Diet and Cancer

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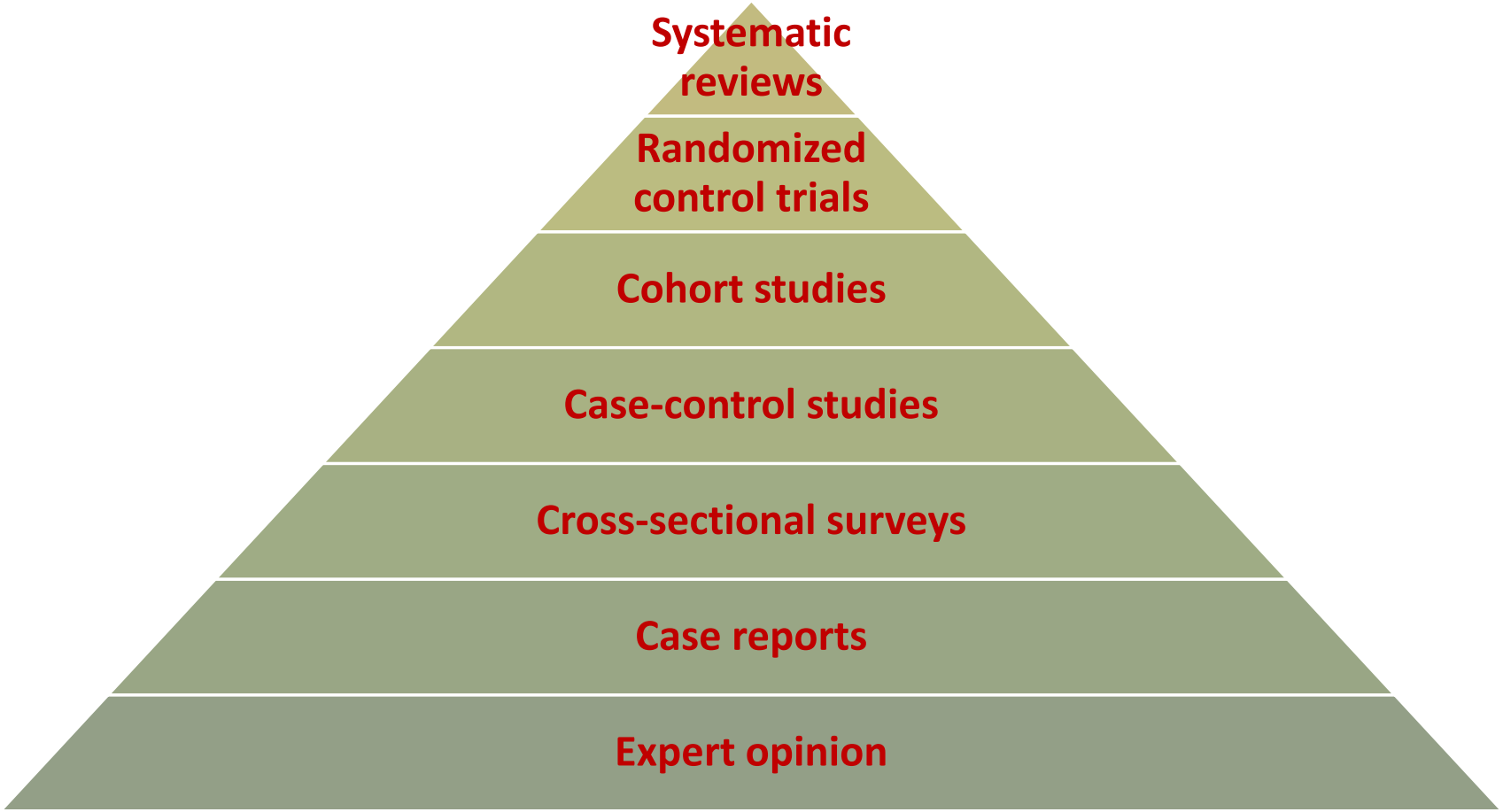
NATIONAL® CANCER INSTITUTE

Outline

- How do we know whether/how diet is related to cancer?
- What more do we need to know?
- Why is multidimensionality important, and what are the key questions?
- Why is dynamism important, and what are the key questions?
- Wrap-up

How do we know whether/how diet is related to cancer?

Hierarchy of evidence



Systematic evidence review criteria

Is the review based on a focused question that is adequately formulated and described?

Were eligibility criteria for included and excluded studies predefined and specified?

Did the literature search strategy use a comprehensive, systematic approach?

Were titles, abstracts, and full-text articles dually and independently reviewed for inclusion and exclusion to minimize bias?

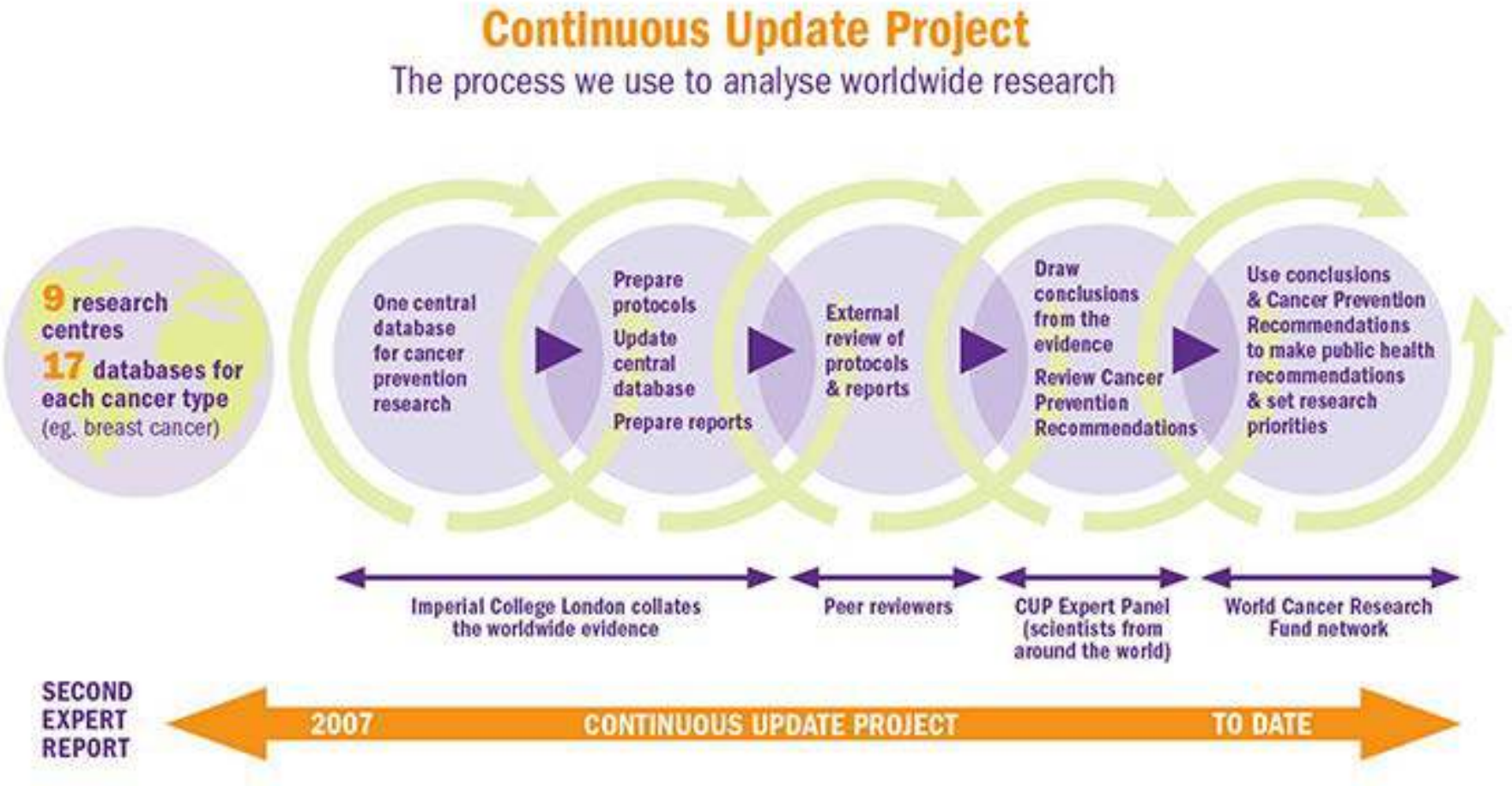
Was the quality of each included study rated independently by two or more reviewers using a standard method to appraise its internal validity?

Were the included studies listed along with important characteristics and results of each study?

Was publication bias assessed?

Was heterogeneity assessed?

WCRF/AICR follows established criteria



http://www.aicr.org/reduce-your-cancer-risk/

WCRF/AICR cancer prevention recommendations

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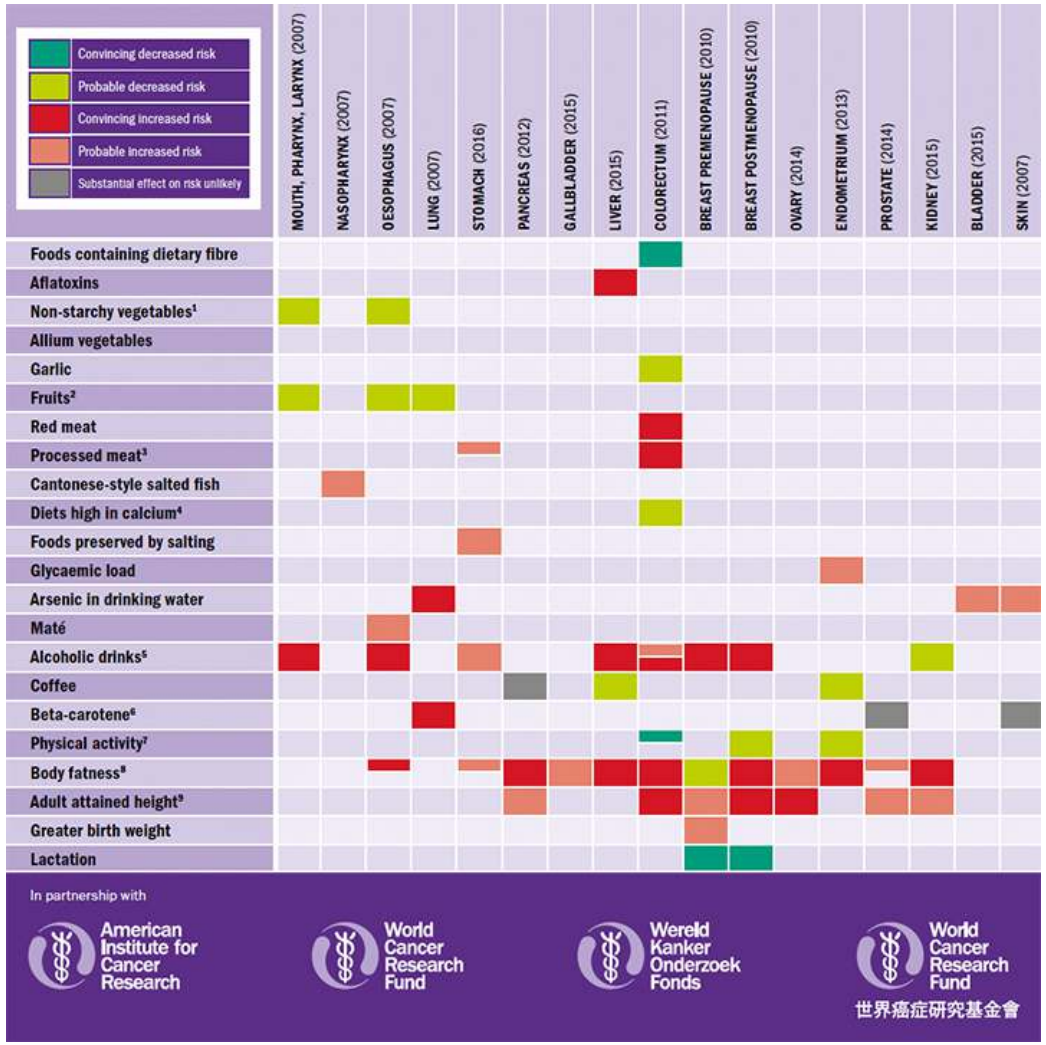
Convincing decreased risk
Probable decreased risk
Convincing increased risk
Probable increased risk
Substantial effect on risk unlikely
MOUTH, PHARYNX, LARYNX (2007)
NASOPHARYNX (2007)
OESOPHAGUS (2007)
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KIDNEY (2015)
BLADDER (2015)
SKIN (2007)
Foods containing dietary fibre
Aflatoxins
Non-starchy vegetables[1]
Allium vegetables
Garlic
Fruits[2]
Red meat
Processed meat[3]
Cantonese-style salted fish
Diets high in calcium[4]
Foods preserved by salting
Glycaemic load
Arsenic in drinking water
Maté
Alcoholic drinks[5]
Coffee
Beta-carotene[6]
Physical activity[7]
Body fatness[8]
Adult attained height[9]
Greater birth weight
Lactation
In partnership with
American Institute for Cancer Research
World Cancer Research Fund
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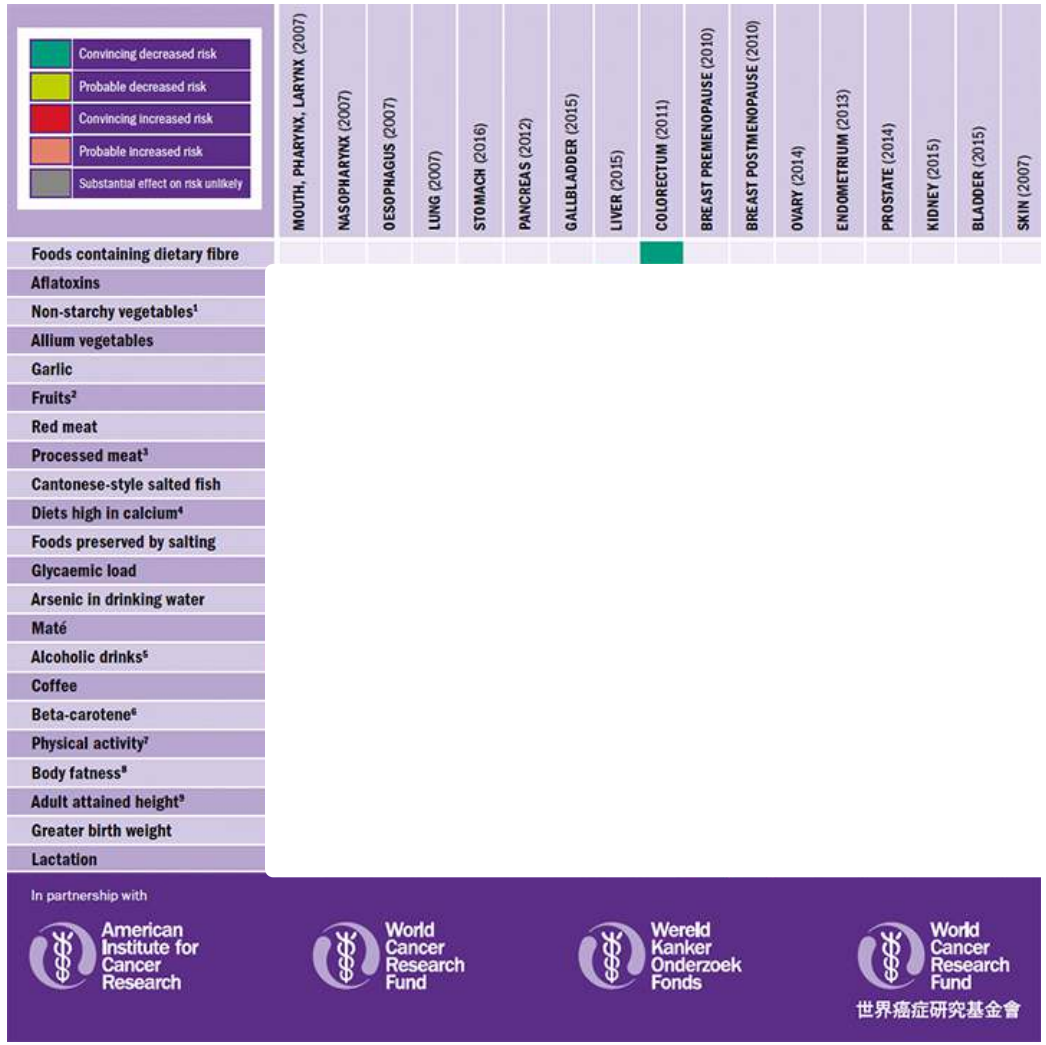
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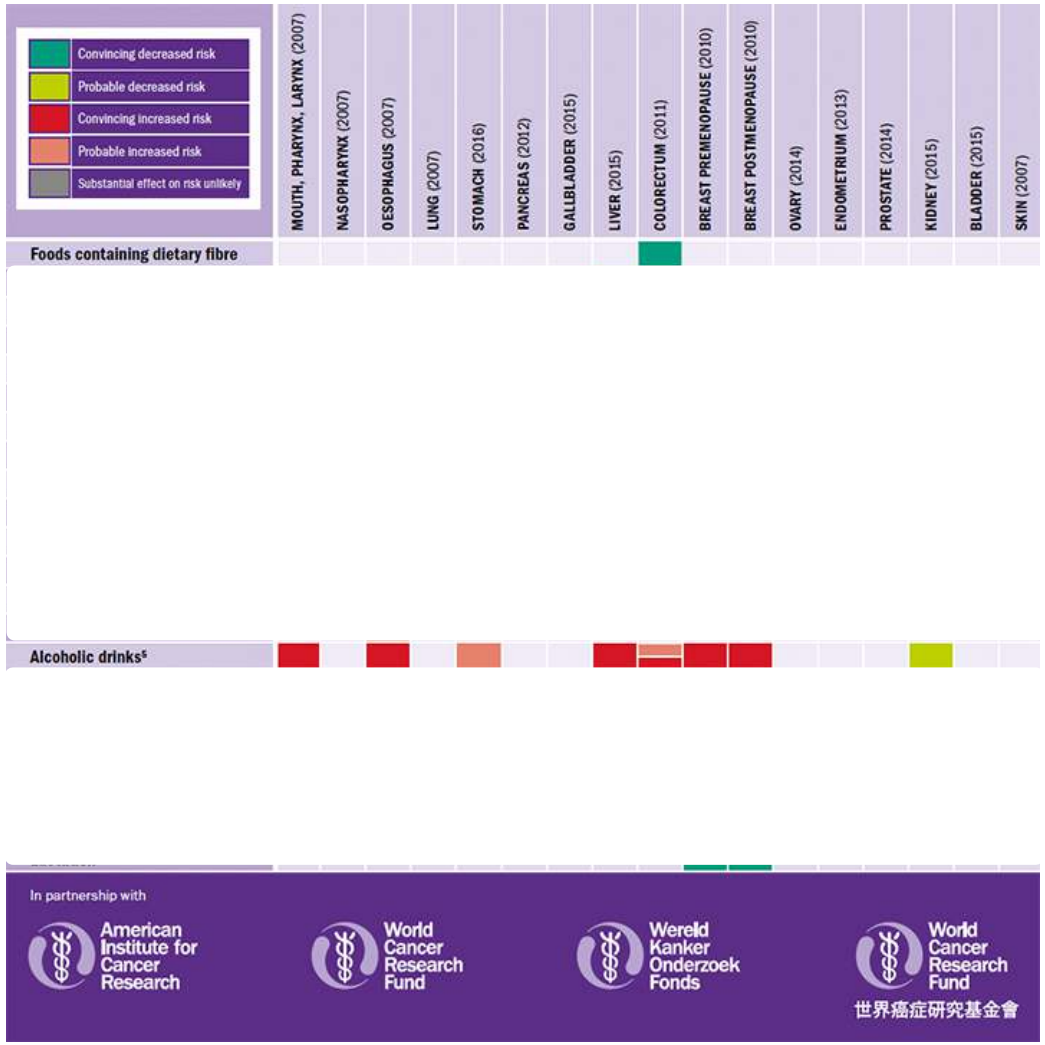
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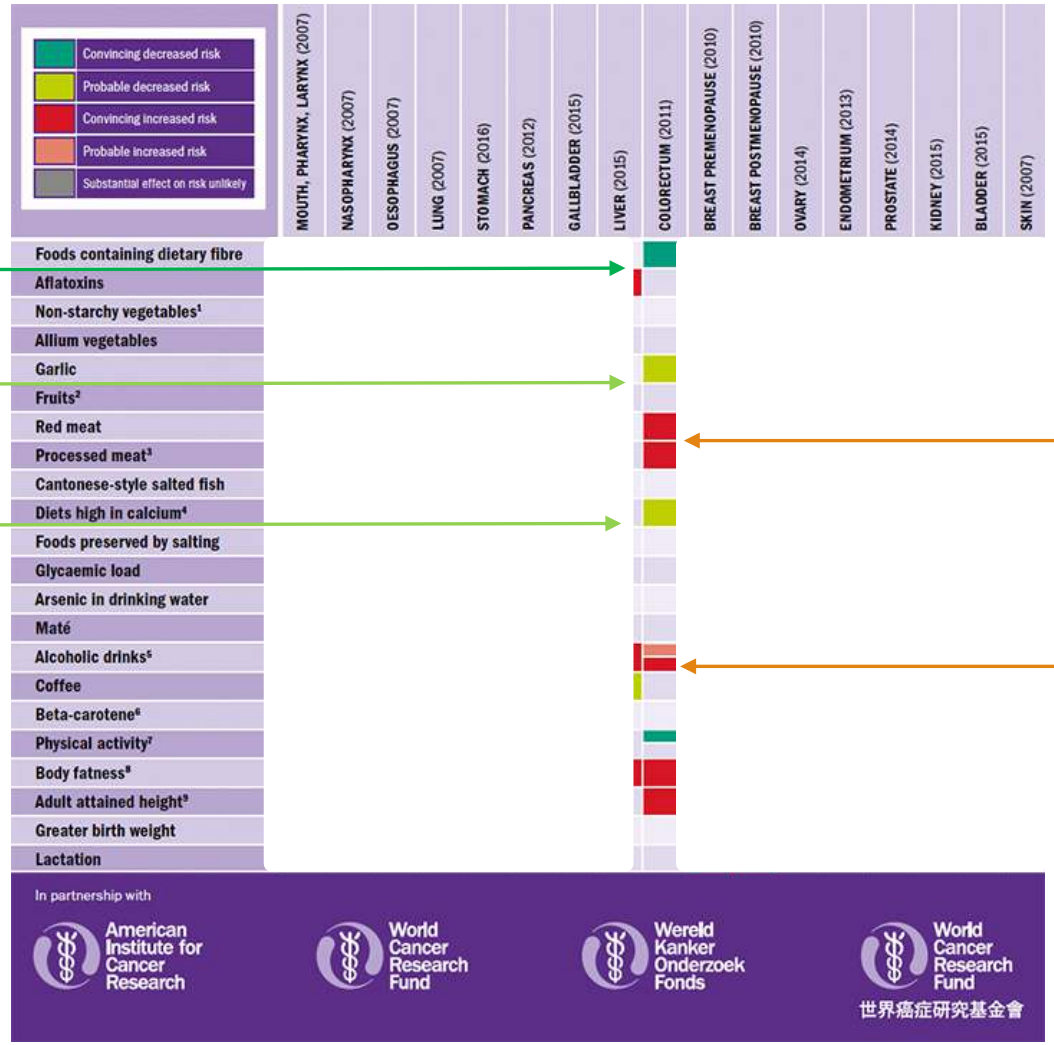
Fiber reduces risk

Garlic probably reduces risk

Calcium probably reduces risk



Red meat and processed meat increase risk

Alcohol increases risk

What more do we need to know?

"…even a small insect is much more complicated than a star, and… everything about humans is very complicated…"

Considering the confusion about diet, "It's not that the people working in those fields are less competent, it's that anything to do with humans and their behavior … is ***far more complicated than the cosmos****…"*

Lord Martin Rees, Cosmologist and Astrophysicist, *On Being,* November 21, 2013

Nutrition Evidence Library

2014

Definition of “dietary patterns”

“ . . . the quantities, proportions, variety, or combination of different foods, drinks, and nutrients (when available) in diets, and the frequency with which they are habitually consumed”

Further extend this definition to include:

Multidimensionality

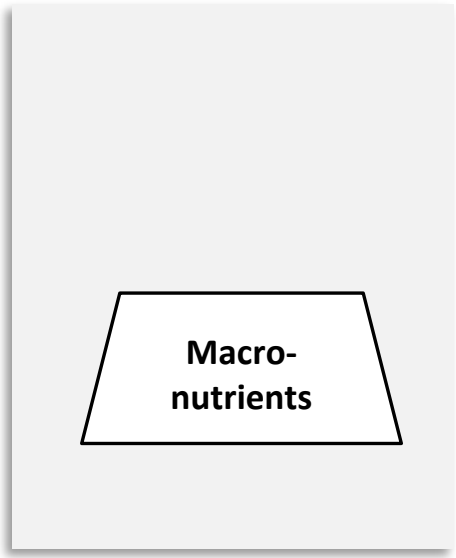
- Diet is a complex exposure: it is multilayered and multidimensional

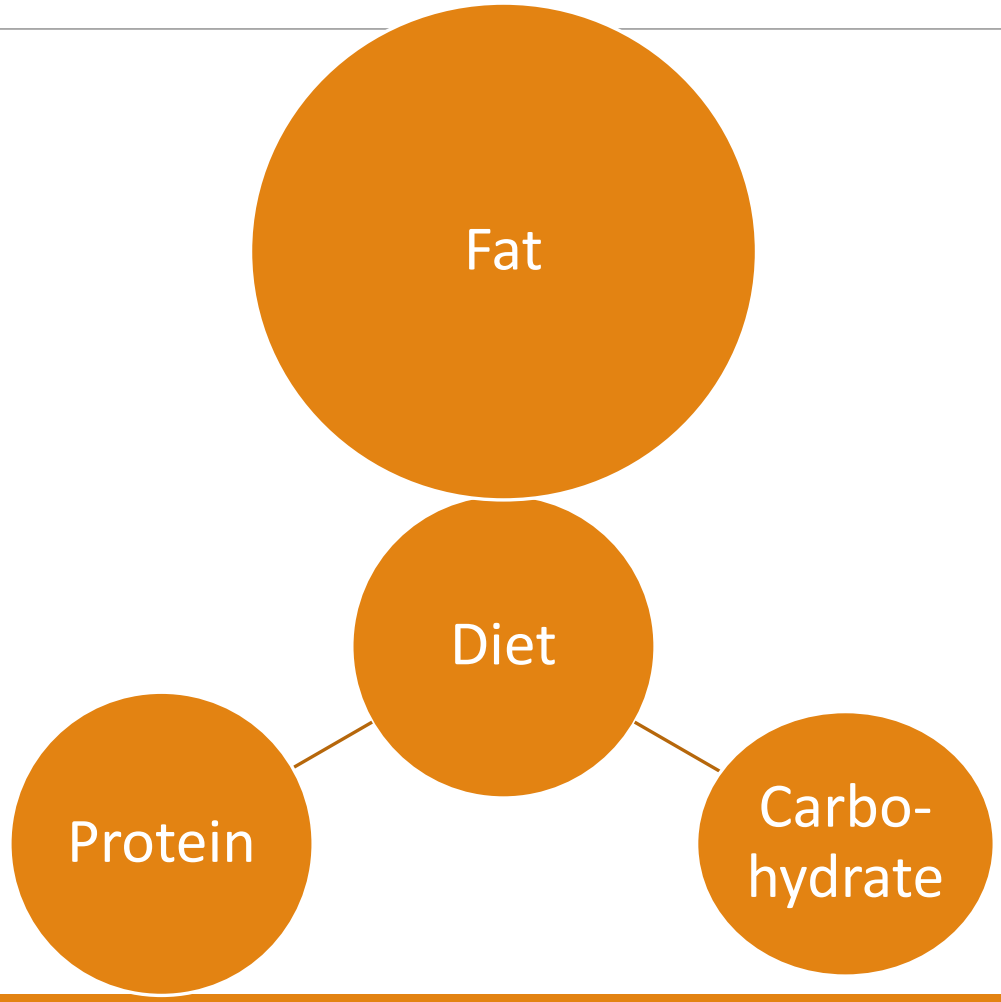
Dynamism

- Diet is a dynamic exposure : it varies over time, at both shorter and longer intervals

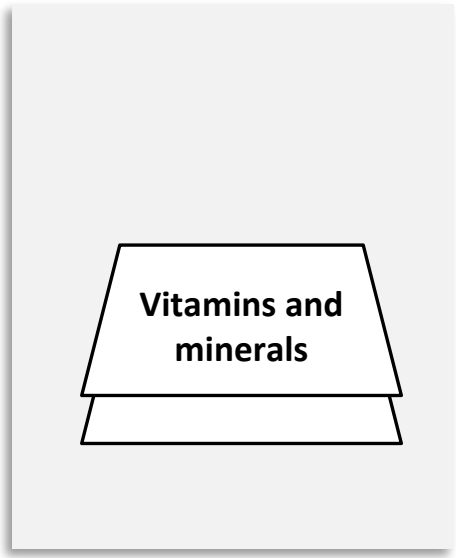
Why is multidimensionality important?

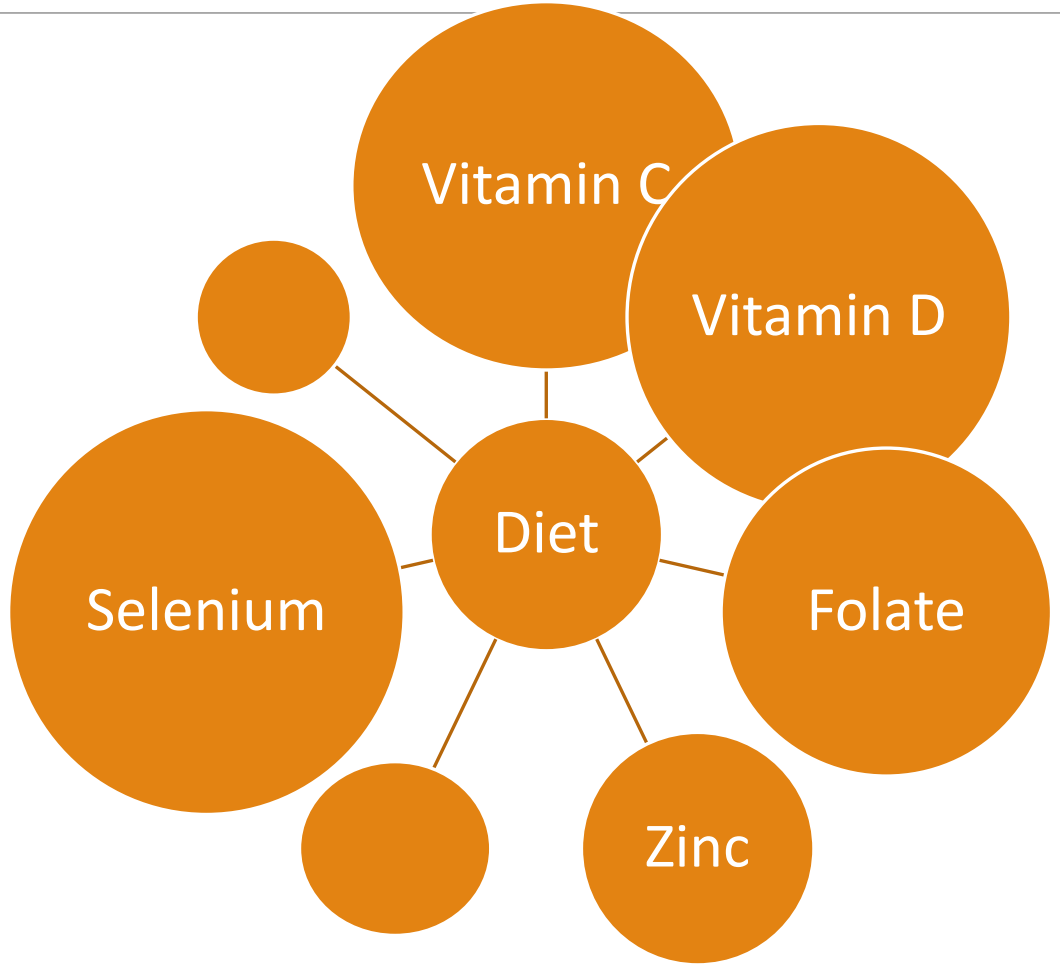
Diet is multidimensional





Diet is multidimensional





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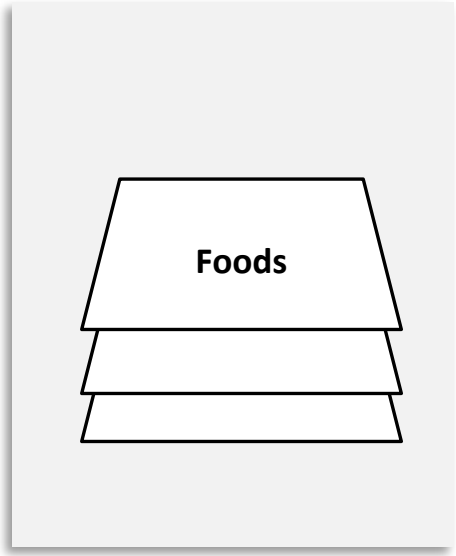

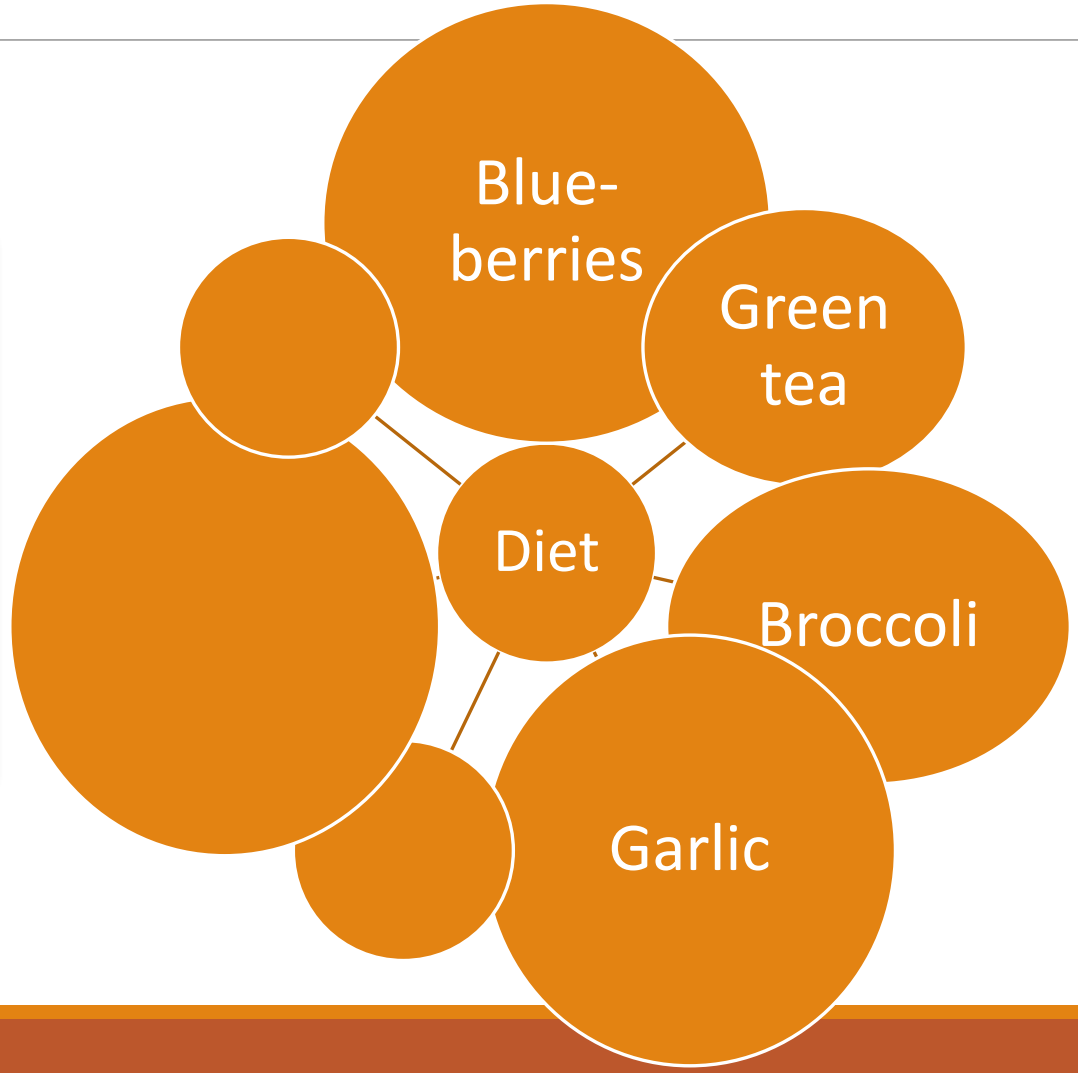

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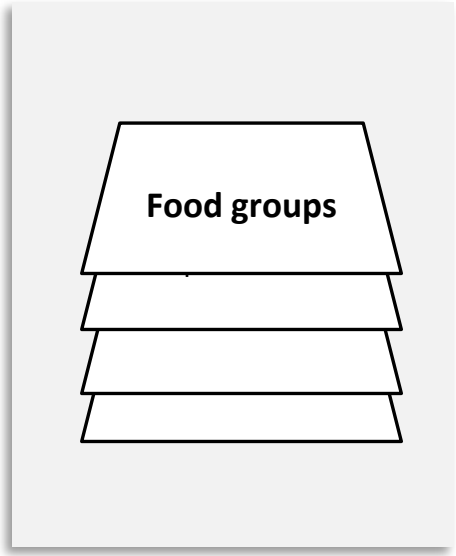

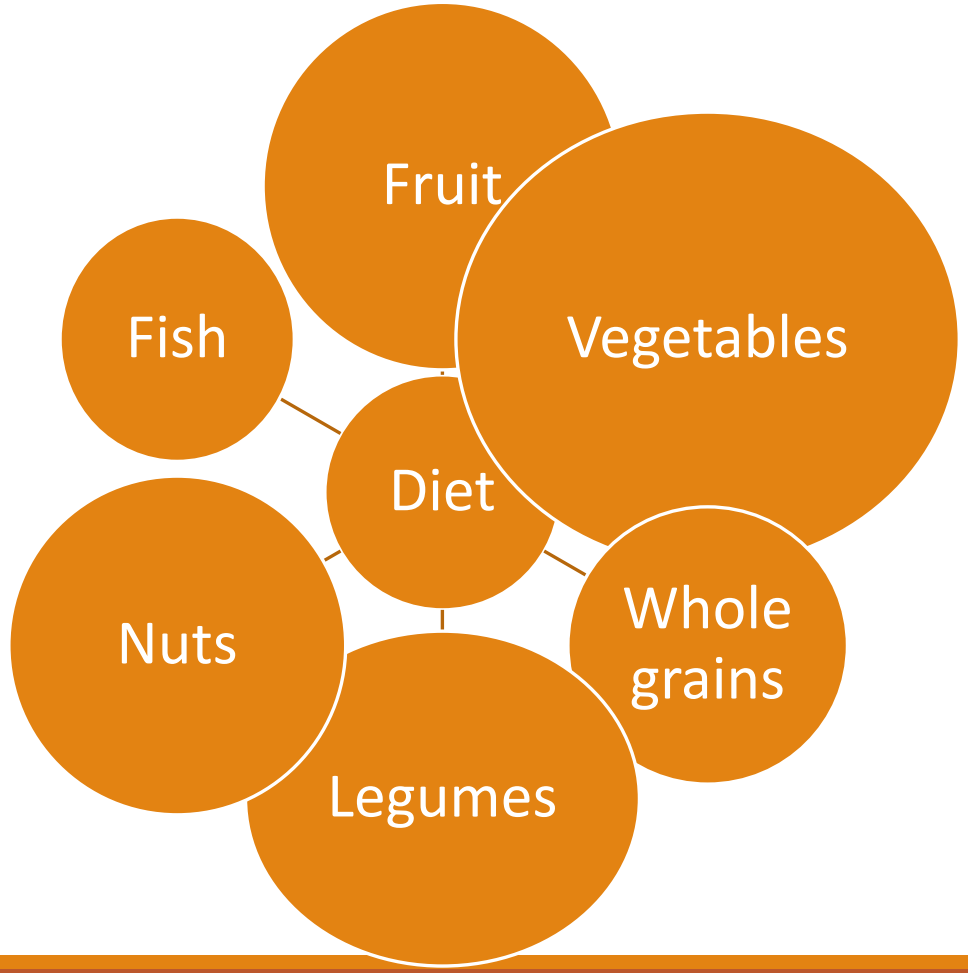

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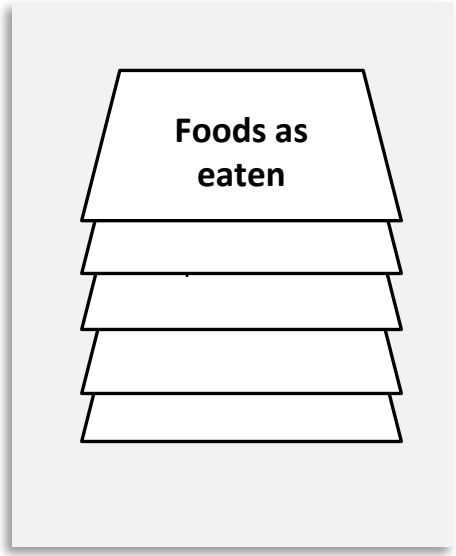

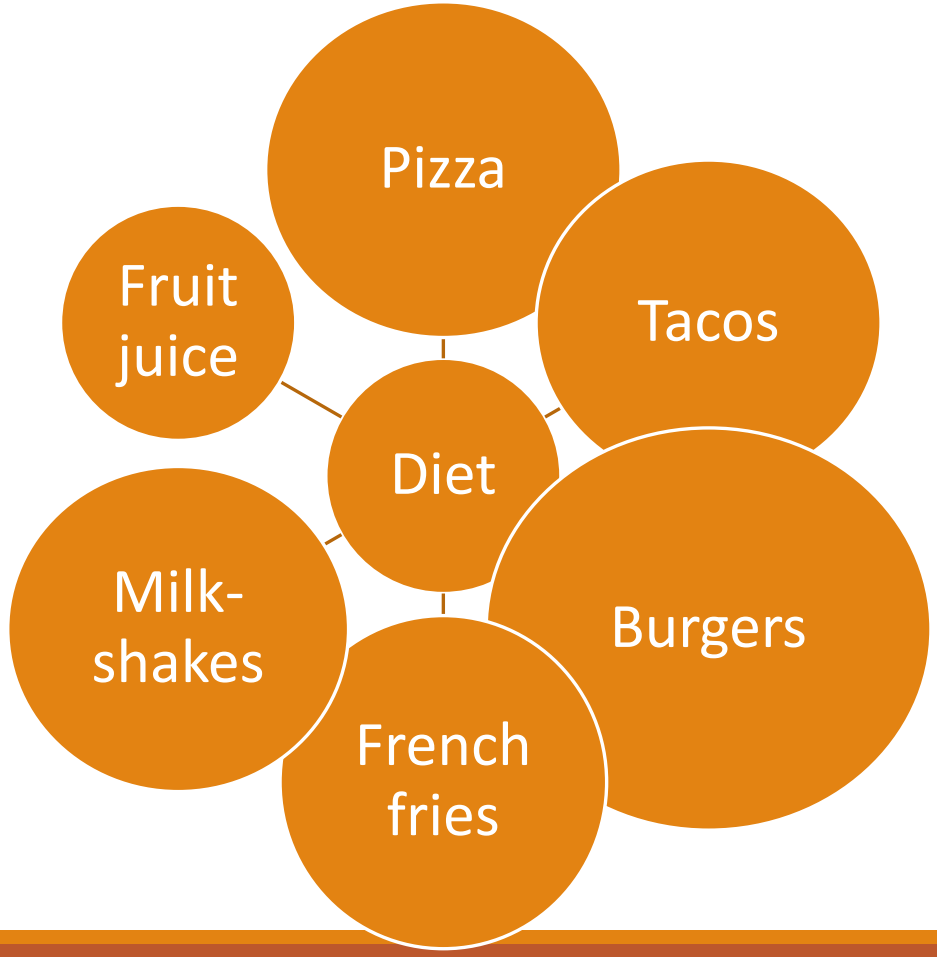

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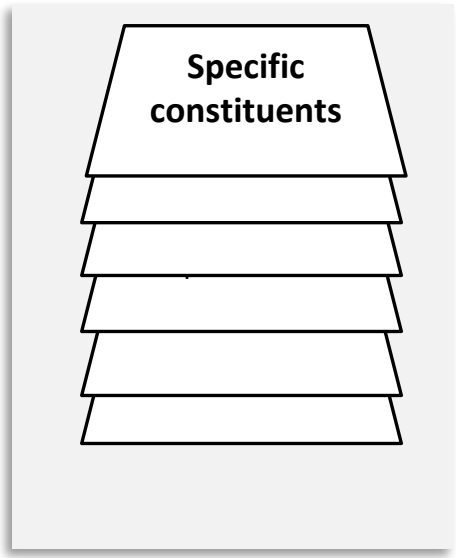
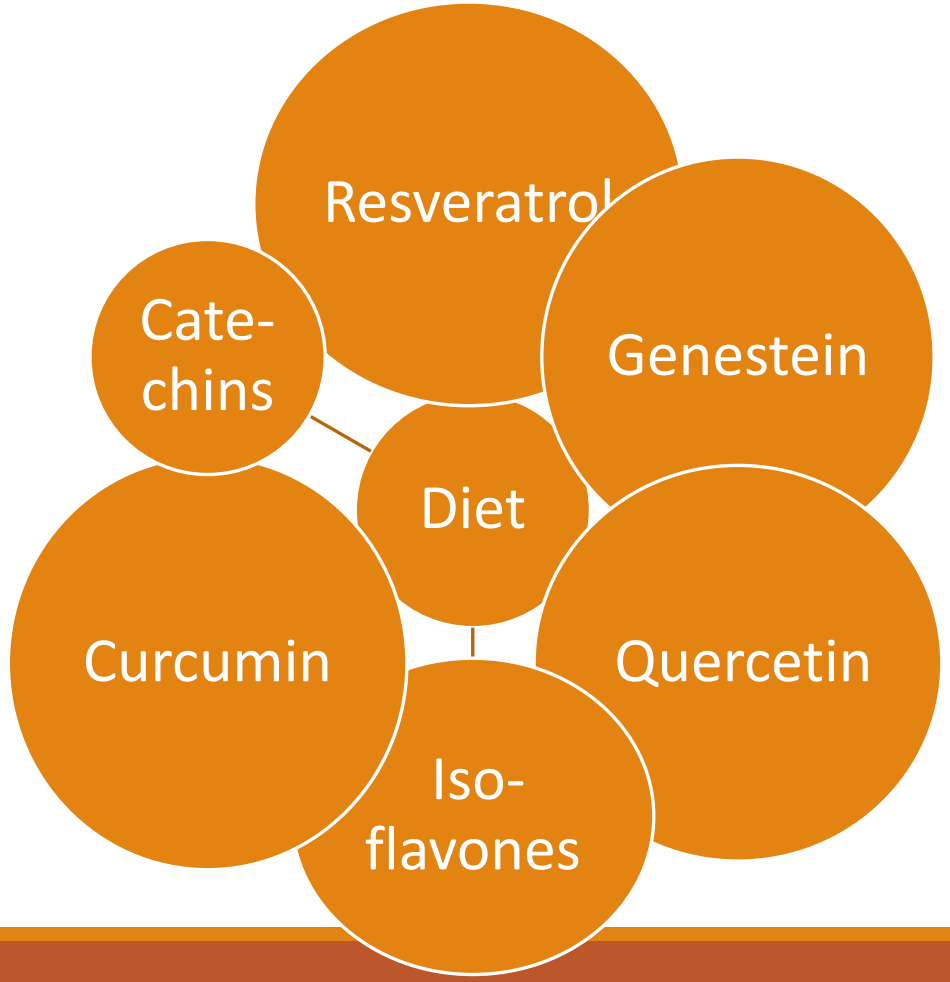
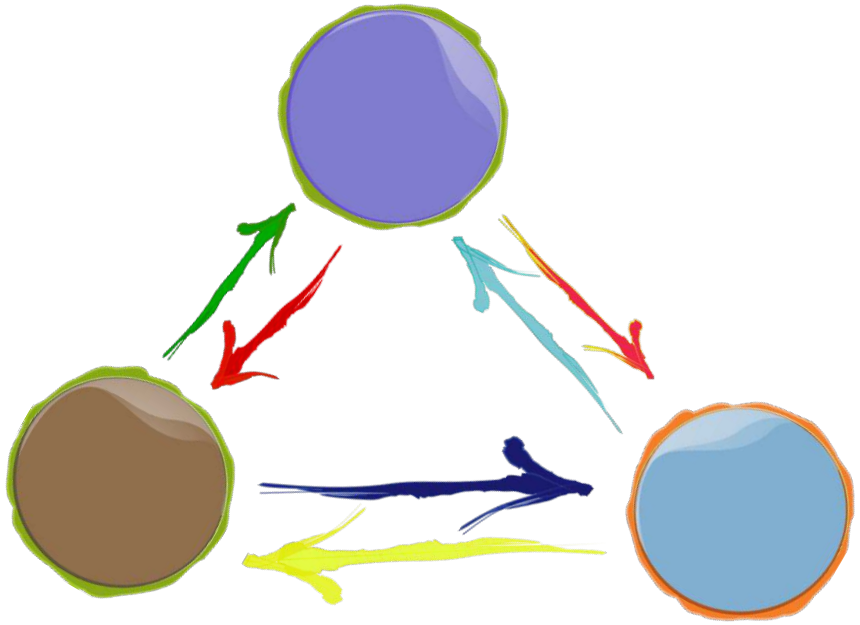




Multiple dimensions compound complexity

SYNERGY

INTERACTIONS



What are the key questions regarding multidimensionality?

Selective Diets

(e.g., Vegetarian)

Who are the vegetarians?

Exclude

- Meat
- Fish
- Poultry
- (Eggs)
- (Milk)

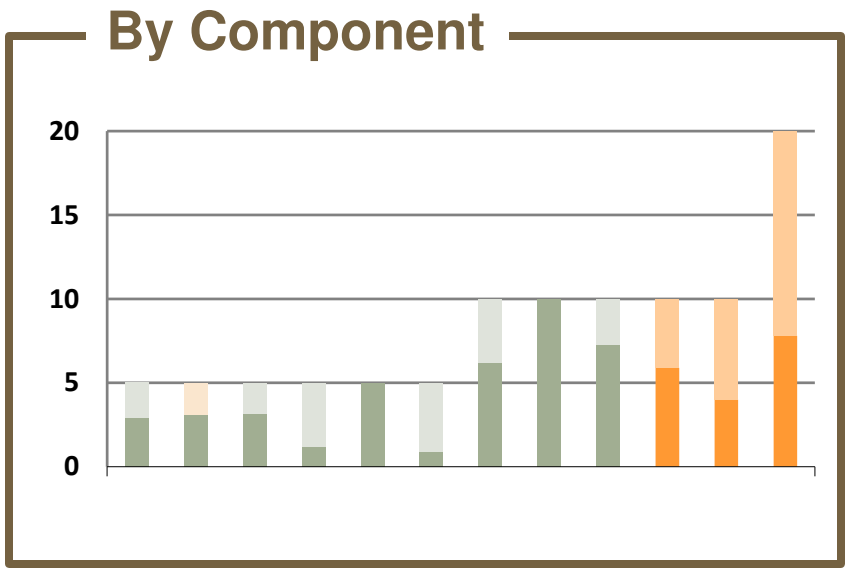
Include

- Fruits?
- Vegetables?
- Whole grains?
- Refined grains?
- Added sugars?
- Solid fats?

Indexes/Scores

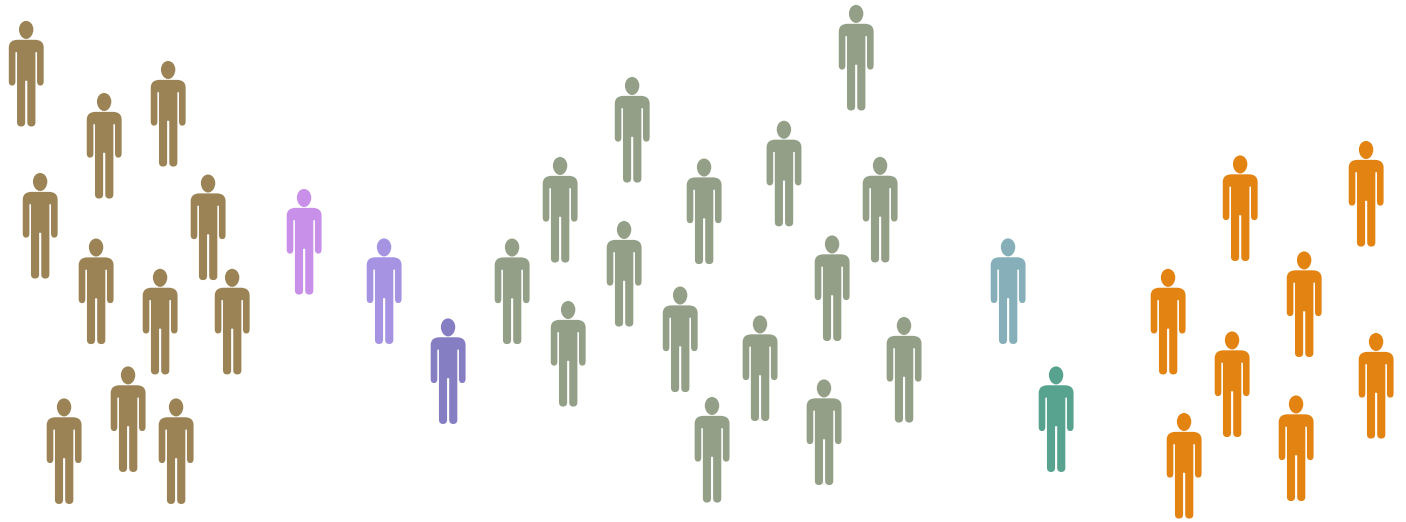
How close is the population to meeting a set of dietary recommendations?

Overall Diet Quality:
Total score = 58/100



Cluster Analysis

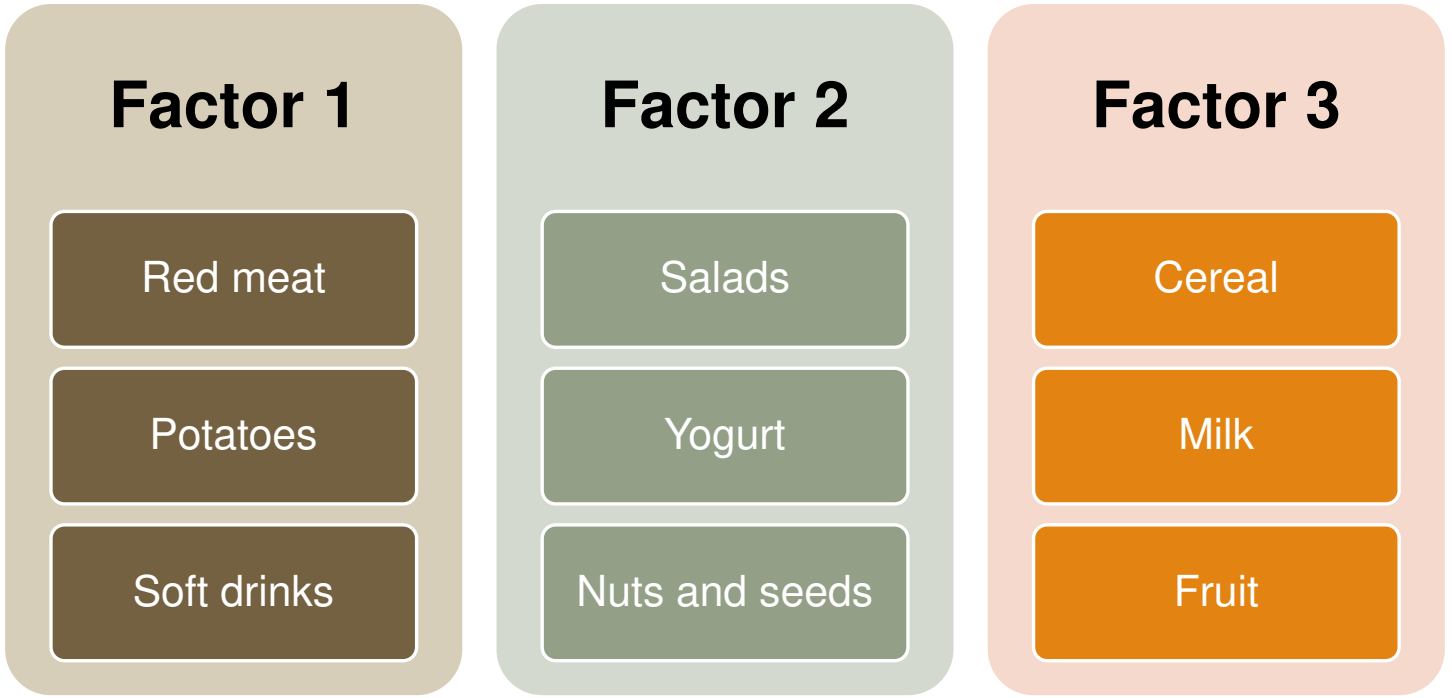
Are there groups of people with distinct eating patterns?



Groups **people** according to their dietary patterns

Factor Analysis

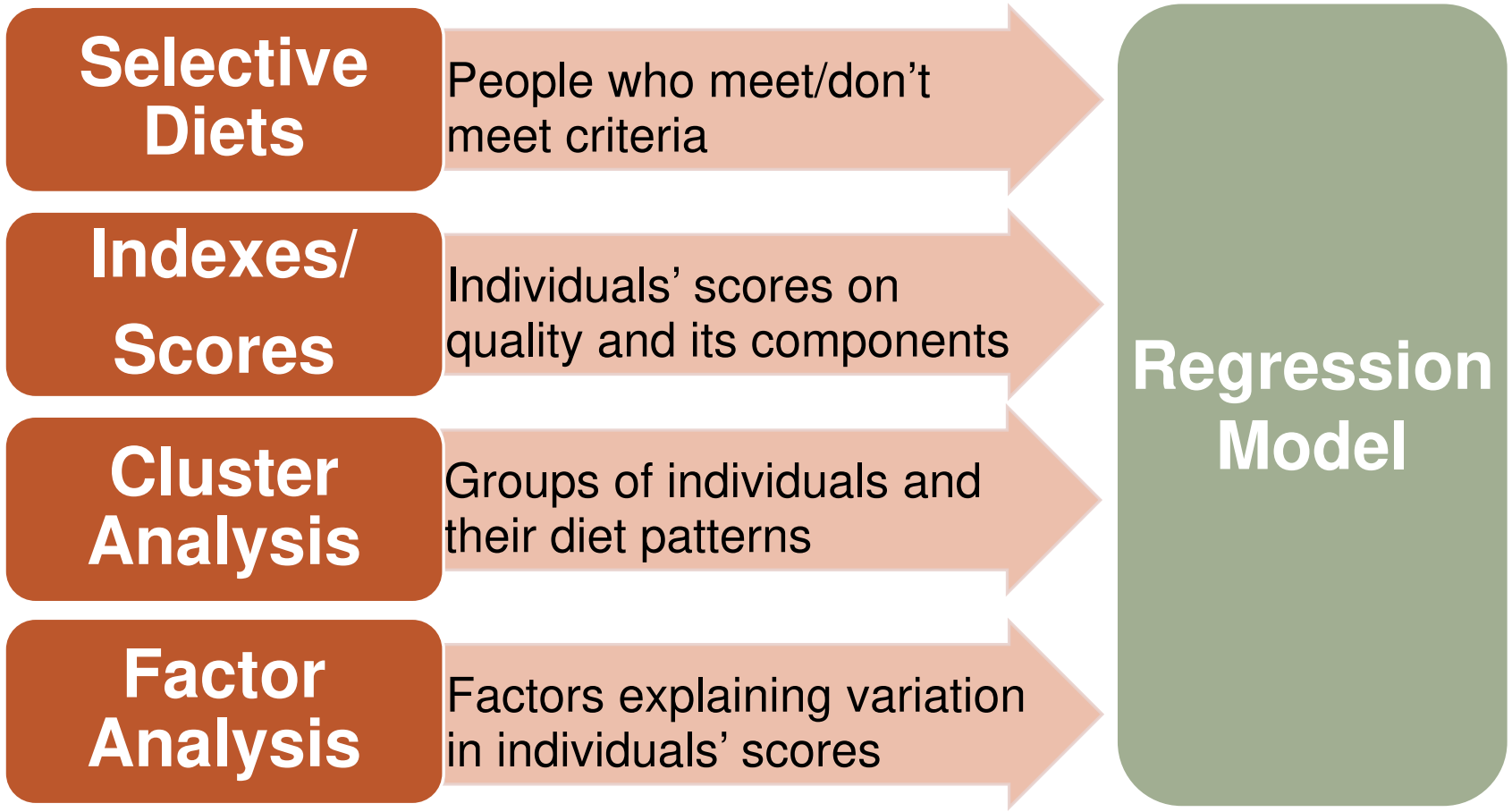
What elements of the diet track together in explaining variation in diets?



Identifies **elements of the diet** that track together

Hypothesis Testing

How do dietary patterns relate to health outcome?



Nutrition Evidence Library

What is the relationship between dietary patterns and risk of colorectal cancer?

2014

Findings This systematic review included 21 articles from prospective cohort studies and one article from an RCT published since 2000 that examined the relationship between dietary patterns and risk of colorectal cancer

The articles used diverse methodology to assess dietary patterns. Nine articles used indices and scores to assess dietary patterns, 10 articles used data-driven methods and three used other approaches.

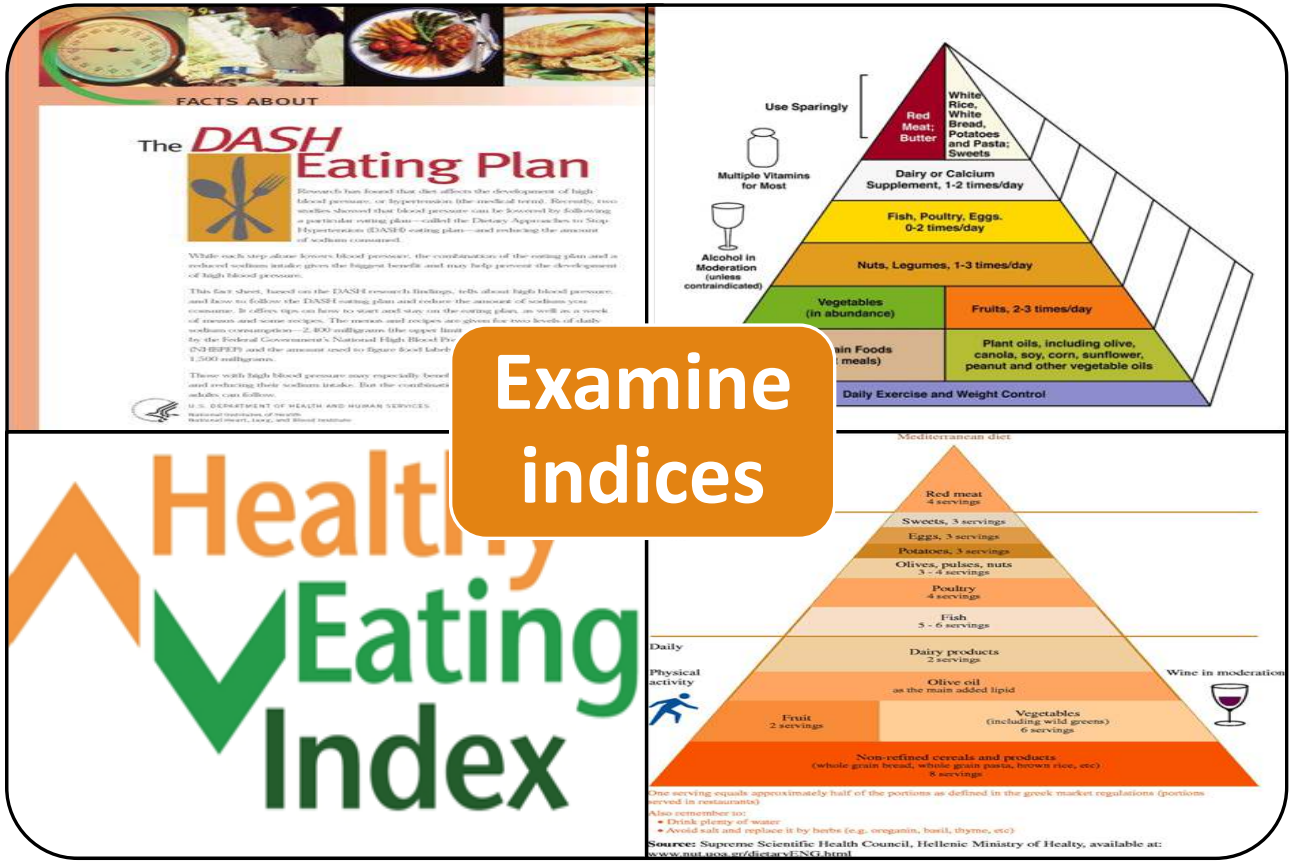
The dietary patterns examined in this systematic review were defined in various ways, making comparisons between articles difficult. However, despite general heterogeneity in this body of evidence, some protective dietary patterns emerged, particularly in articles where patterns were defined by index or score; articles using data-driven methods were less consistent.

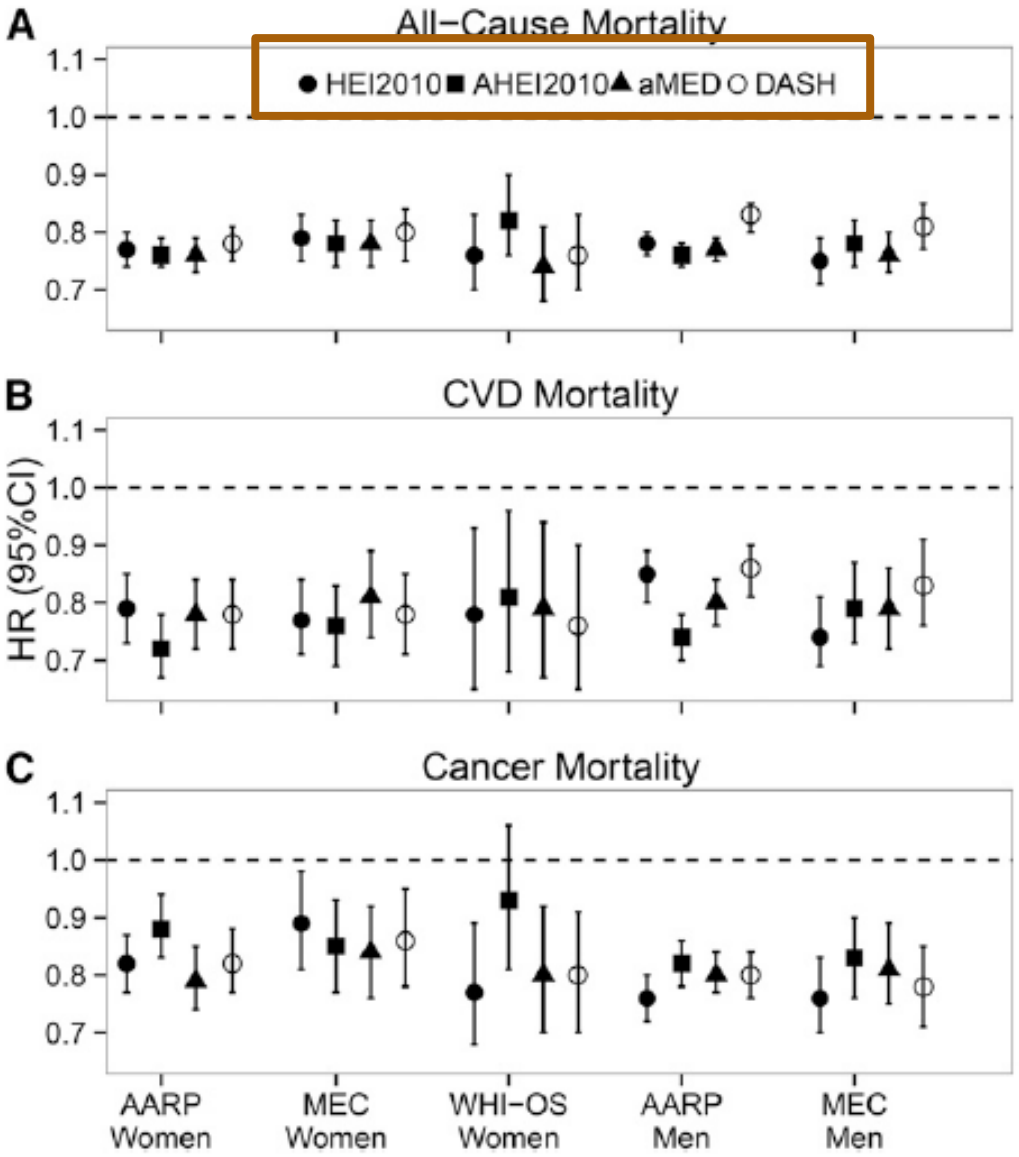
- Patterns emphasizing vegetables, fruits, fish and seafood, legumes, low-fat dairy, and whole grains were generally associated with reduced risk of colorectal cancer
- Patterns higher in red and processed meats; potatoes and French fries; and sodas, sweets, added sugars were generally associated with increased risk of colorectal cancer.

The relationship between dietary patterns and colorectal cancer risk often varied by sex and tumor location. Results based on analysis by sex were mixed, while analysis in tumor subgroups seemed to indicate that dietary patterns may be more strongly associated with tumor development in distal regions of the colon and rectum.

Dietary Patterns Methods Project

a systematic comparison of diet quality indices with mortality





NIH-AARP

Multiethnic Cohort

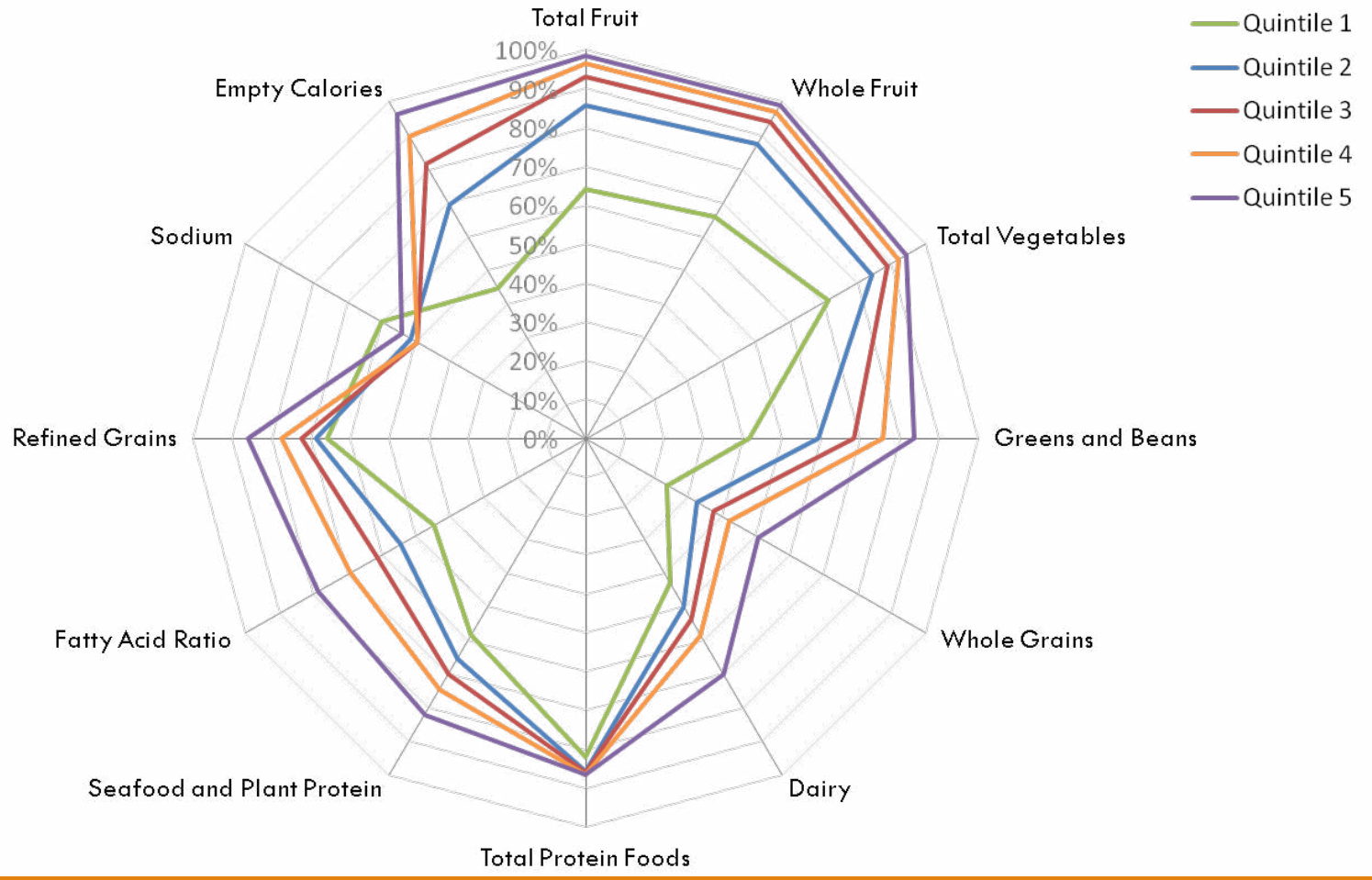
Women's Health Initiative

Adjusted for age, race/ethnicity, education, marital status, physical activity, smoking, energy, BMI, diabetes, alcohol (HEI & DASH), HRT (women only).

Liese AD et al, J Nutr, 2015

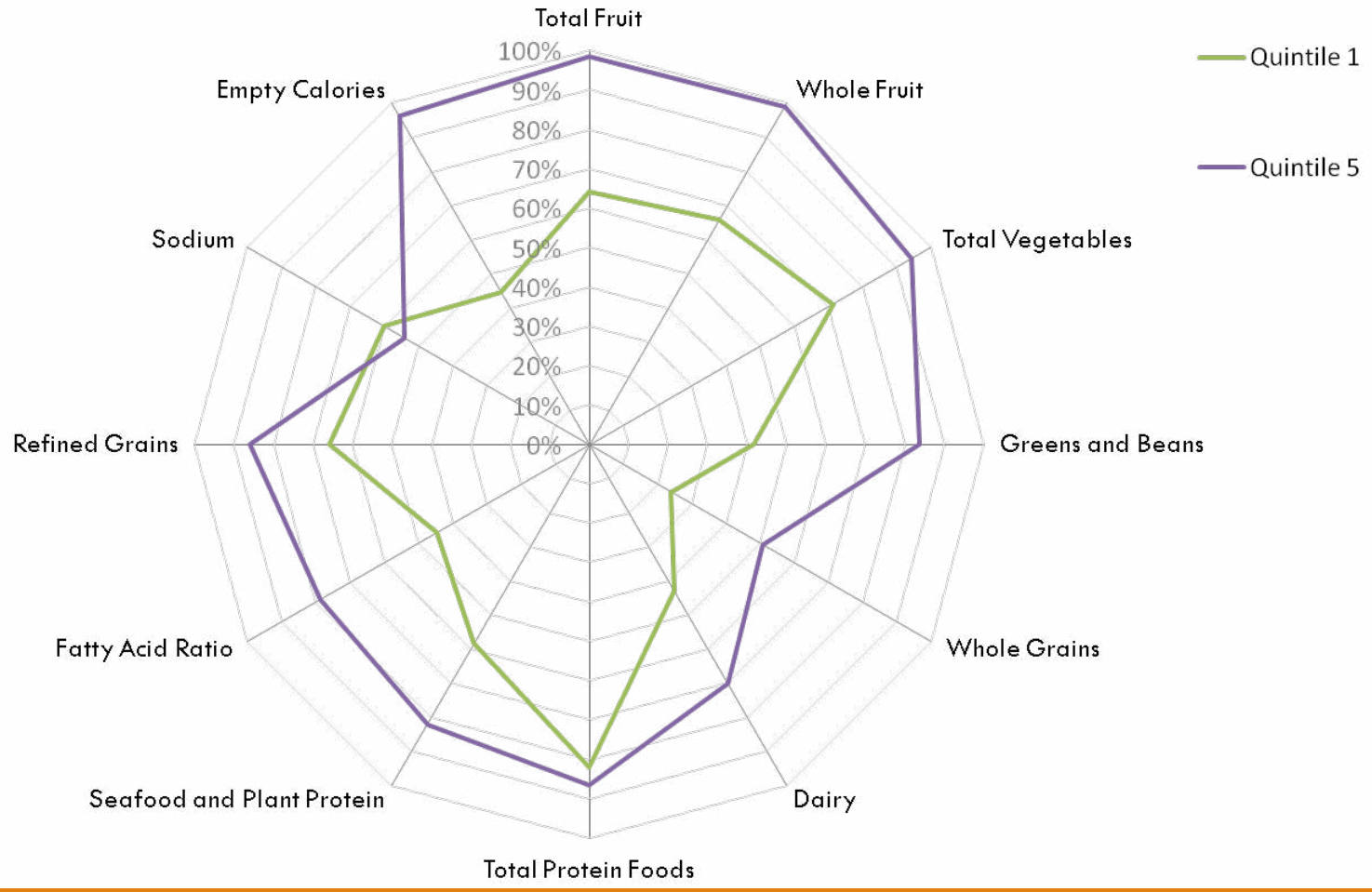
Perfect HEI score

Average HEI-2010 component scores, by quintile of total score



Data Source: AARP study, FFQ, total scores = 52, 63, 69, 74 and 80

Average HEI-2010 component scores, by quintile of total score

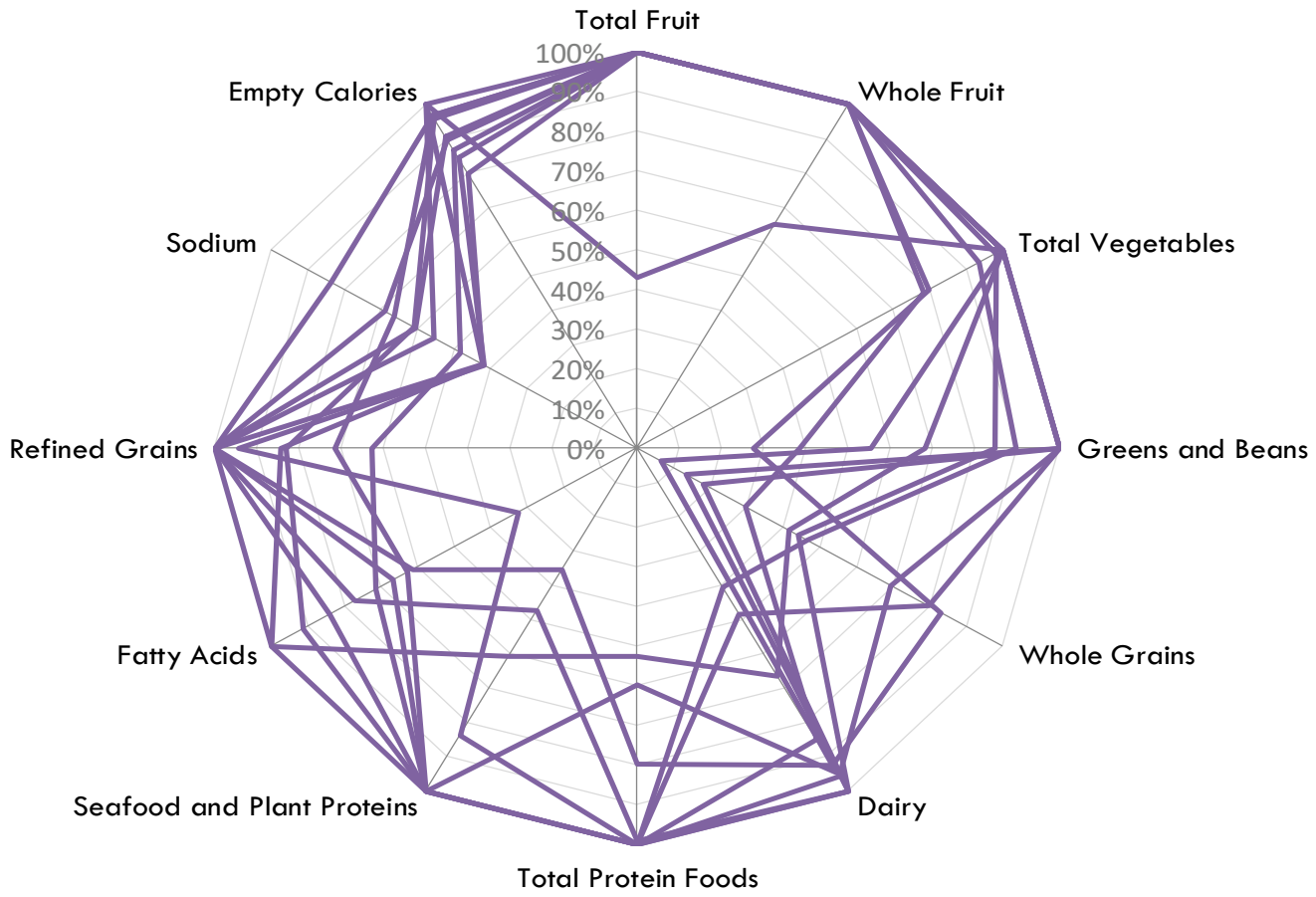


Data Source: AARP study, FFQ, total scores = 52 and 80

10 randomly selected females within quintile 1 of total HEI-2010 score

Data Source: AARP study, FFQ, range of total scores = 37-58

10 randomly selected females within quintile 5 of total HEI-2010 score

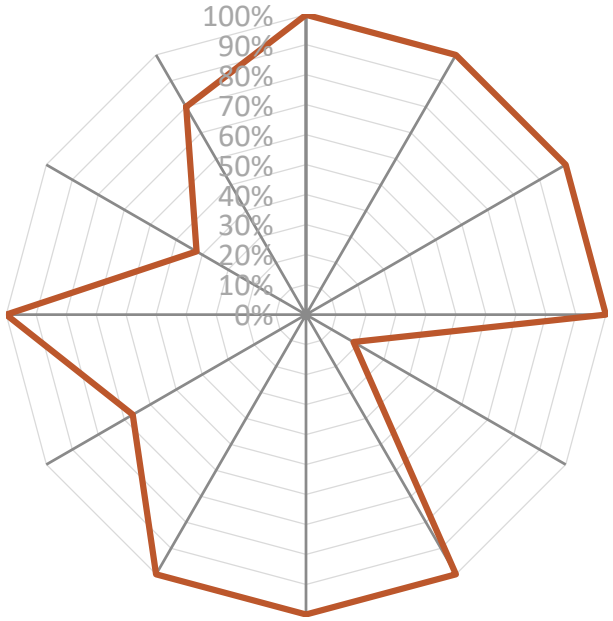


Data Source: AARP study, FFQ, range of total scores = 76-89

Patterning of indexes and hypothesis testing

Are different patterns of overall high quality equally protective?

Overall score=79



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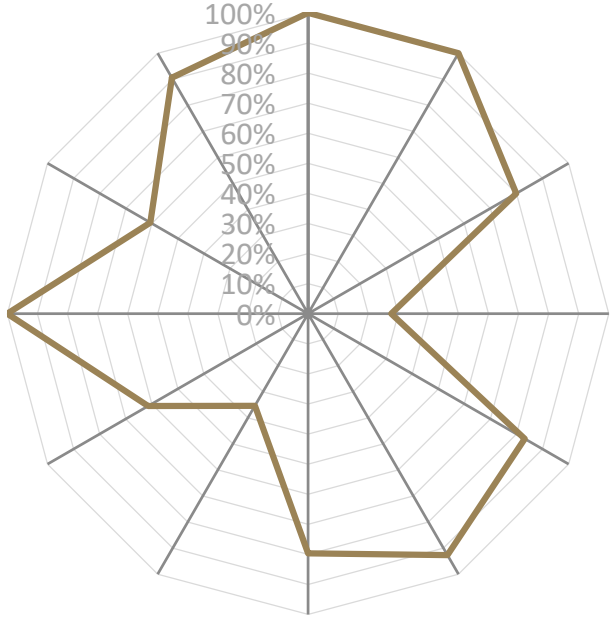
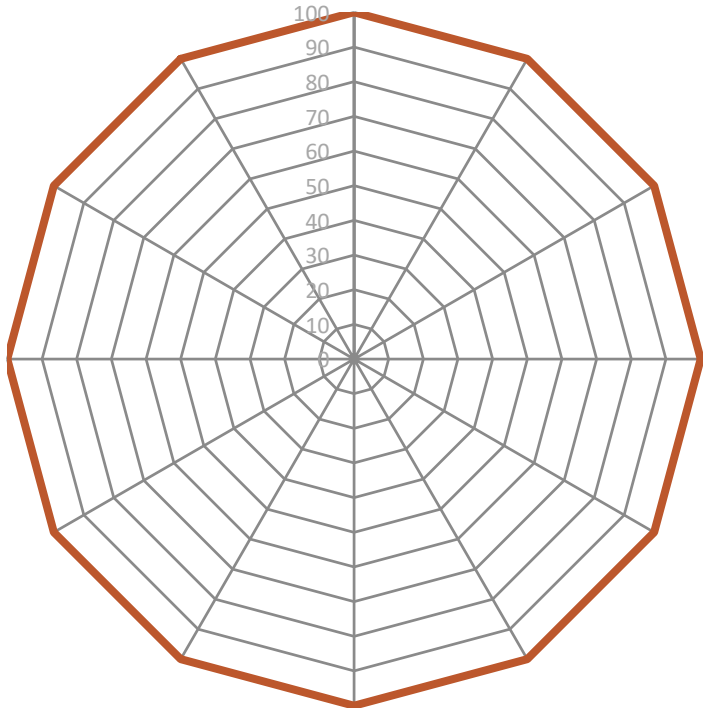


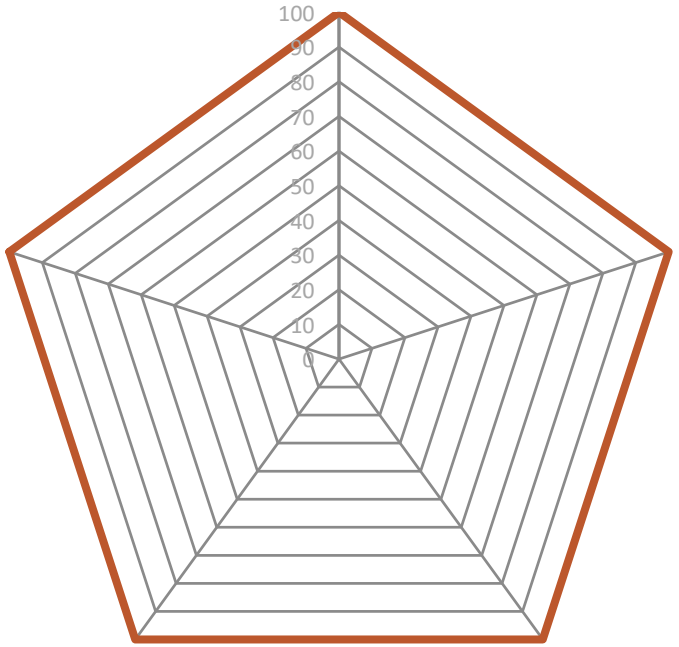
Indexes, modifications and hypothesis testing

Are all components of pattern necessary or is a subset sufficient?

Necessary?



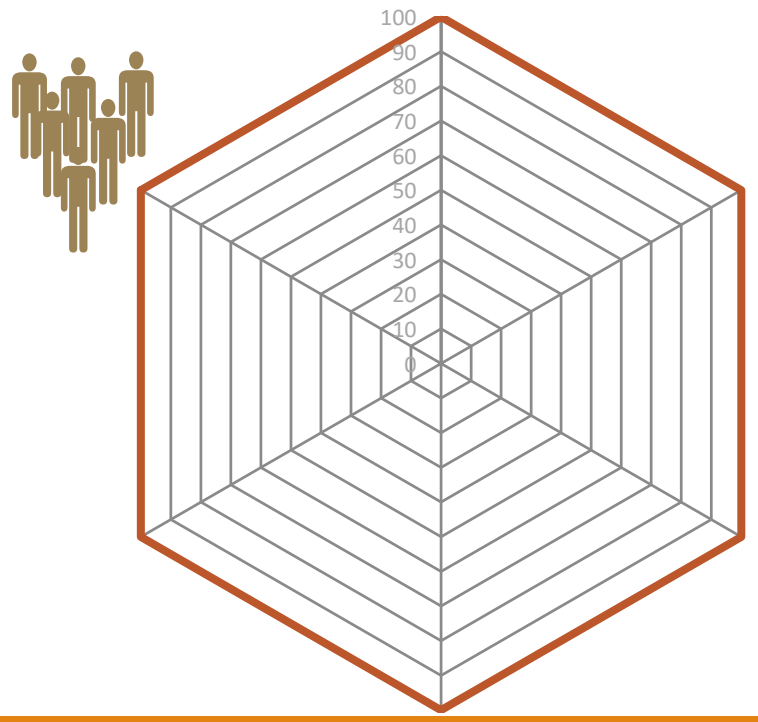
Sufficient?



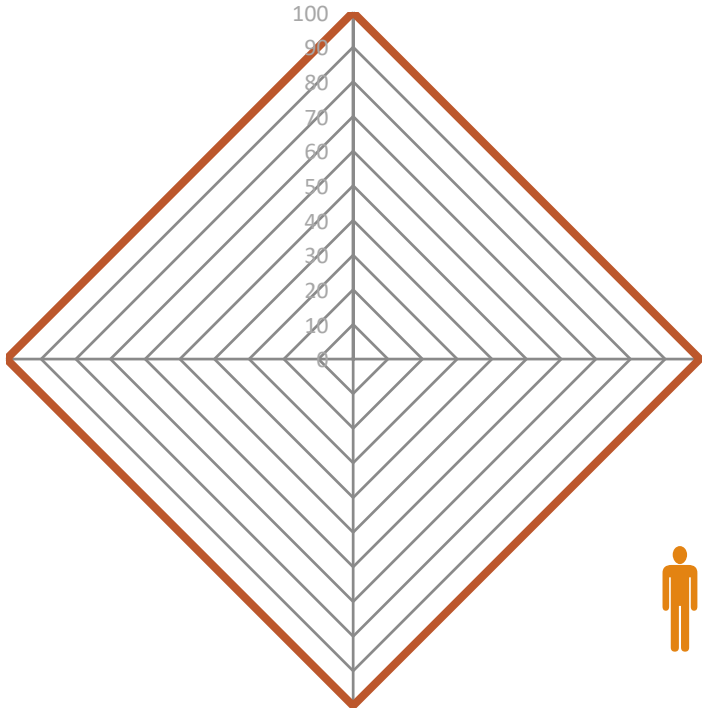
Sorting of population, indexes, and hypothesis testing

Is recommended pattern of eating optimal/necessary/ sufficient for everyone?

Ideal for some?

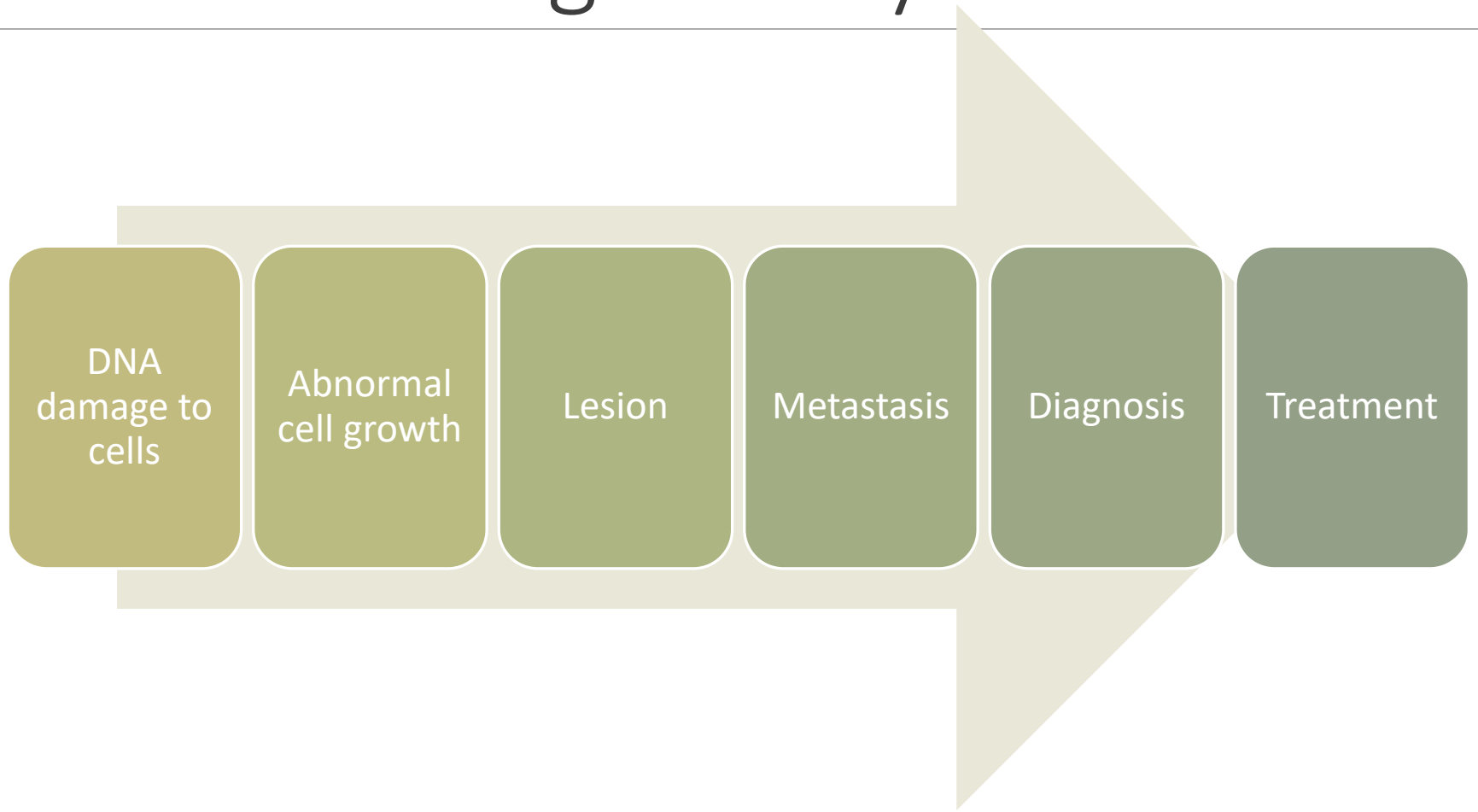


Ideal for others?

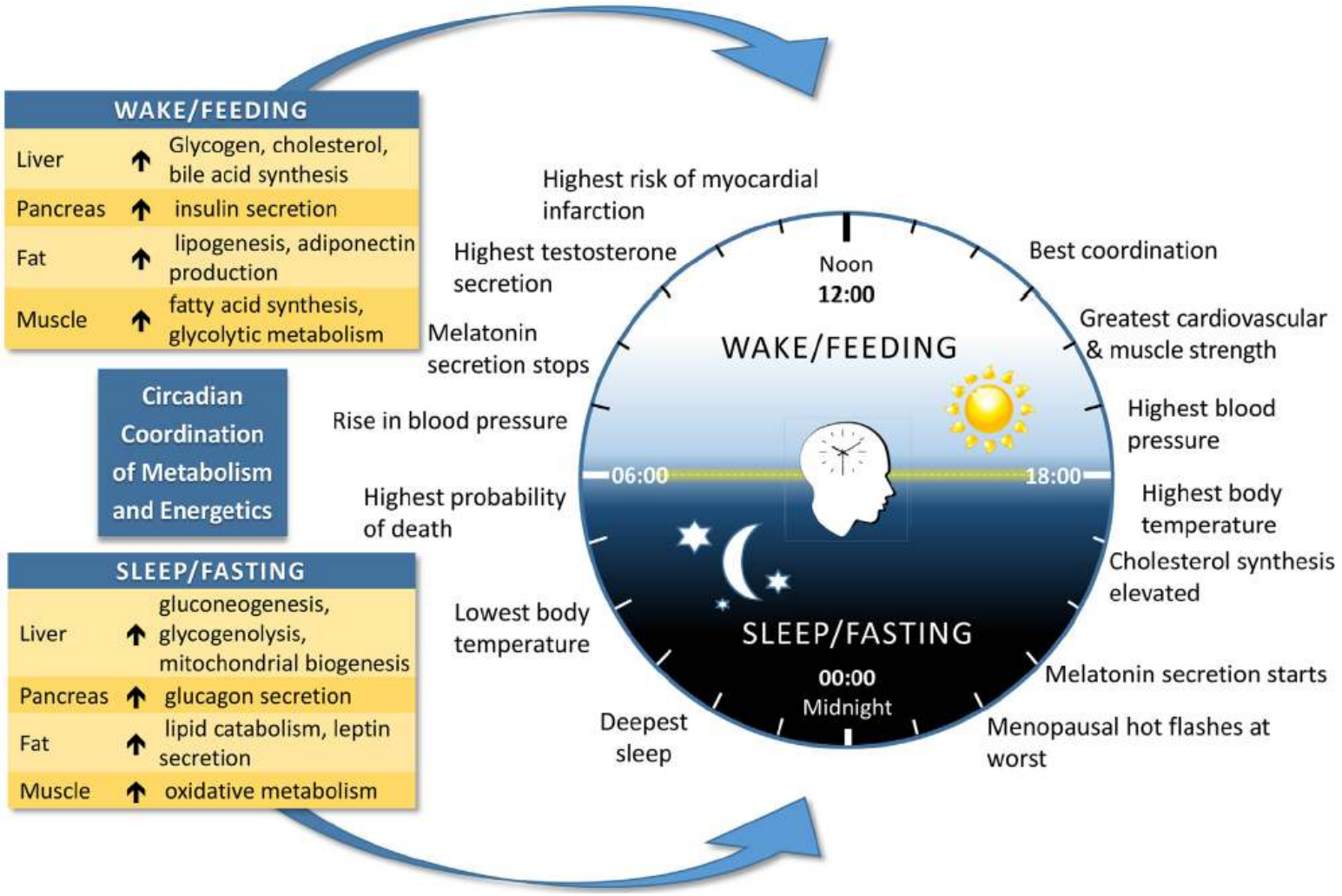


Why is dynamism important?

Cancer has a long latency



Cellular processes are influenced by diurnal variations

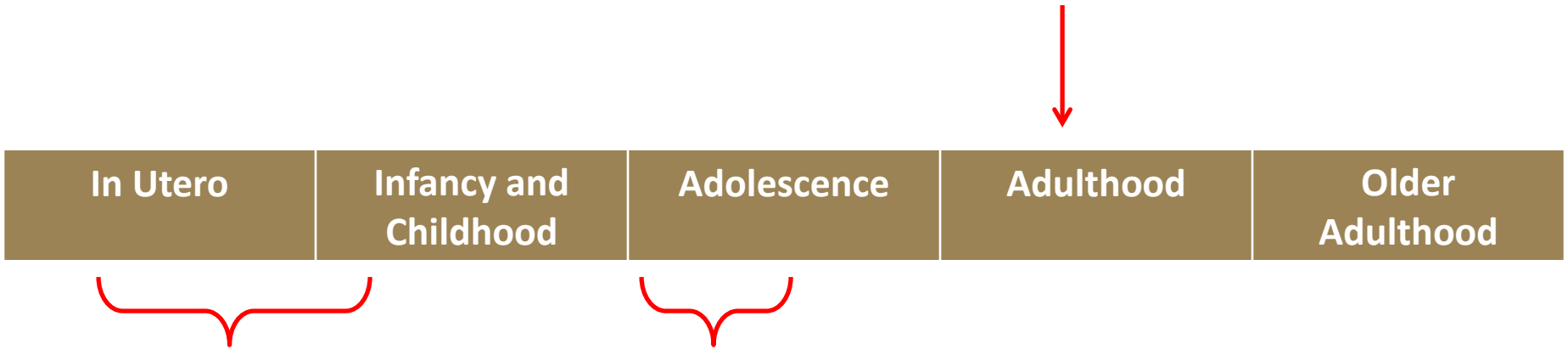


Patterson et al., *J. Acad. Nutr. Diet.*, 2015

What are the key questions regarding dynamism?

Long-term

Do specific time periods represent heightened risk?



Life transitions and diet change

Reflects maternal diet

Food intake independent of parents

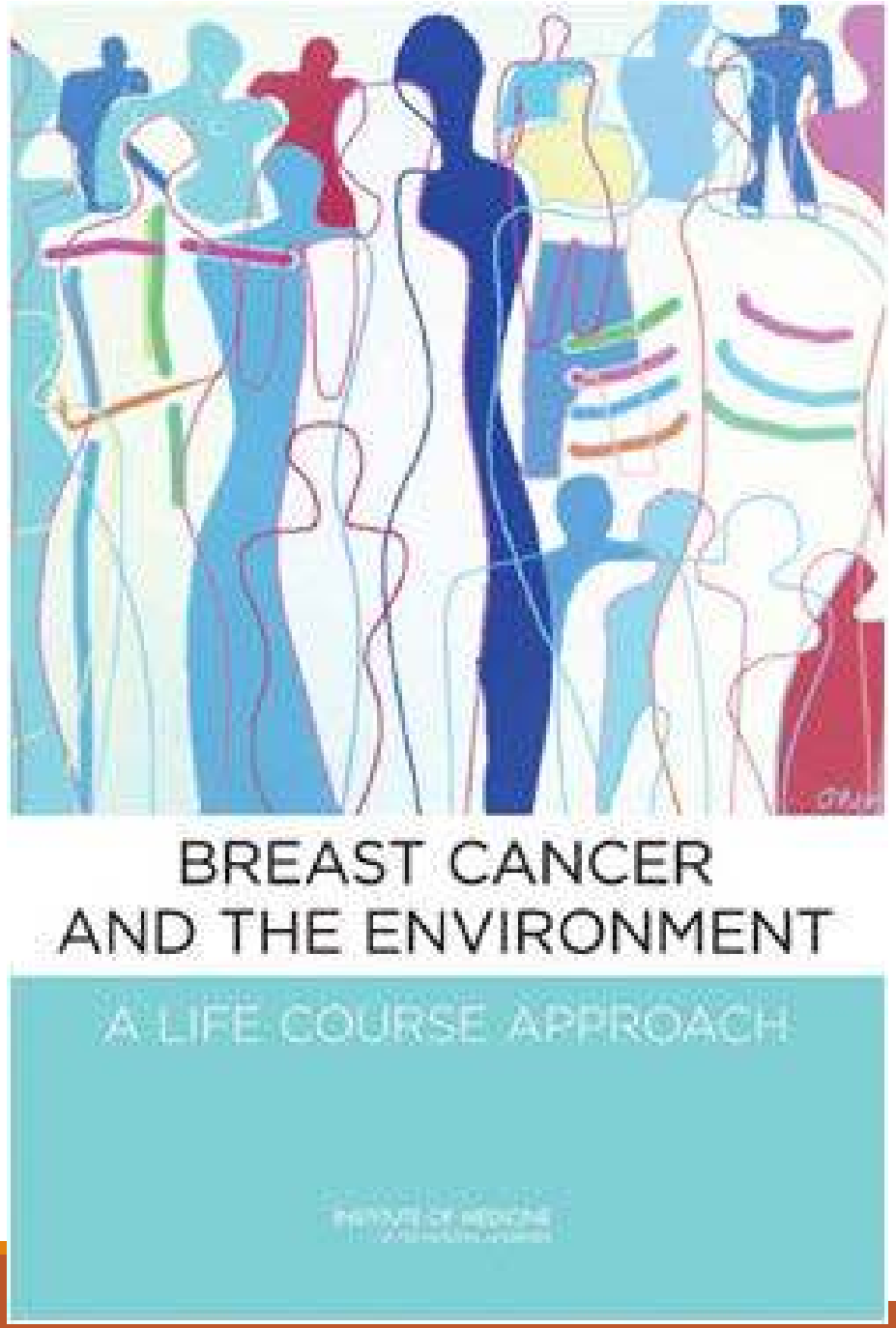
Dietary change explored or necessary

In Utero	Infancy and Childhood	Adolescence	Adulthood	Older Adulthood

Breast/formula fed?

Food preferences established

Partner, children influence food choices



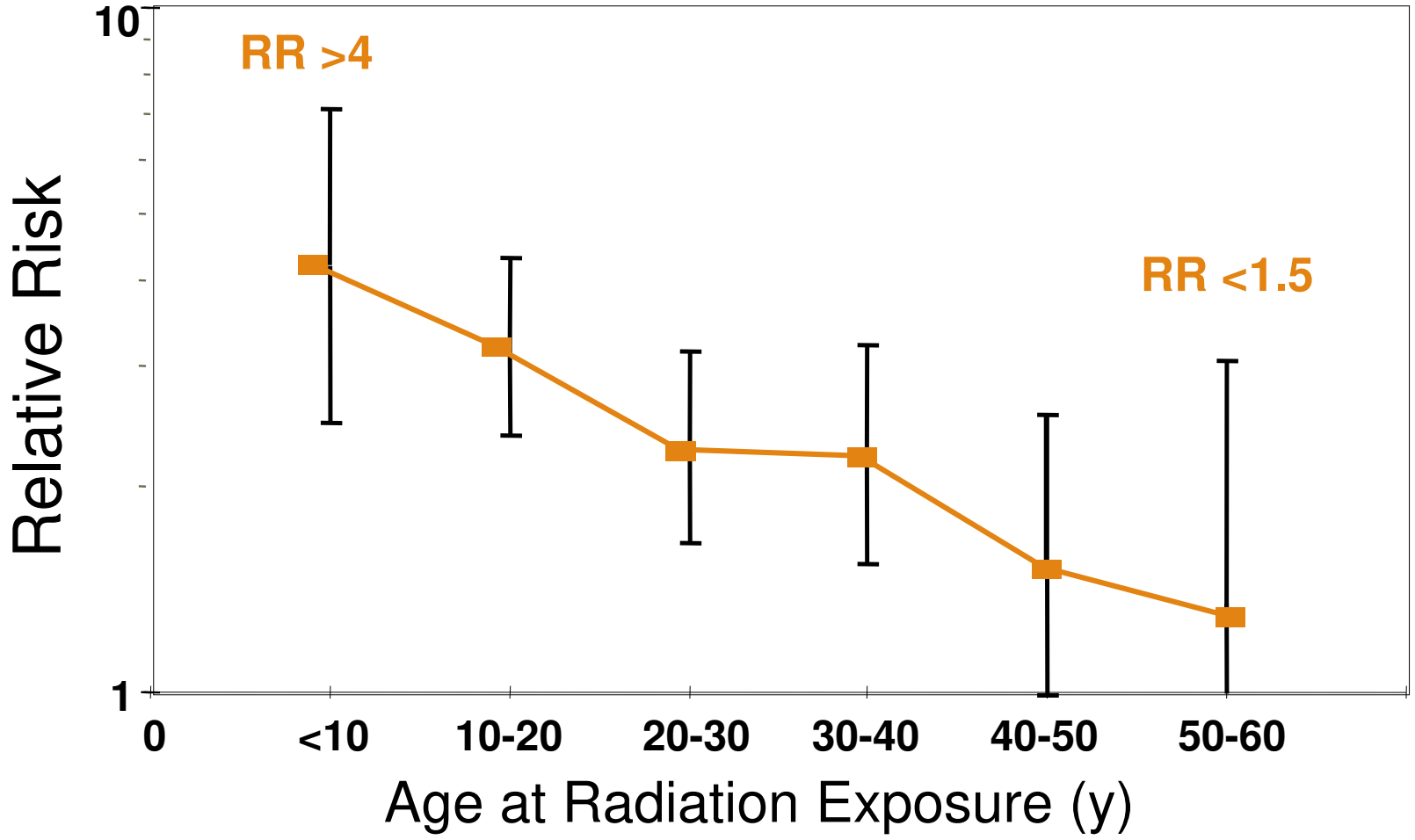
Institute of Medicine,

Board on Health Care Services, Board on Health Sciences Policy

published December 7, 2011

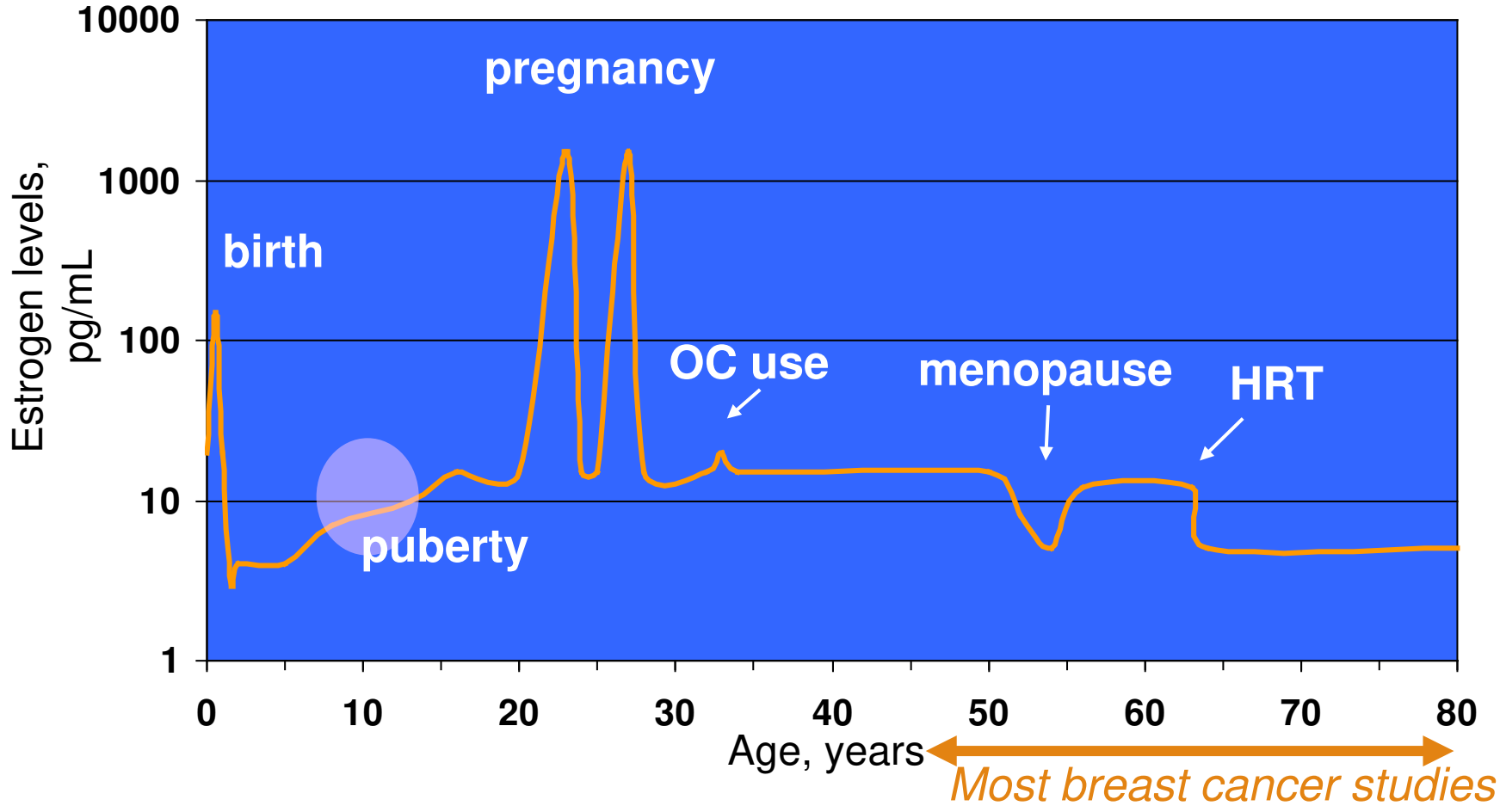
"Overall, the IOM finds that major advances have been made in understanding breast cancer and its risk factors, but more needs to be learned about its causes and how to prevent it. **The report urges a life-course approach to studying breast cancer because new information suggests that women and girls might be more susceptible to some risk factors during certain life stages.**"

Atomic bomb radiation and breast cancer

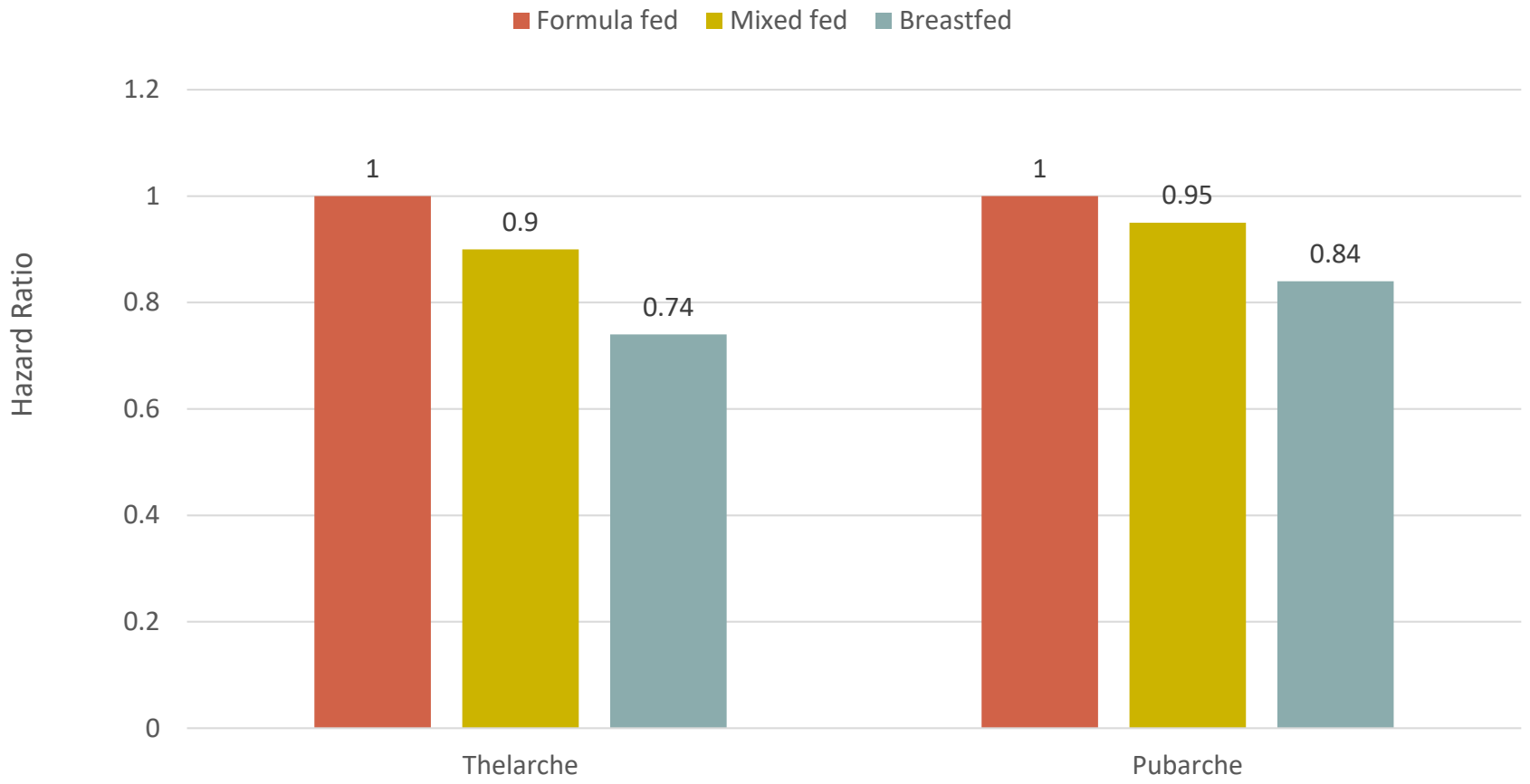


Tokunaga et al., *Radiat. Res.*, 1994

Estrogen levels throughout life



Risk of early puberty by infant feeding practice*



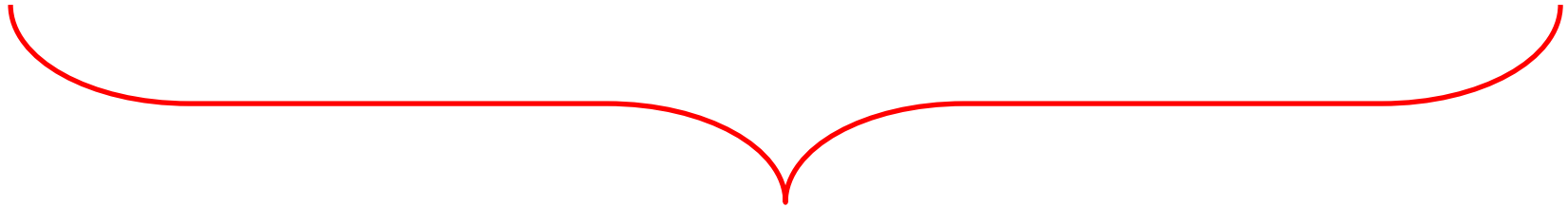
*BCERP studies

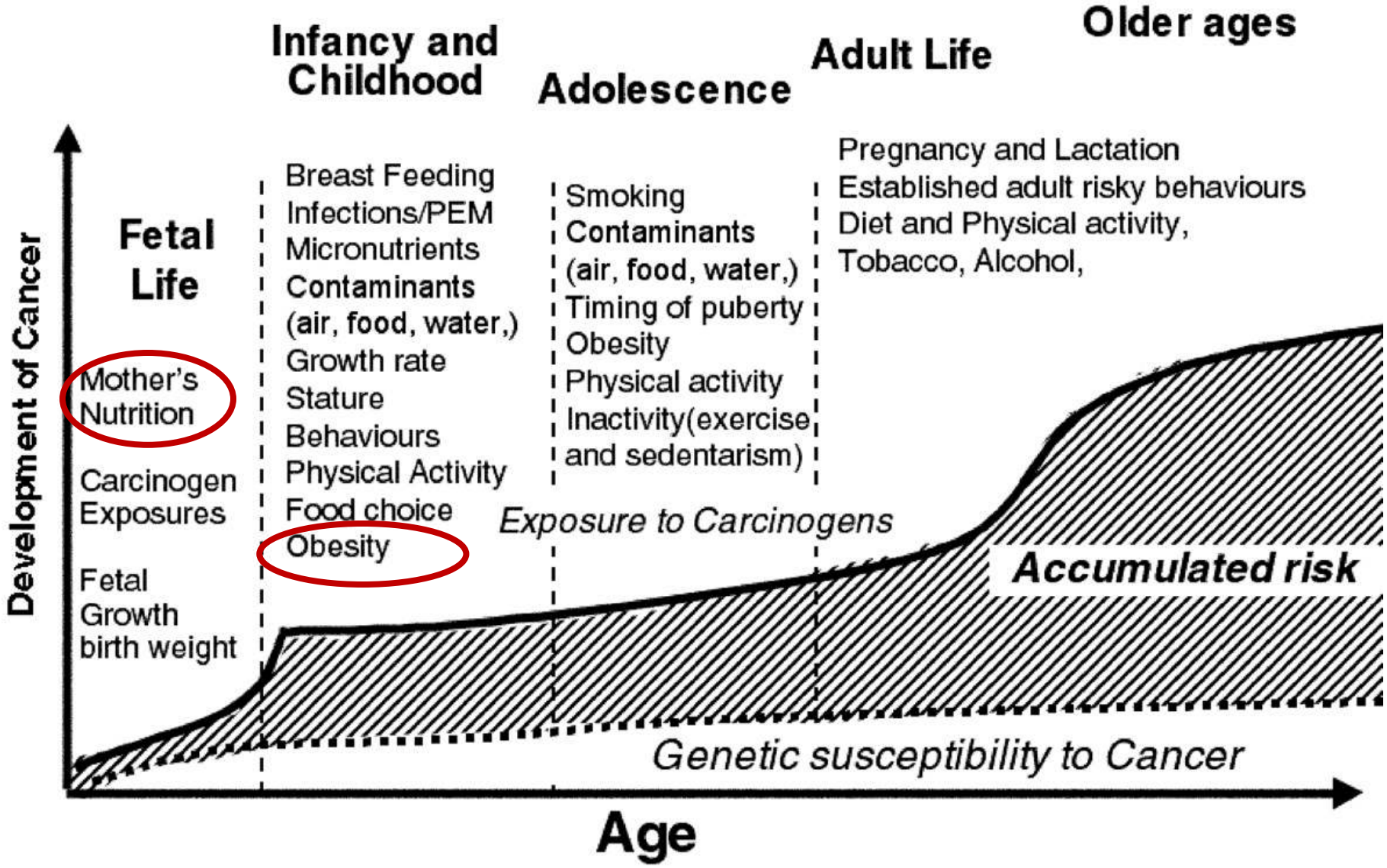
Kale et al., *Matern Child Hlth. J.*, 2015

Long-term

Does risk or benefit accumulate over time?

In Utero	Infancy and Childhood	Adolescence	Adulthood	Older Adulthood





Uauy and Solomons, *J Nutr.*, 2005

Long-term

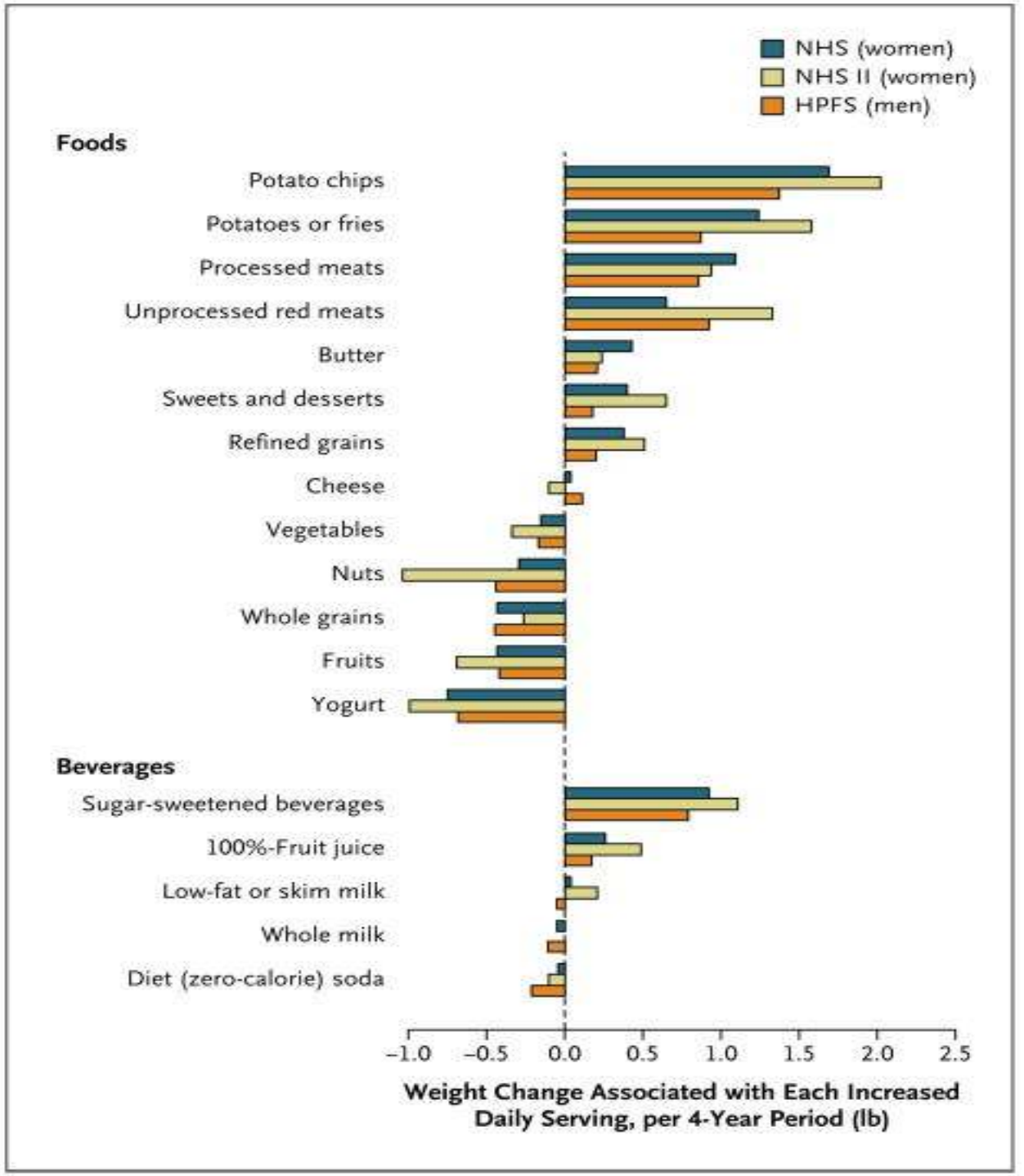
Does a change in diet alter the course of the risk profile?

Healthy diet

Unhealthy diet

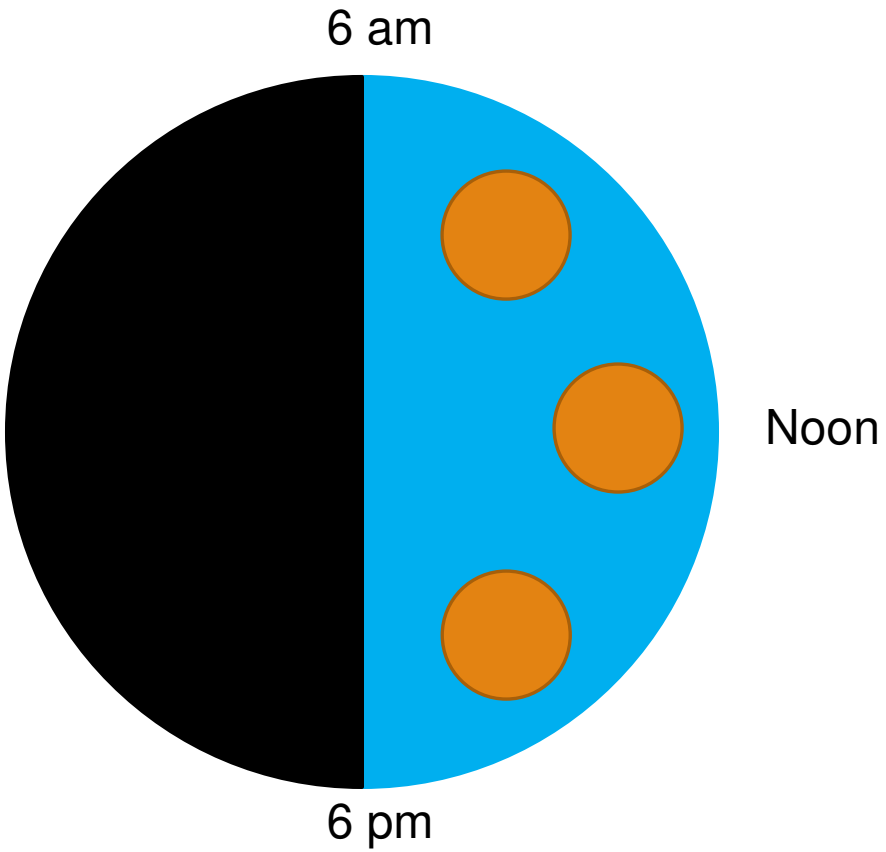
In Utero	Infancy and Childhood	Adolescence	Adulthood	Older Adulthood

Mozaffarian et al., *N. Engl. J. Med.*, 2011.

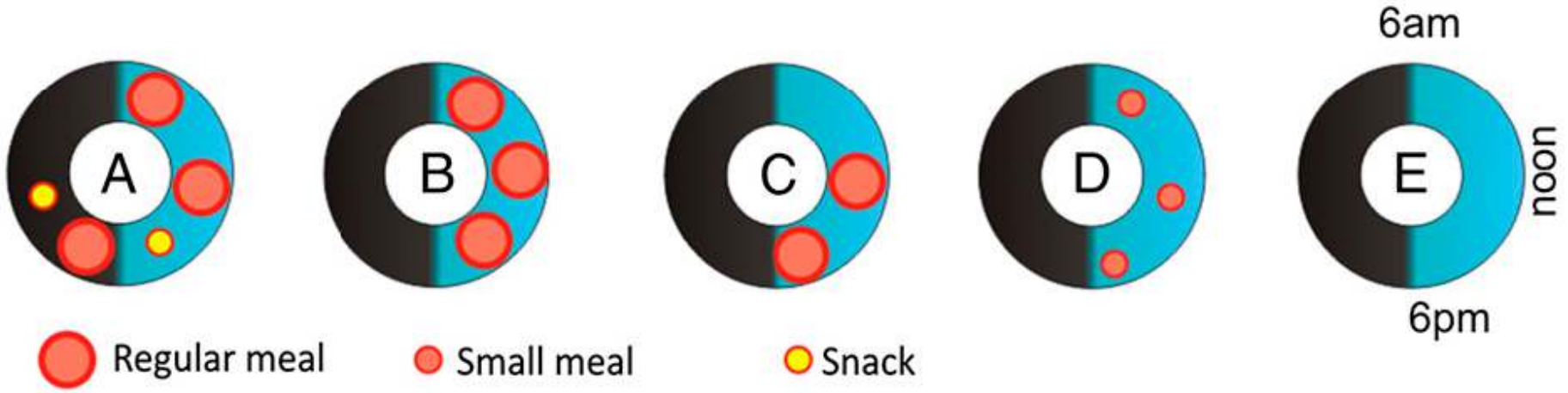


Short-term

What are the patterns of eating frequency?



Examples of eating frequency patterns

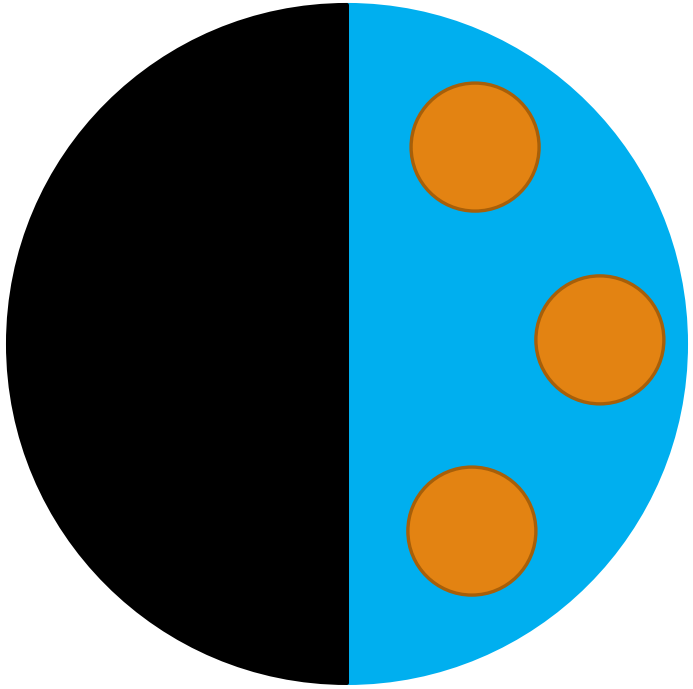


A. 3 meals and snacks
B. 3 meals consumed during the day
C. 2 meals no breakfast
D. 3 small meals
E. Complete fast

	M	T	W	Th	F	S	Su
Common Diet	A	A	A	A	A	A	A
TRF	B	B	B	B	B	B	B
5:2 diet	D	D	B	B	B	B	B
Alternate day fast	A	E	A	E	A	E	A
Alternate day ER	A	D	A	D	A	D	A

Short-term

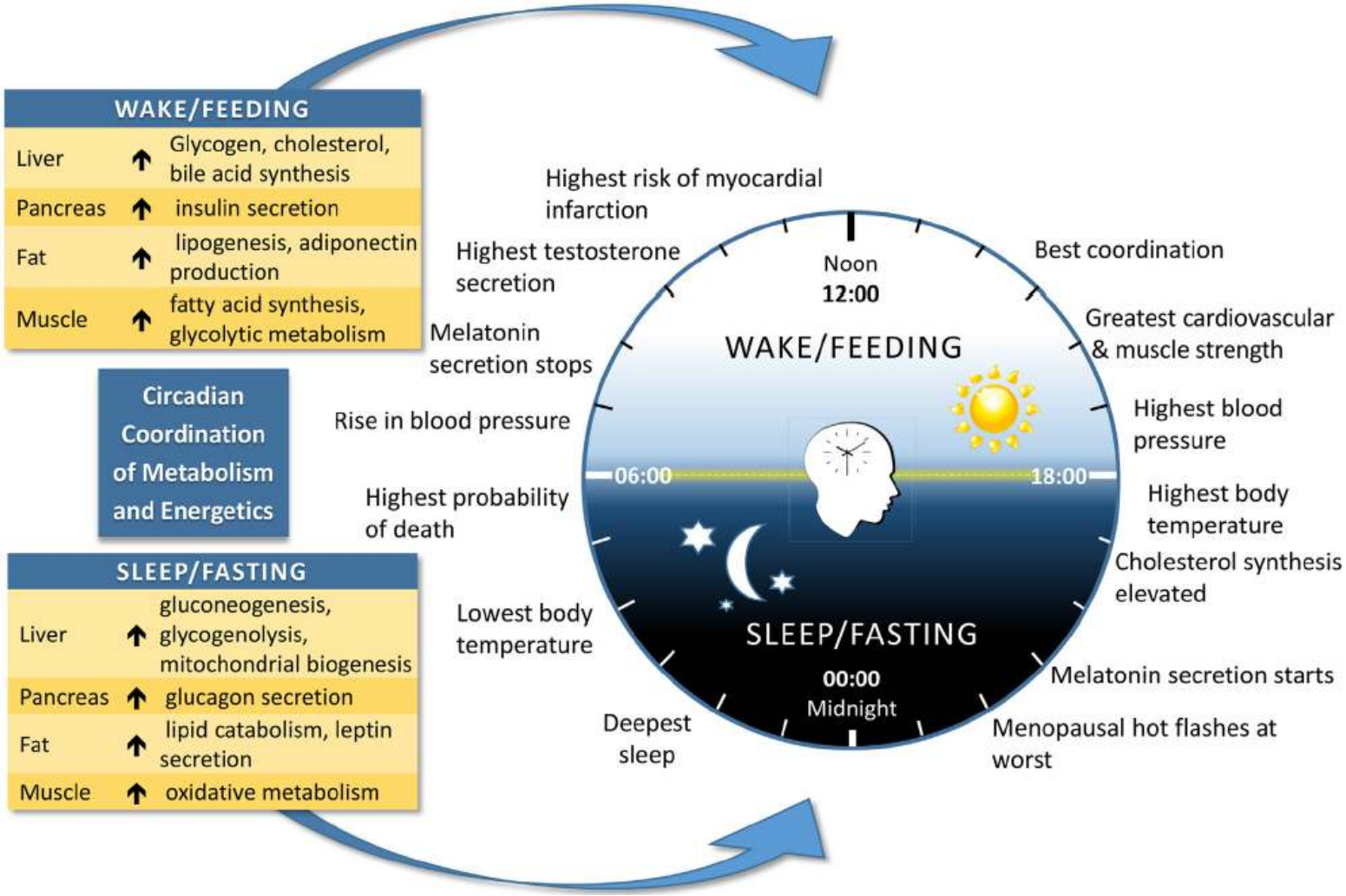
If we alter eating frequency, does it modify the biology?



Calendar for the month of _____

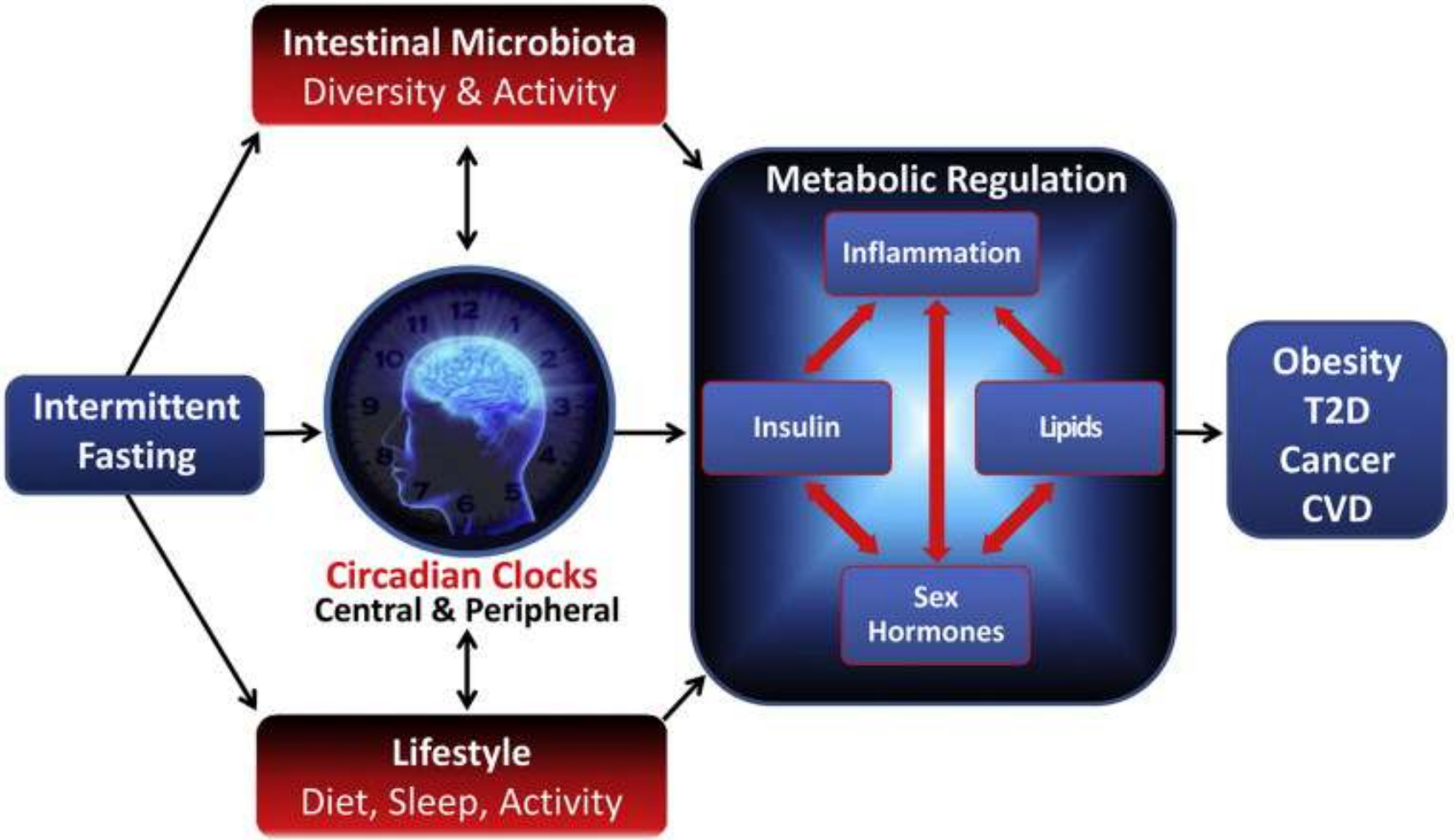
Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday

Short-term metabolic effects



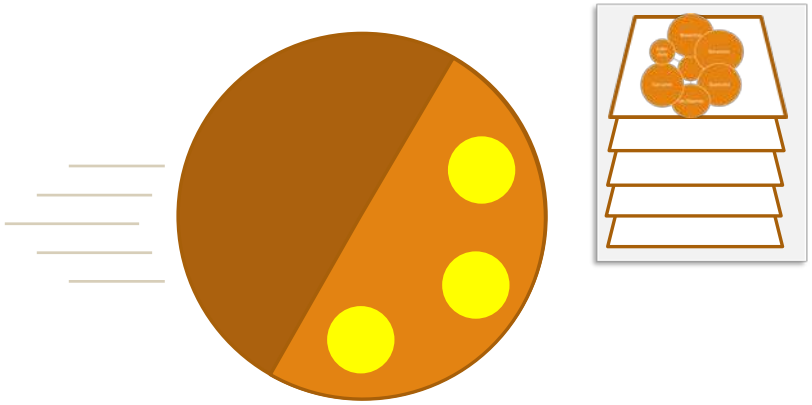
Patterson et al., *J. Acad. Nutr. Diet.*, 2015

Downstream effects on health



Patterson et al., *J. Acad. Nutr. Diet.,* 2015

Putting it all together…



In Utero	Infancy and Childhood	Adolescence	Adulthood	Older Adulthood
Prevention	Screening	Diagnosis	Treatment	Survivorship through end of life

Key takeaways

Evidence-based reviews that follow strict criteria represent the pinnacle of research quality.

The WCRF/AICR recommendations are based on reviews which follow such criteria.

Diet is extraordinarily complex, involving both multidimensionality and dynamism.

Diets are multi-dimensional on a number of layers and dynamic in both the short-term and long-term

Patterns of multidimensionality and long- and short-term dynamism may be critical to cancer control

Further research into patterns of multidimensionality and dynamism may help elucidate better understanding of relationship between diet and cancer risk.

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