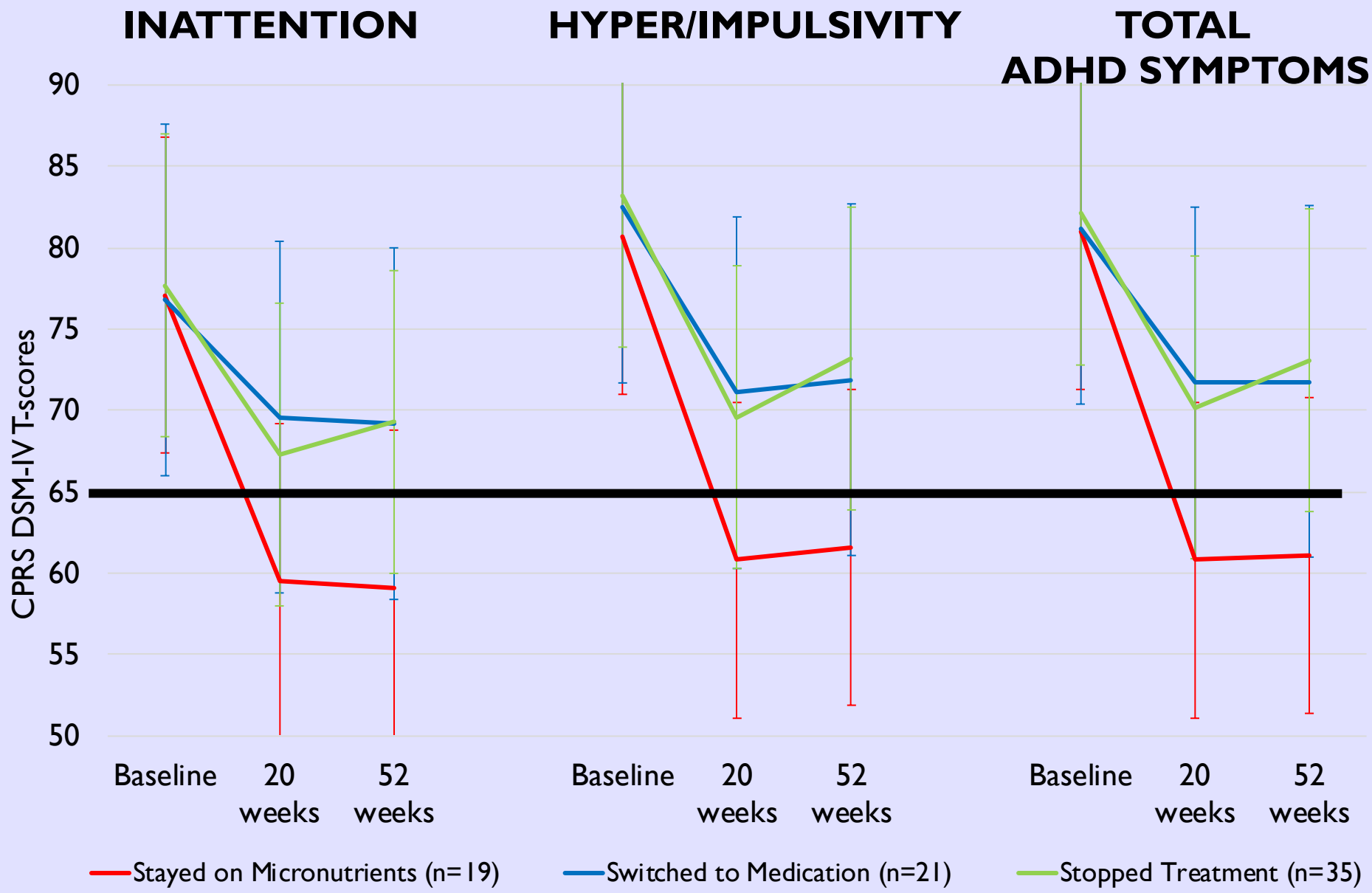
Background: Evaluation of broad-spectrum micronutrient (vitamins and minerals) treatment for childhood ADHD has been limited to open-label studies that highlight beneficial effects across many aspects of psychological functioning. **Method:** This is the first fully blinded randomized controlled trial of medication-free children ($n = 93$) with ADHD (7–12 years) assigned to either micronutrients ($n = 47$) or placebo ($n = 46$) in a 1:1 ratio, for 10 weeks. All children received standardized ADHD assessments. Data were collected from clinicians, parents, participants and teachers across a range of measures assessing ADHD symptoms, general functioning and impairment, mood, aggression and emotional regulation. **Results:** Intent-to-treat analyses showed significant between-group differences favouring micronutrient treatment on the Clinical Global Impression-Improvement (ES = 0.46), with 47% of those on micronutrients identified as 'much' to 'very much' improved versus 28% on placebo. No group differences were identified on clinician, parent and teacher ratings of overall ADHD symptoms (ES ranged 0.03–0.17). However, according to clinicians, 32% of those on micronutrients versus 9% of those on placebo showed a clinically meaningful improvement on inattentive (OR = 4.9; 95% CI: 1.5–16.3), but no group differences on improvement in hyperactive-impulsive symptoms (OR = 1.0; 95% CI: 0.4–2.5). Based on clinician, parent and teacher report, those on micronutrients showed greater improvements in emotional regulation, aggression and general functioning compared to placebo (ES ranged 0.35–0.66). There were two dropouts per group, no group differences in adverse events and no serious adverse events identified. Blinding was successful with guessing no better than chance. **Conclusions:** Micronutrients improved overall function, reduced impairment and improved inattention, emotional regulation and aggression, but not hyperactive/impulsive symptoms, in this sample of children with ADHD. Although direct benefit for core ADHD symptoms was modest, with mixed findings across raters, the low rate of adverse effects and the benefits reported across multiple areas of functioning indicate micronutrients may be a favourable option for some children, particularly those with both ADHD and emotional dysregulation. Trial registered with the Australian New Zealand Clinical Trials Registry ACTRN12613000896774. **Keywords:** ADHD; micronutrient; vitamin; mineral; Treatment; Mood; aggression.

RESPONDERS ACROSS 2 STUDIES

RUCKLIDGE ET AL., 2014, *BJP* (N=80); RUCKLIDGE ET AL., 2018, *JCPP* (N=93)



One-year Follow-up: Parent-rated ADHD



Those who continued to take micronutrients were rated as doing:

1. As well or better than those who switched to medications:

ADHD Total, d = 0.4-0.7

1. Better than those who stopped treatment:

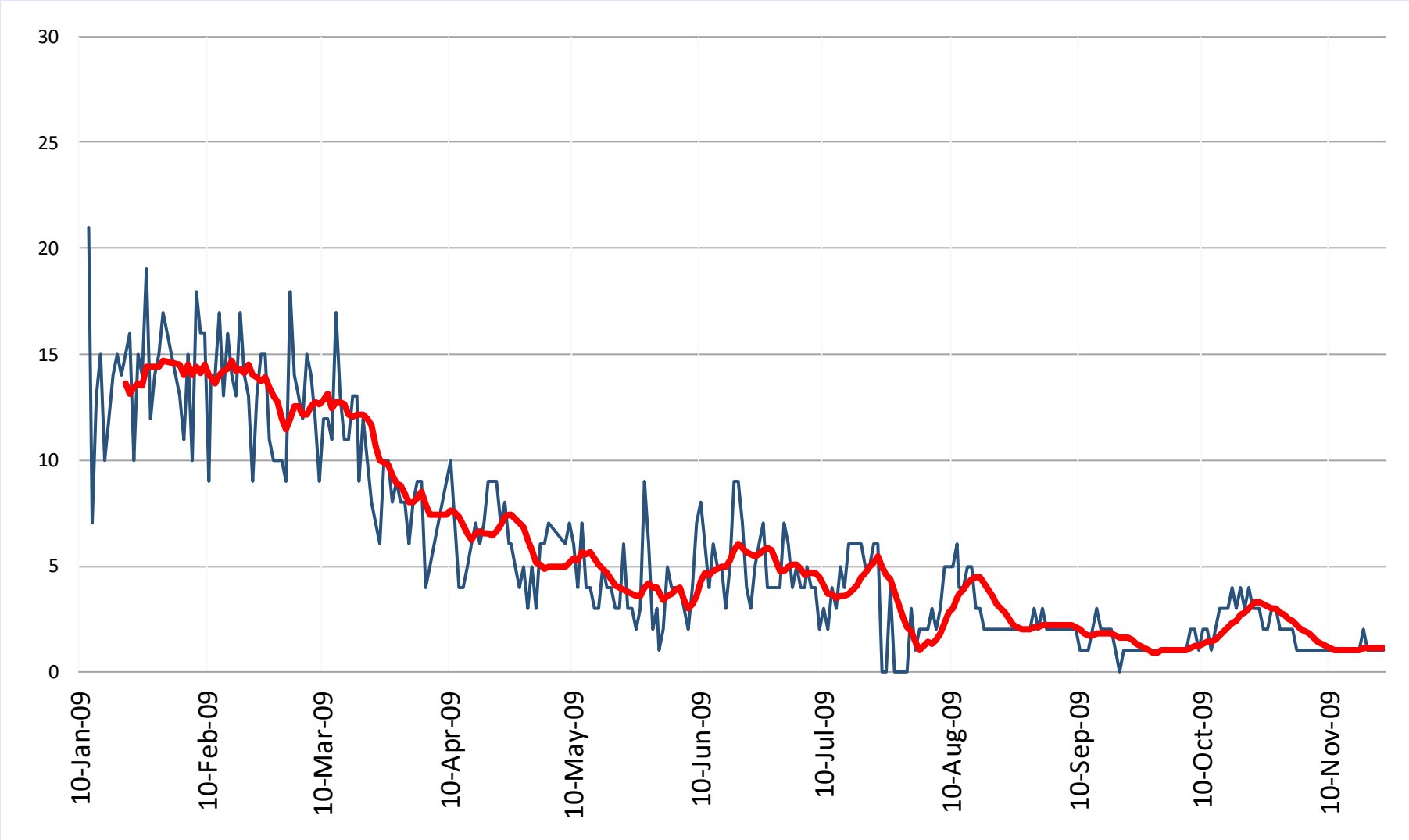
ADHD Total, d = 1.2-0.9.

Social Implications: Cost to health care

- "Andrew': Middle child of 3; intact Calgary family, apparently eating well --- healthy
- Borderline IQ, moderately severe language problems
- Age 10: "stressed" and "overwhelmed"
- Disturbances in sleep, concentration, behaviour
- Auditory hallucinations, paranoid ideation
- Symptoms of Obsessive Compulsive Disorder

Rodway et al., 2012, *British Medical Journal Case Reports*

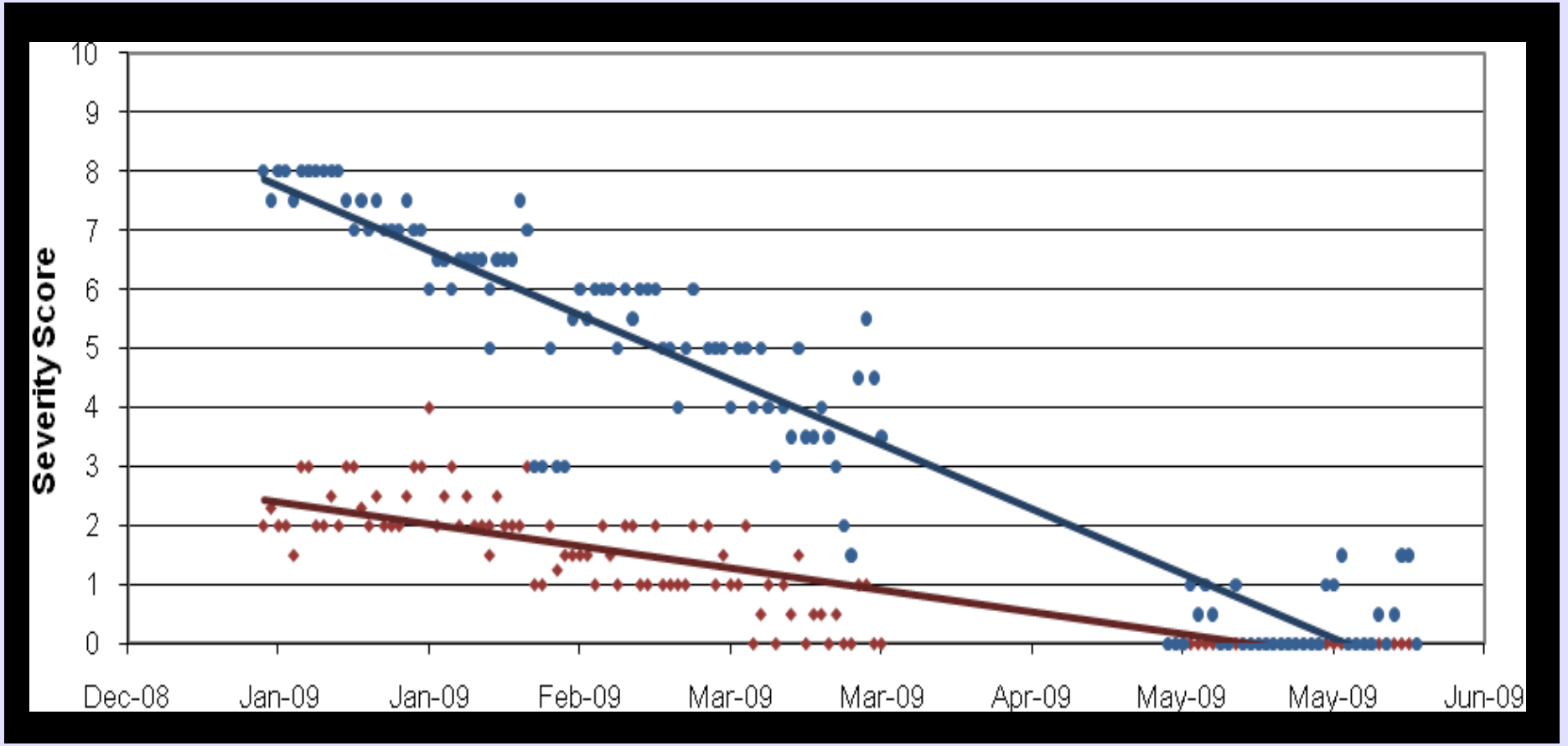
Daily psychosis symptom score



Self-reported account of hallucinations

Visual hallucinations

Auditory hallucinations



COST TO HEALTH CARE
(RODWAY ET AL., 2012, *BMJ CASE REPORTS*)

Cost of conventional inpatient treatment

Micronutrients cost

<2%

of conventional treatment

Cost of micronutrient outpatient treatment

Story of "Marie"

1997 (age 33), multiple diagnoses

- Bipolar disorder, depression, PTSD

Conventional treatment for years

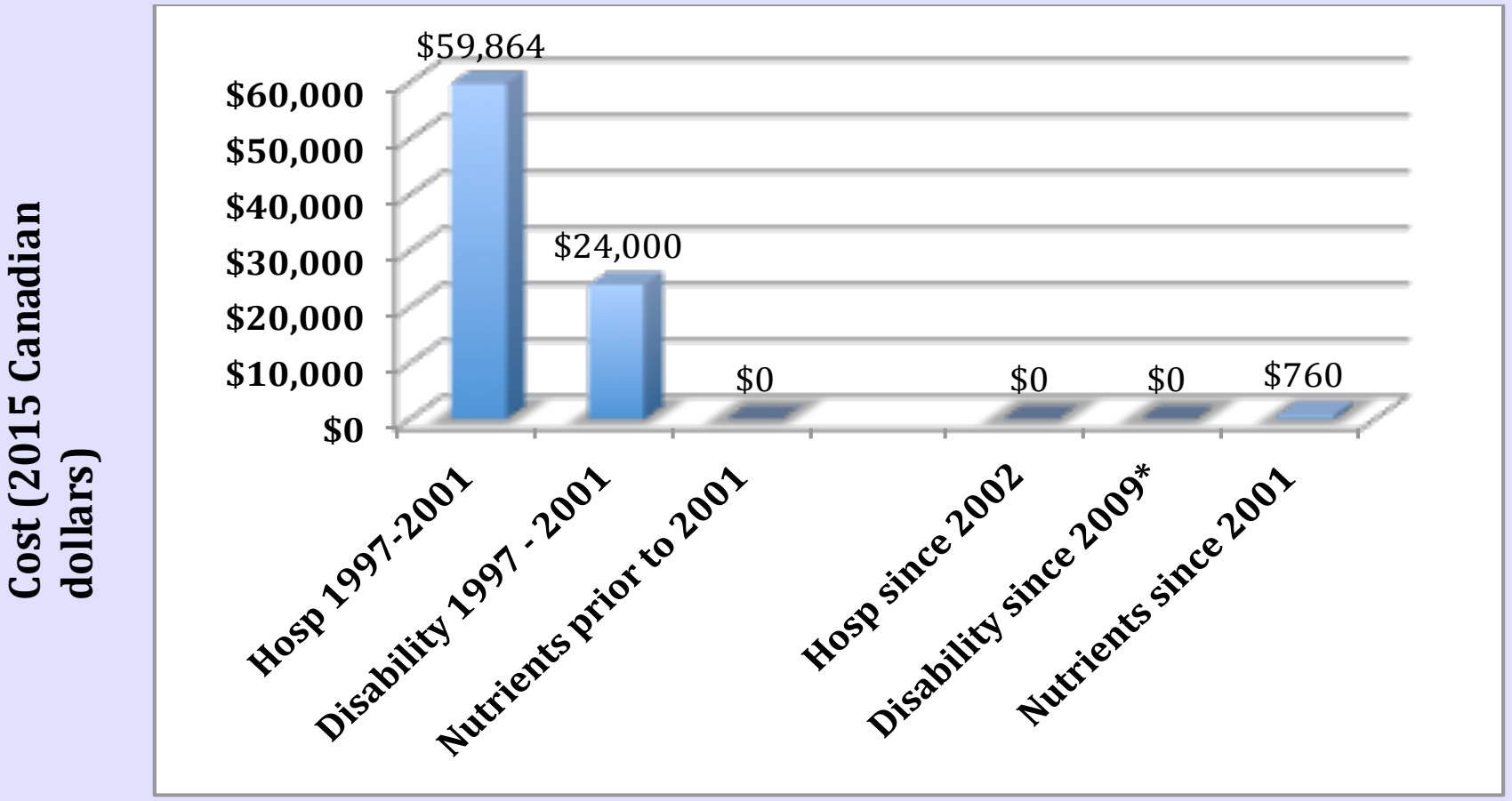
- BC, ON, AB

2001 began micronutrient formula

- 0 need for mental health services

Kaplan et al. (2017). Hospitalization cost of conventional psychiatric care compared to broad-spectrum micronutrient treatment. *Int J MH Systems,* 11:14

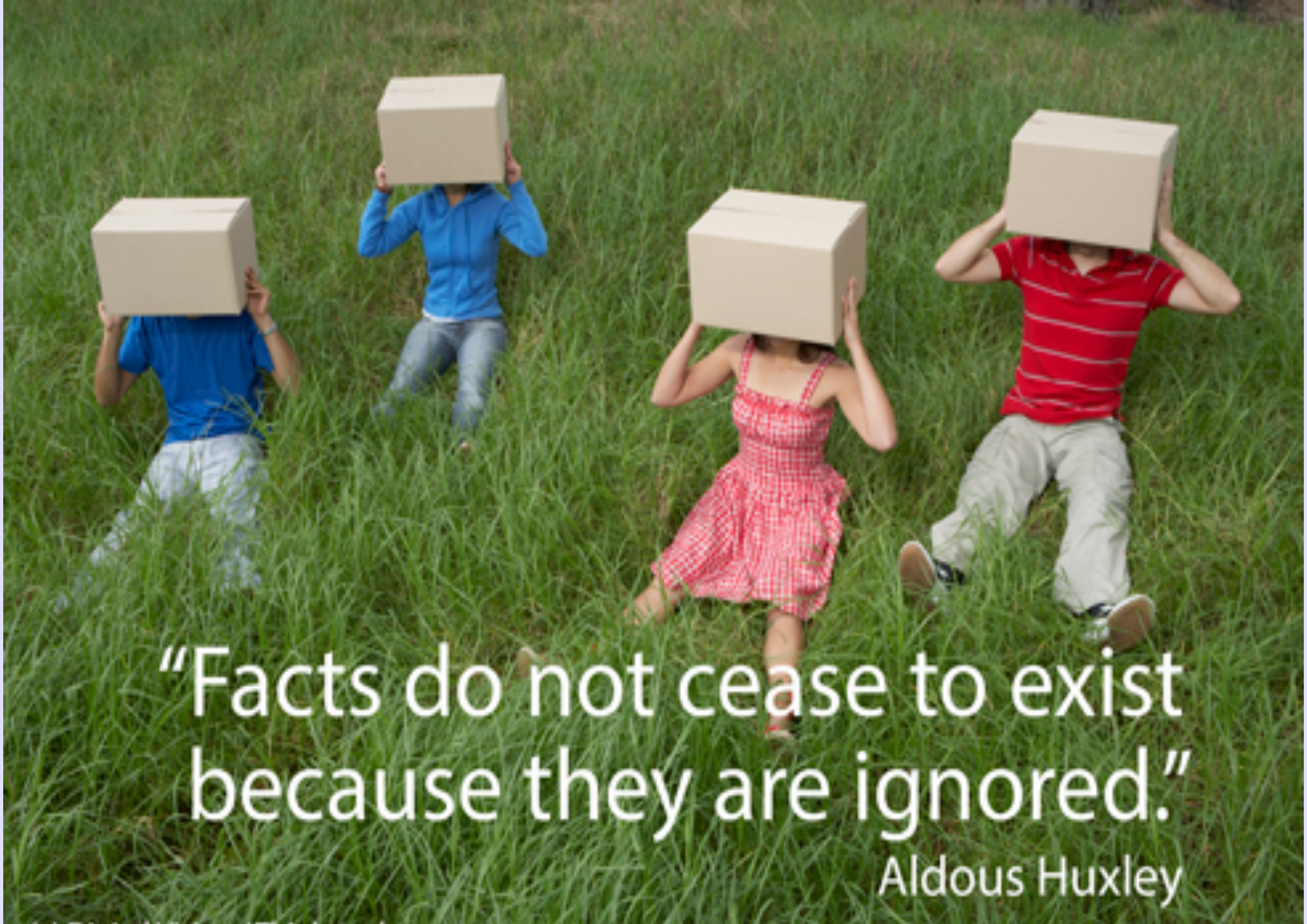
Figure 2. Annual costs for hospitalization, disability payments, and micronutrients. Hospitalization costs are based on data from Canadian Institute for Health Information (CIHI). Costs for provincial disability payments and self-funded micronutrients are patient-reported estimates. *Disability payments continued until 2009 as explained in the text.



ANOTHER SOCIAL IMPLICATION: THE STIGMA OF MENTAL ILLNESS

- 1910 *People's Home Library*: source of in-depth practical knowledge for North Americans; 500 pages
- guided families; health care providers not easily accessed; treatments for everything from minor burns up to TB and heart disease
  - *The number one cause of acquired insanity was:*

"imperfect nutrition"


“Facts do not cease to exist
because they are ignored.”
Aldous Huxley

How to reach me

KAPLAN@UCALGARY.CA

- Links to various lectures on Nutrition and Mental Health, join my email updates list
- Ask about the two donor-advised charitable funds I manage, over $700,000 raised and distributed to support young scientists wanting to study nutritional treatment of mental disorders
- Can also follow: www.Facebook.com/NutritionandMentalHealth

THE MADDY TRIAL
"MICRONUTRIENTS IN ADD YOUTH"

- **Multi-centre international trial: Oregon Health & Science Univ, Ohio State Univ, and *Univ of Lethbridge***
- **Funded by my two charitable funds *in part***
- **Children aged 6-12 years, will be assessed for ADHD symptoms**
- **Dr. Brenda Leung, Emmy Droog Chair in Complementary and Alternative Health Care in your Faculty of Health Sciences, University of Lethbridge…….**