Childhood Obesity around the Globe - Prevalence, Trends, and Causal Pathways

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JHSPH Child Obesity Symposium, April 2013

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Outline

- Global prevalence and trends
- Particular illustrative cases
- Are there plateaus or reductions in prevalence in some populations?
- Causal pathways
  - Unpeeling the layers of determinants
  - Different 'causal questions'
  - Epidemic patterns and determinants
    - Global food system drivers + local food/PA environmental moderators/modulators
- Opportunities for modelling

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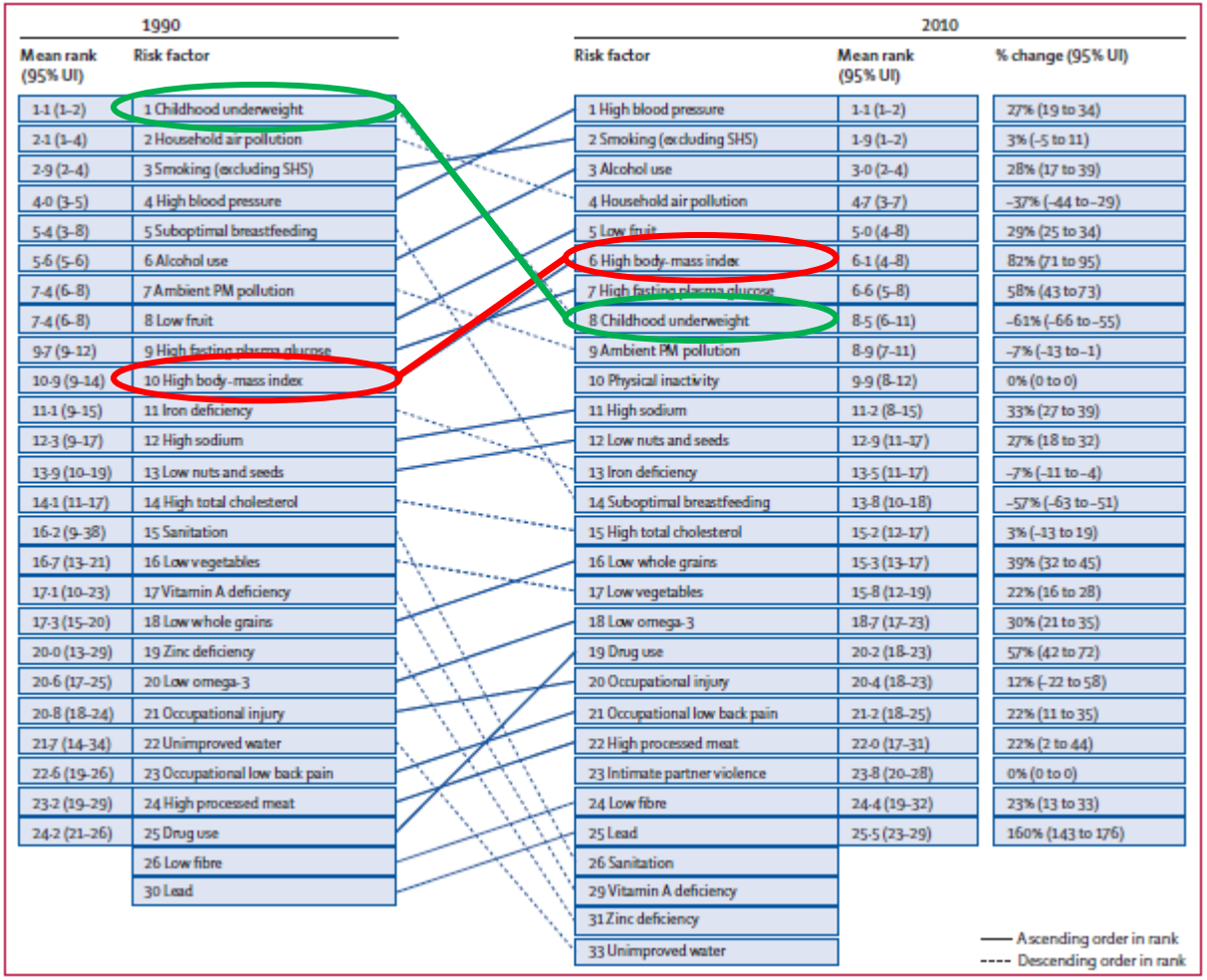
Childhood obesity prevalence

- Increasing globally children and adults
- Overnutrition overtaking undernutrition in many LMICs
  - Recent burden of diseases estimates (~10% due to poor diet and low PA)
- Trends and patterns
  - Largely mimic adult patterns
    - Sex, SES, ethnicity, urban/rural
  - Enormous variation by population
  - But later into the epidemic and earlier out

A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010

Lim et al
Lancet Dec 2012



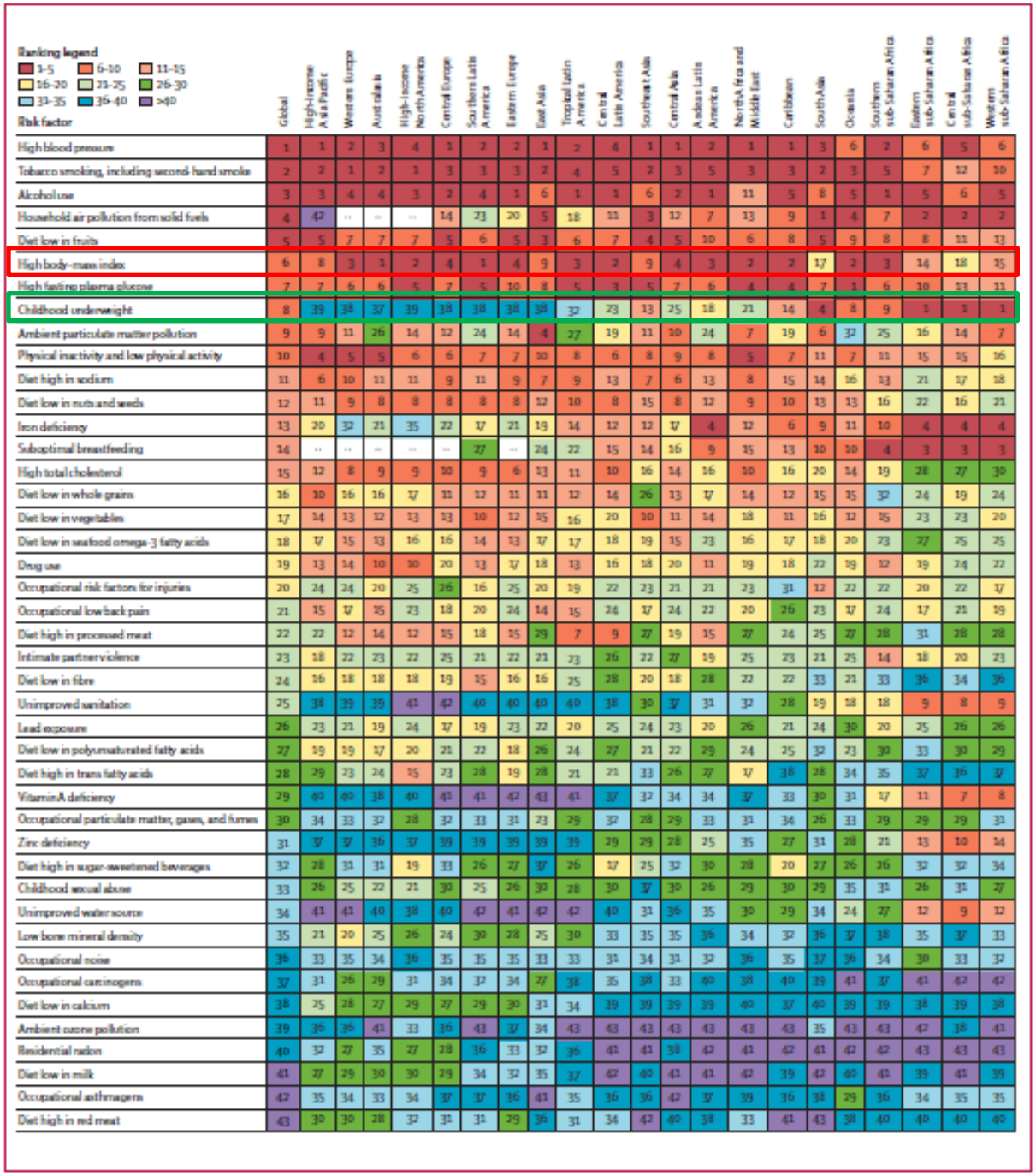
- Burden of poor diet & low PA ~10% (vs tobacco ~6%)
- High BP or BMI in top 3 risk factors in 18/21 sub-regions

Adult high BMI

Child underweight

Comparative risk assessment rankings

Lim et al Lancet 2012

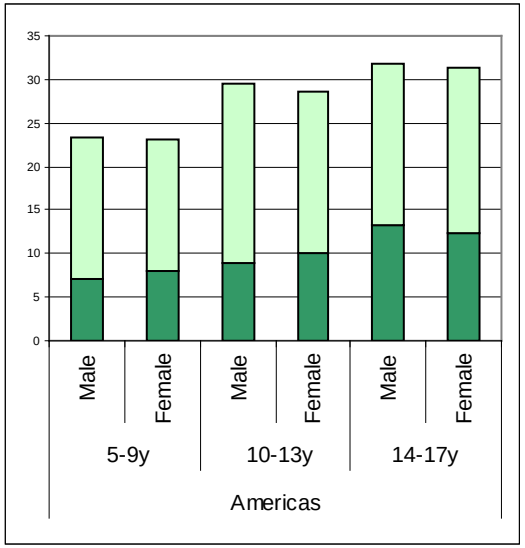


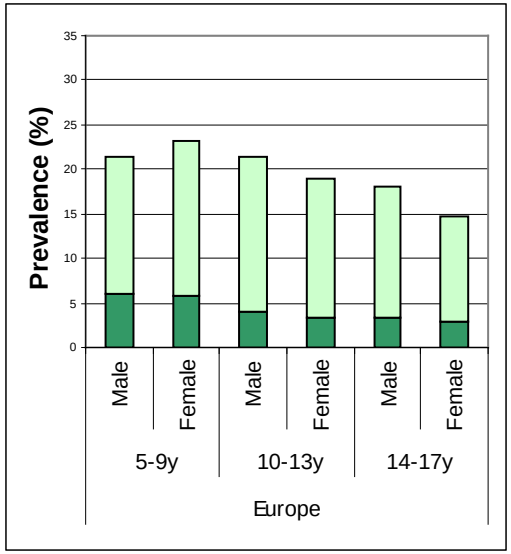
Ranking legend

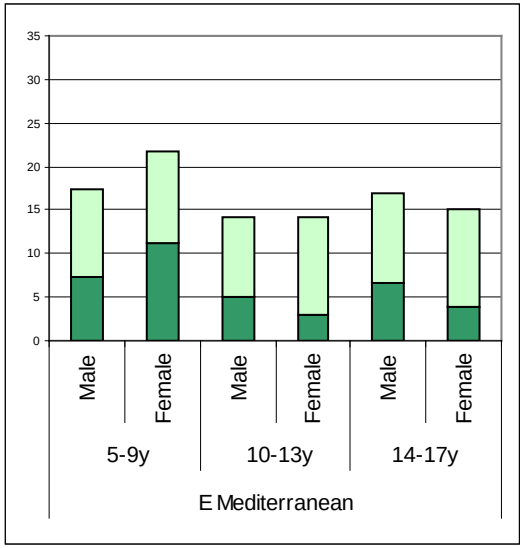
1–5	6–10	11–15	
16–20	21–25	26–30	
31–35	36–40	>40	

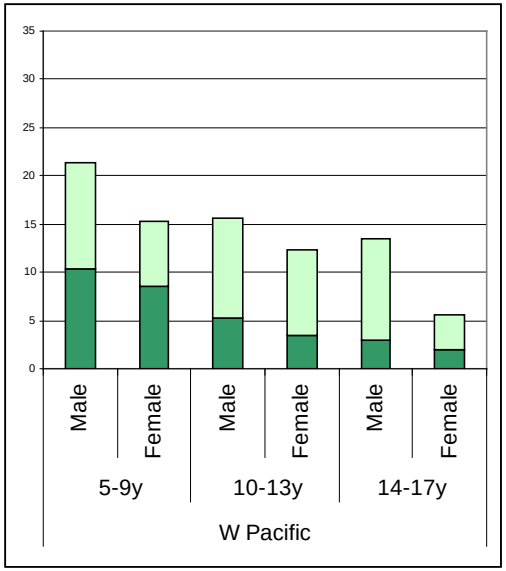
Risk factor	Global	High-income Asia Pacific	Western Europe	Australasia	High-income North America	Central Europe	Southern Latin America	Eastern Europe	East Asia	Tropical Latin America	Central Latin America	Southeast Asia	Central Asia	Andean Latin America	North Africa and Middle East	Caribbean	South Asia	Oceania	Southern sub-Saharan Africa	Eastern sub-Saharan Africa	Central sub-Saharan Africa	Western sub-Saharan Africa
High blood pressure	1	1	2	3	4	1	2	2	1	2	4	1	1	2	1	1	3	6	2	6	5	6
Tobacco smoking, including second-hand smoke	2	2	1	2	1	3	3	3	2	4	5	2	3	5	3	3	2	3	5	7	12	10
Alcohol use	3	3	4	4	3	2	4	1	6	1	1	6	2	1	11	5	8	5	1	5	6	5
Household air pollution from solid fuels	4	42	..	..	..	14	23	20	5	18	11	3	12	7	13	9	1	4	7	2	2	2
Diet low in fruits	5	5	7	7	7	5	6	5	3	6	7	4	5	10	6	8	5	9	8	8	11	13
High body-mass index	6	8	3	1	2	4	1	4	9	3	2	9	4	3	2	2	17	2	3	14	18	15
High fasting plasma glucose	7	7	6	6	5	7	5	10	8	5	3	5	7	6	4	4	7	1	6	10	13	11
Childhood underweight	8	39	38	37	39	38	38	38	38	32	23	13	25	18	21	14	4	8	9	1	1	1
Ambient particulate matter pollution	9	9	11	26	14	12	24	14	4	27	19	11	10	24	7	19	6	32	25	16	14	7
Physical inactivity and low physical activity	10	4	5	5	6	6	7	7	10	8	6	8	9	8	5	7	11	7	11	15	15	16
Diet high in sodium	11	6	10	11	11	9	11	9	7	9	13	7	6	13	8	15	14	16	13	21	17	18
Diet low in nuts and seeds	12	11	9	8	8	8	8	8	12	10	8	15	8	12	9	10	13	13	16	22	16	21
Iron deficiency	13	20	32	21	35	22	17	21	19	14	12	12	17	4	12	6	9	11	10	4	4	4
Suboptimal breastfeeding	14	..	..	..	..	..	27	..	24	22	15	14	16	9	15	13	10	10	4	3	3	3
High total cholesterol	15	12	8	9	9	10	9	6	13	11	10	16	14	16	10	16	20	14	19	28	27	30
Diet low in whole grains	16	10	16	16	17	11	12	11	11	12	14	26	13	17	14	12	15	15	32	24	19	24
Diet low in vegetables	17	14	13	12	13	13	10	12	15	16	20	10	11	14	18	11	16	12	15	23	23	20
Diet low in seafood omega-3 fatty acids	18	17	15	13	16	16	14	13	17	17	18	19	15	23	16	17	18	20	23	27	25	25
Drug use	19	13	14	10	10	20	13	17	18	13	16	18	20	11	19	18	22	19	12	19	24	22
Occupational risk factors for injuries	20	24	24	20	25	26	16	25	20	19	22	23	21	21	23	31	12	22	22	20	22	17
Occupational low back pain	21	15	17	15	23	18	20	24	14	15	24	17	24	22	20	26	23	17	24	17	21	19
Diet high in processed meat	22	22	12	14	12	15	18	15	29	7	9	27	19	15	27	24	25	27	28	31	28	28
Intimate partner violence	23	18	22	23	22	25	21	22	21	23	26	22	27	19	25	23	21	25	14	18	20	23
Diet low in fibre	24	16	18	18	18	19	15	16	16	25	28	20	18	28	22	22	33	21	33	36	34	36
Unimproved sanitation	25	38	39	39	41	42	40	40	40	40	38	30	37	31	32	28	19	18	18	9	8	9
Lead exposure	26	23	21	19	24	17	19	23	22	20	25	24	23	20	26	21	24	30	20	25	26	26
Diet low in polyunsaturated fatty acids	27	19	19	17	20	21	22	18	26	24	27	21	22	29	24	25	32	23	30	33	30	29
Diet high in trans fatty acids	28	29	23	24	15	23	28	19	28	21	21	33	26	27	17	38	28	34	35	37	36	37
Vitamin A deficiency	29	40	40	38	40	41	41	42	43	41	37	32	34	34	37	33	30	31	17	11	7	8
Occupational particulate matter, gases, and fumes	30	34	33	32	28	32	33	31	23	29	32	28	29	33	31	34	26	33	29	29	29	31
Zinc deficiency	31	37	37	36	37	39	39	39	39	33	29	29	28	25	35	27	31	28	21	13	10	14
Diet high in sugar-sweetened beverages	32	28	31	31	19	33	26	27	37	26	17	25	32	30	28	20	27	26	26	32	32	34
Childhood sexual abuse	33	26	25	22	21	30	25	26	30	28	30	37	30	26	29	30	29	35	31	26	31	27
Unimproved water source	34	41	41	40	38	40	42	41	42	42	40	31	36	35	30	29	34	24	27	12	9	12
Low bone mineral density	35	21	20	25	26	24	30	28	25	30	33	35	35	36	34	32	36	37	38	35	37	33
Occupational noise	36	33	35	34	36	35	35	35	33	33	31	34	31	32	36	35	37	36	34	30	33	32
Occupational carcinogens	37	31	26	29	31	34	32	34	27	38	35	38	33	40	38	40	33	41	37	41	42	42
Diet low in calcium	38	25	28	27	29	27	29	30	31	34	39	39	39	39	40	37	40	39	39	38	39	38
Ambient ozone pollution	39	36	36	41	33	36	43	37	34	43	43	43	43	43	43	43	35	43	43	42	38	41
Residential radon	40	32	27	35	27	28	36	33	32	36	41	41	38	42	41	42	41	42	42	43	43	43
Diet low in milk	41	27	29	30	30	29	34	32	35	37	42	40	41	41	42	39	42	40	41	33	41	39
Occupational asthmagens	42	35	34	33	34	37	37	36	41	35	36	36	42	37	39	36	38	29	36	34	35	35
Diet high in red meat	43	30	30	28	32	31	31	29	36	31	34	42	40	38	33	41	43	38	40	40	40	40

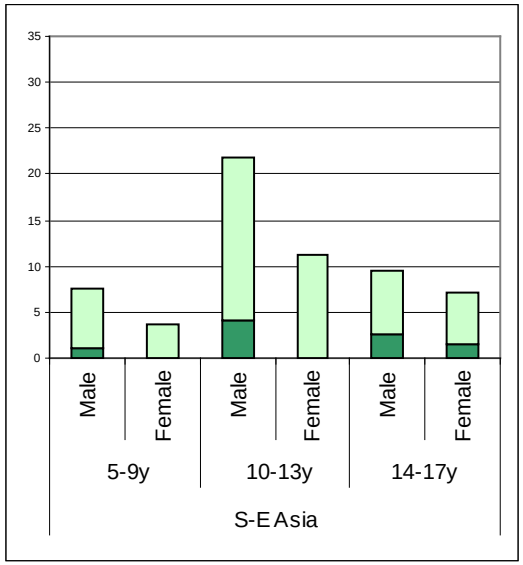
Childhood obesity by WHO region (Lobstein)

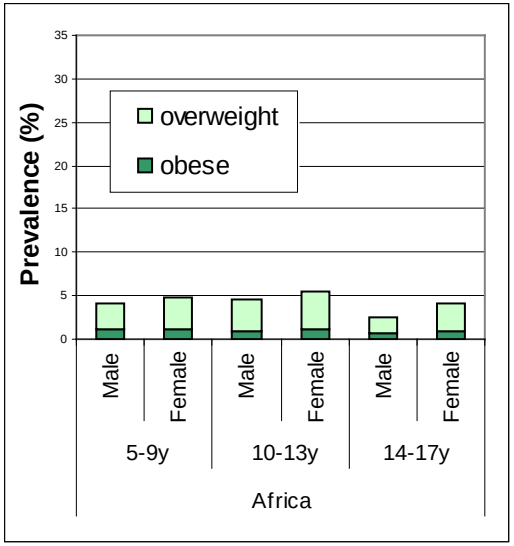












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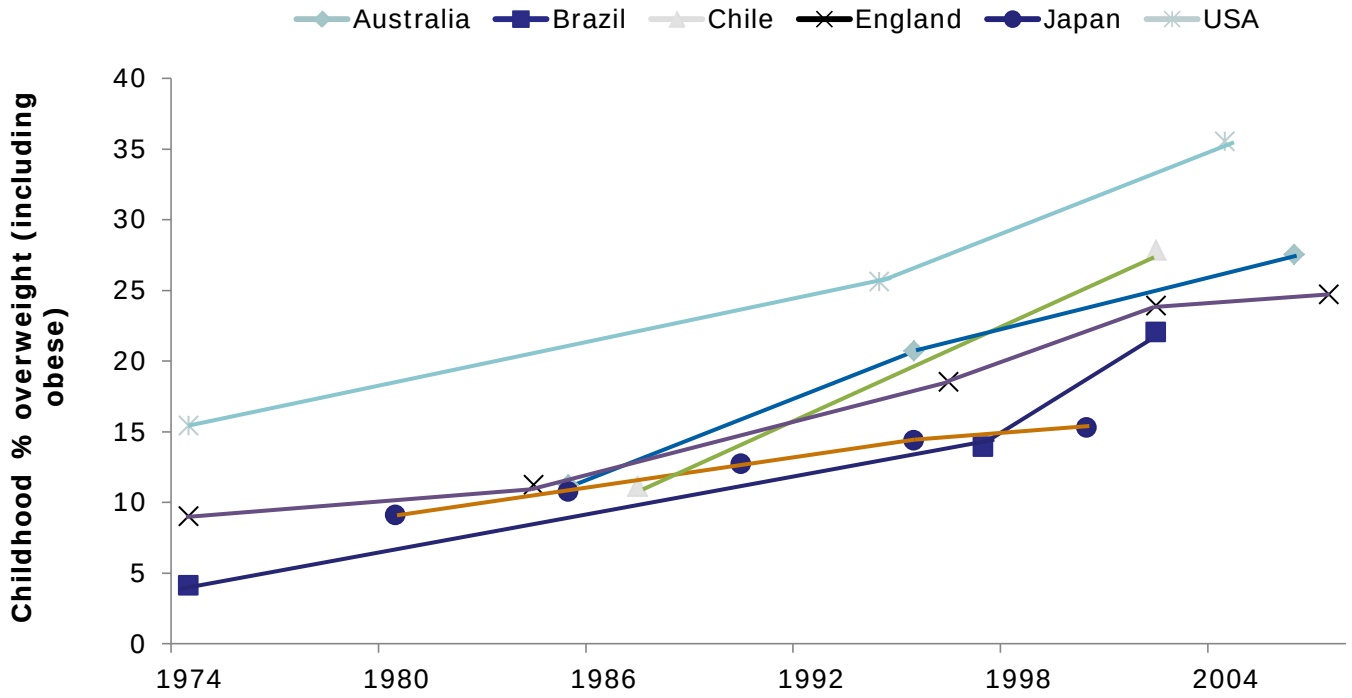
Childhood overweight and obesity trends



Swinburn et al Lancet 2012

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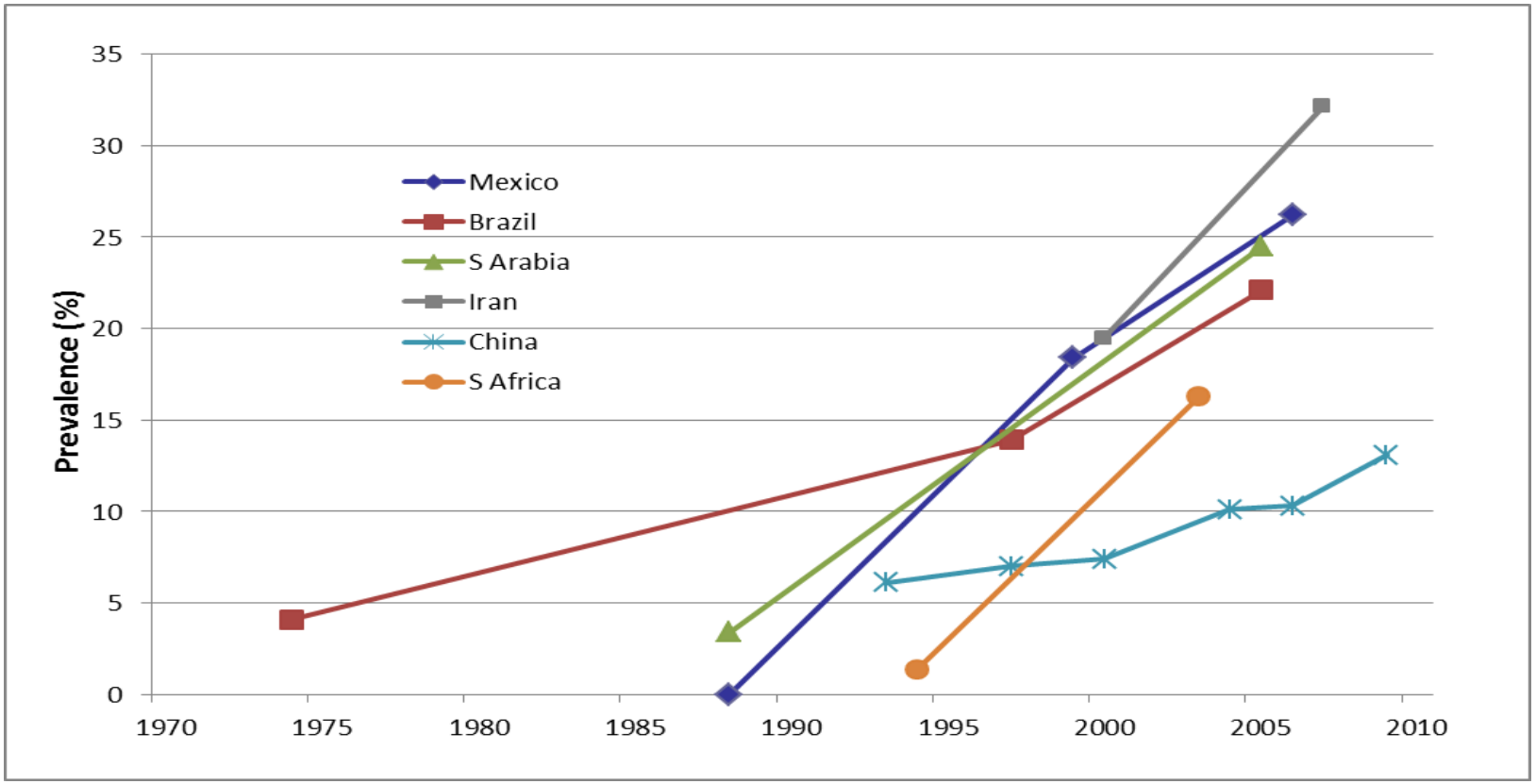
Further trends childhood overweight and obesity in LMICs



Lobstein et al Lancet 2013 (forthcoming)

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Comparative trends in childhood overweight and obesity

International Journal of Pediatric Obesity. 2006; 1: 11–25

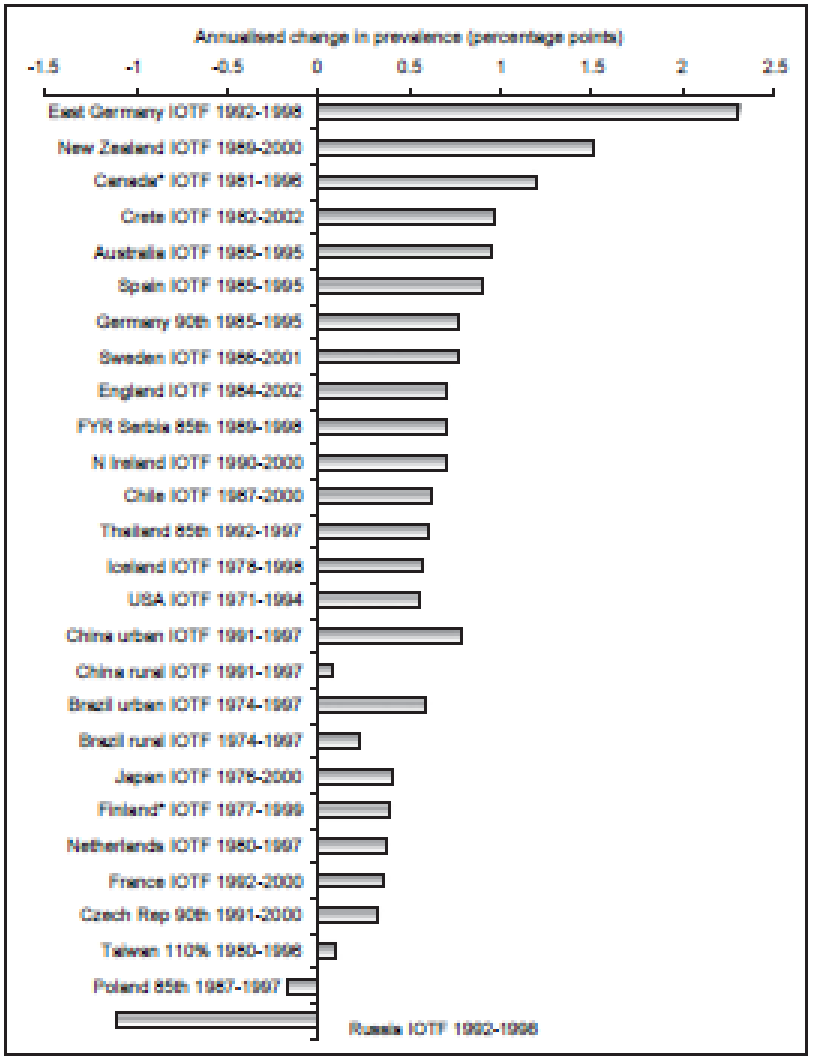
Taylor & Francis

ORIGINAL ARTICLE

Worldwide trends in childhood overweight and obesity

YOUFA WANG[1] & TIM LOBSTEIN[2]

[1]*Center for Human Nutrition, Department of International Health, Bloomberg School of Public Health, Johns Hopkins University,* [2]*International Obesity TaskForce, London*



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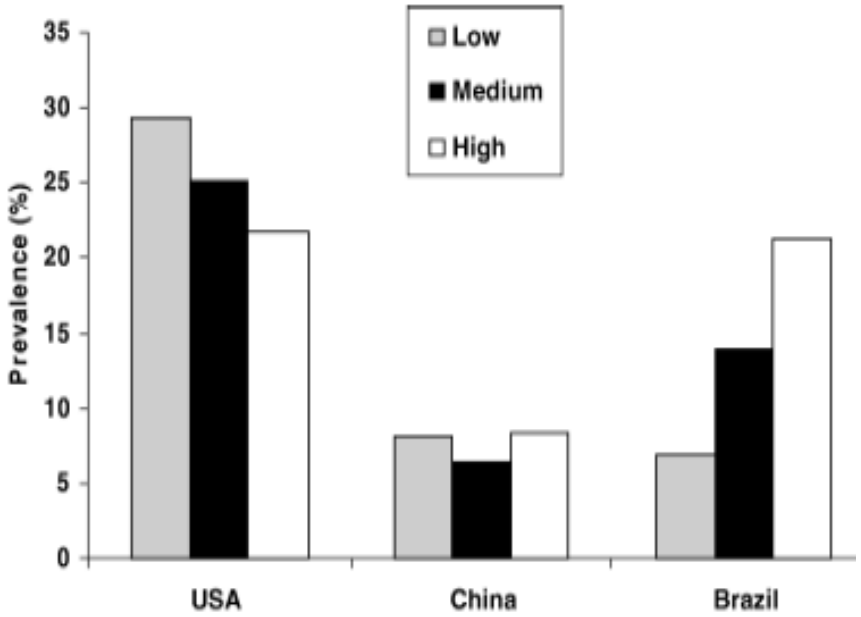
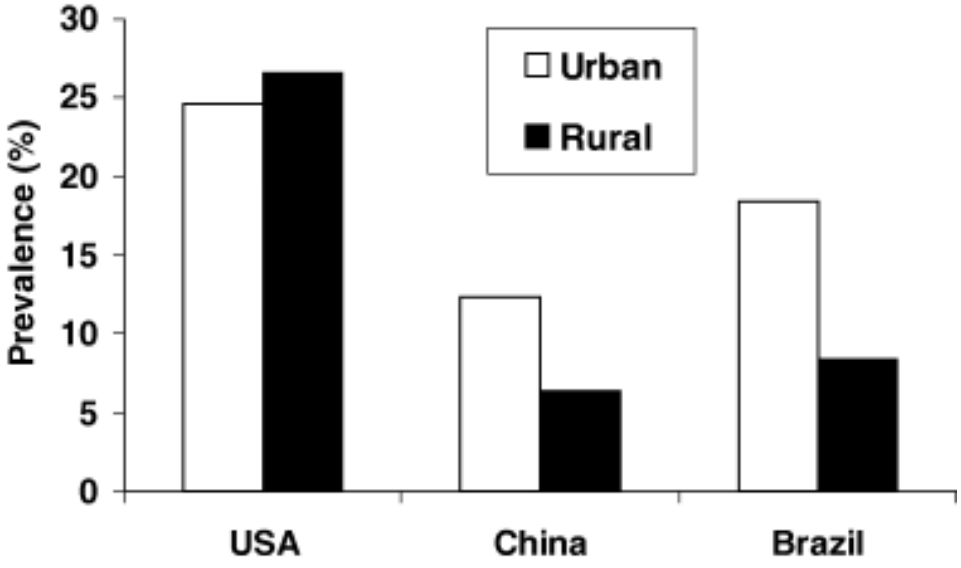
Childhood overweight

Family income



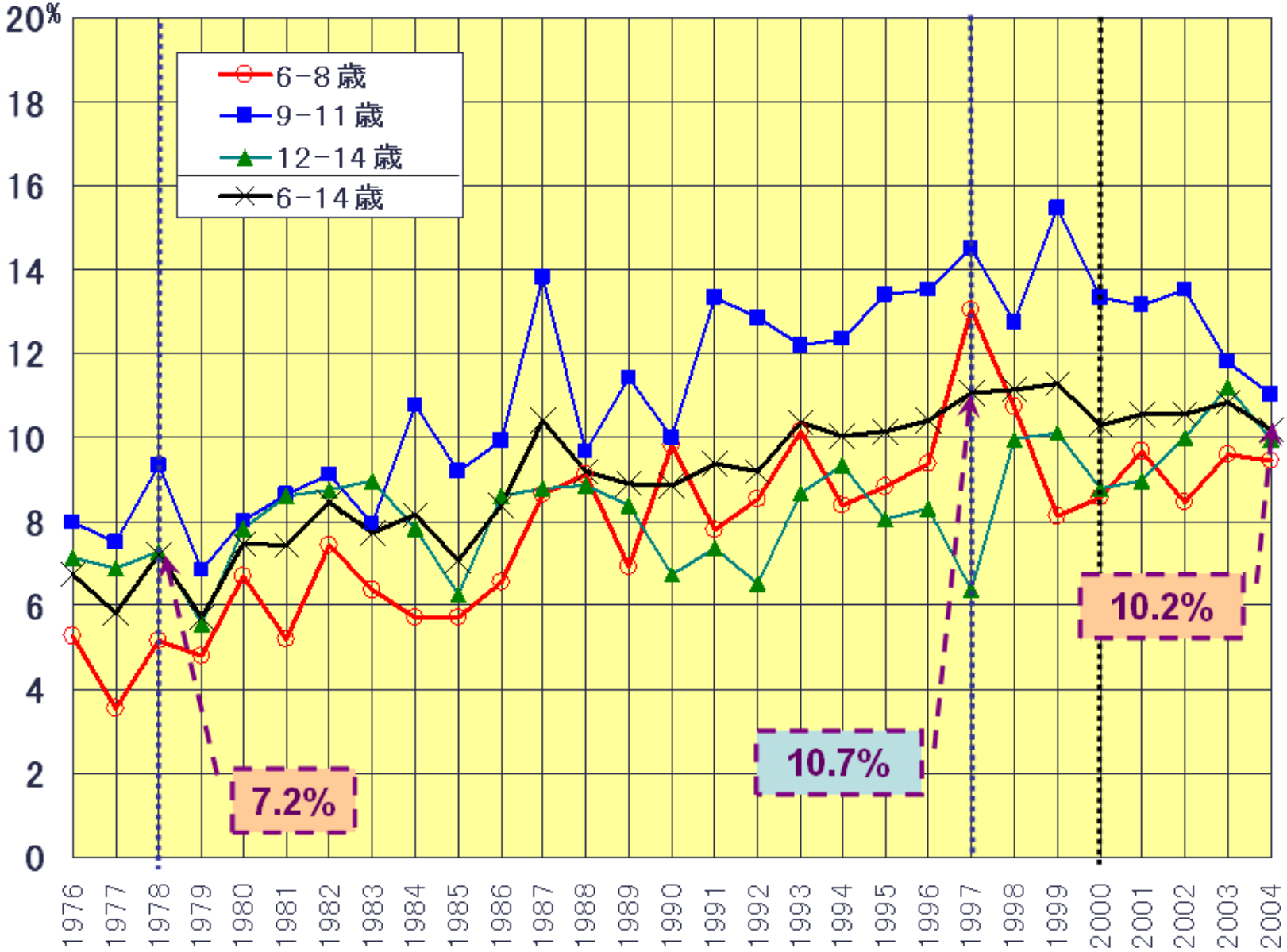
Note: Overweight as defined by IOTF criteria.

Urban/rural



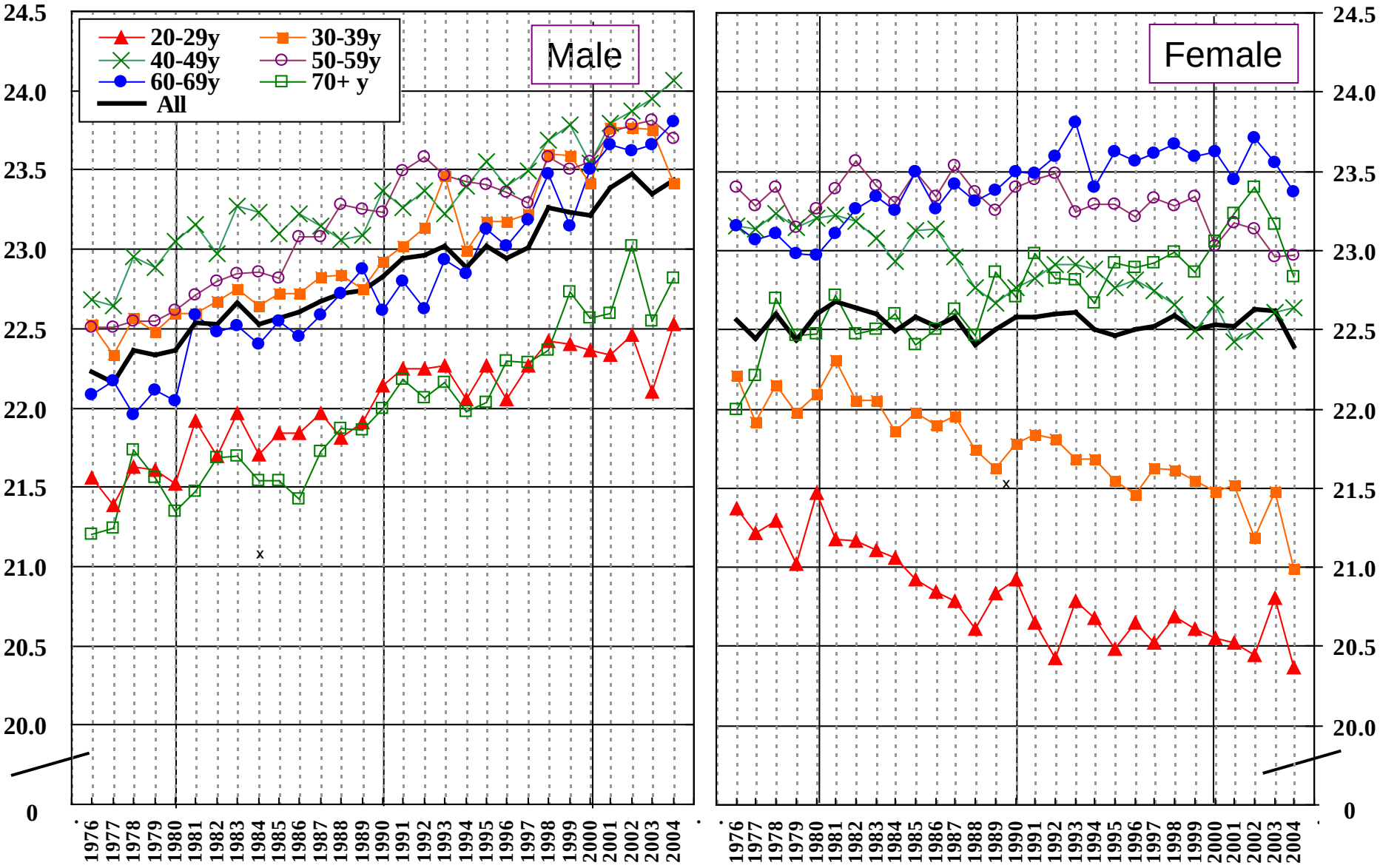
Lobstein et al IOTF working paper 2007

Changes in prevalence of obesity defined as 20% excess of ‘standard body weight’ in school children (NHNS-J 1976-2004)

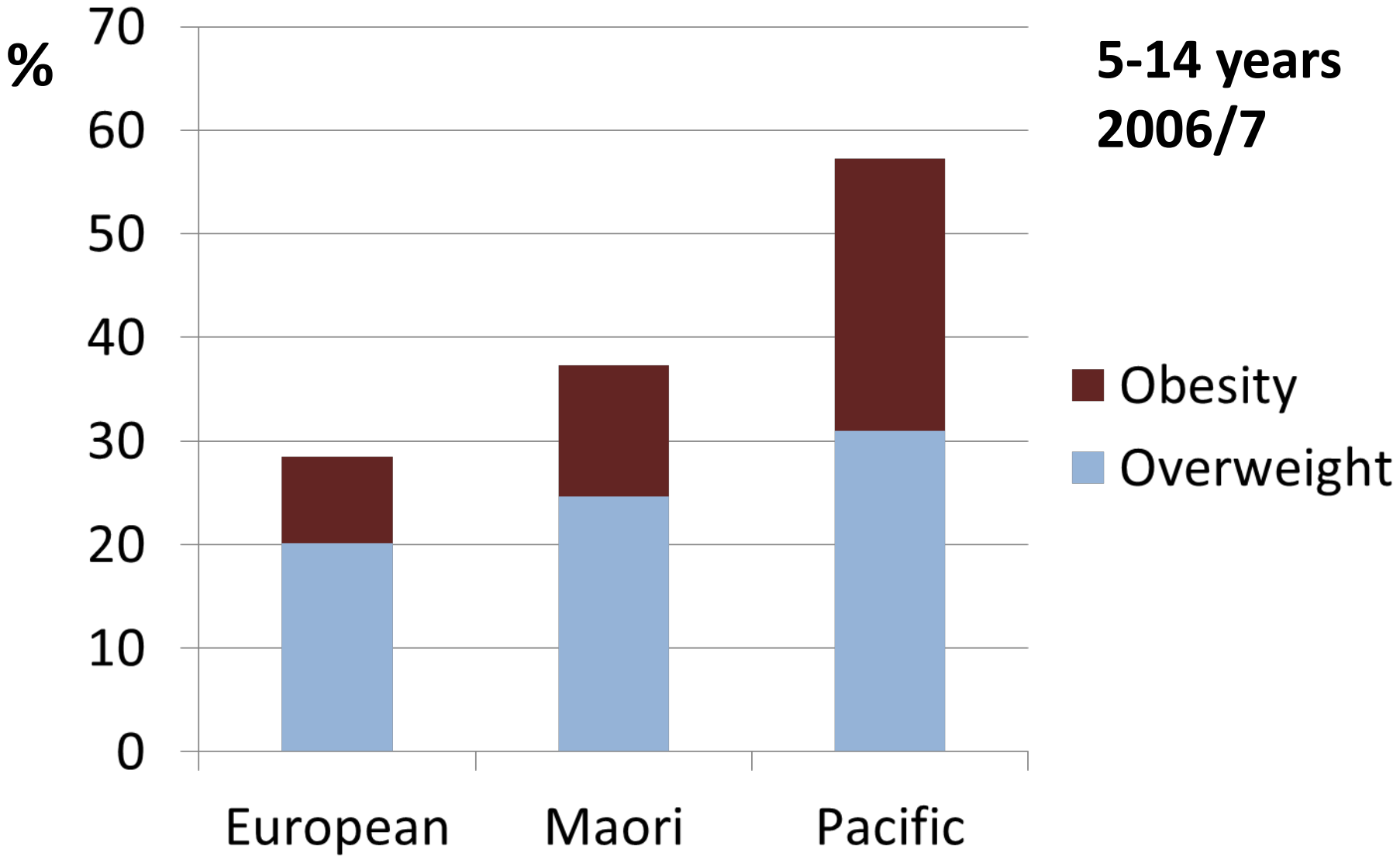


Yearly changes in **mean BMI** by age and sex

(National Health and Nutrition Survey, Japan 1976-2004)



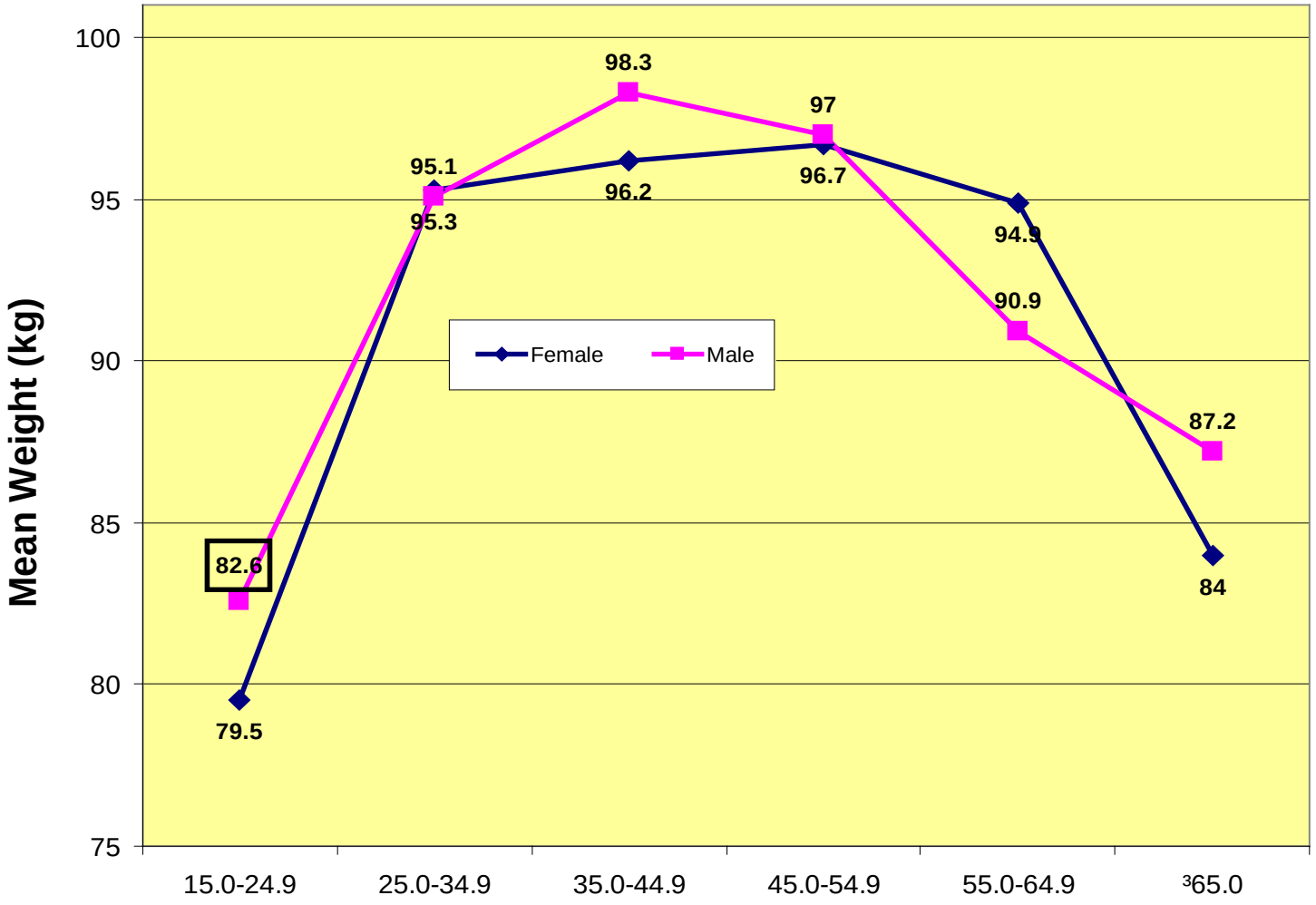
NZ Childhood Overweight/Obesity




HAWAII


everest

Mean body weight – Tonga 2000



From Soana Muimuiheata, National Diabetes Survey

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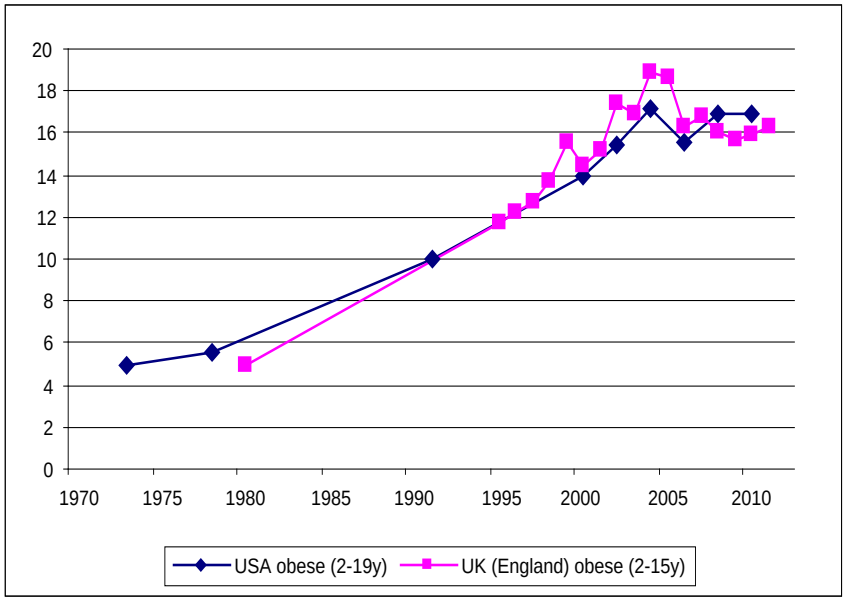
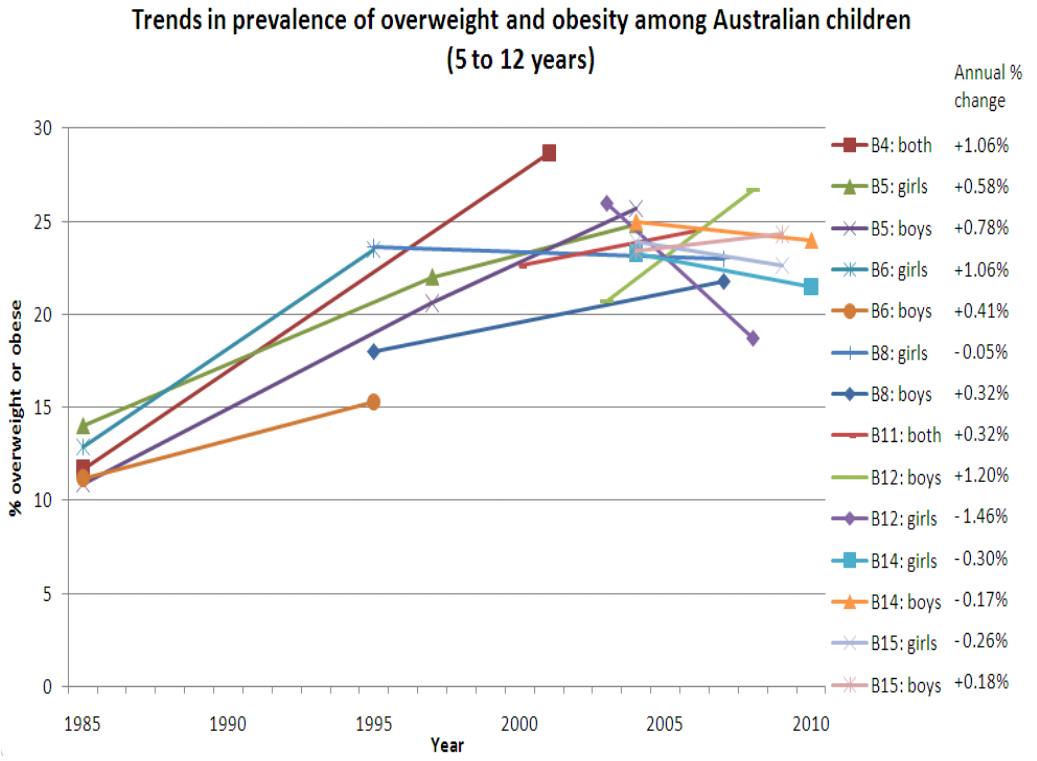
Plateau effect in prevalence rise



US and UK

Australia



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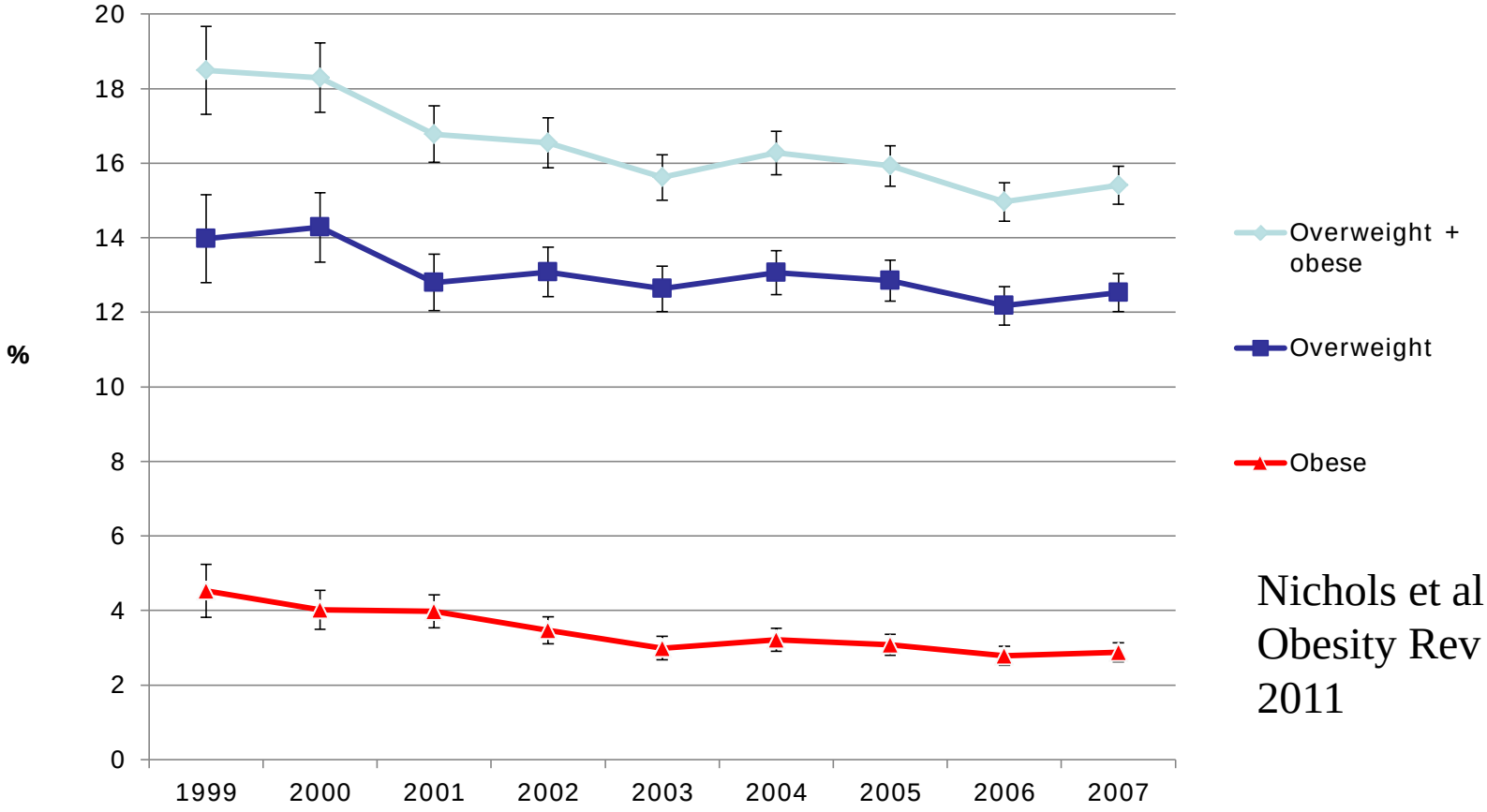
Prevalence of overweight and obesity among 3.5 year old Victorian children 1999 - 2007



Nichols et al Obesity Rev 2011

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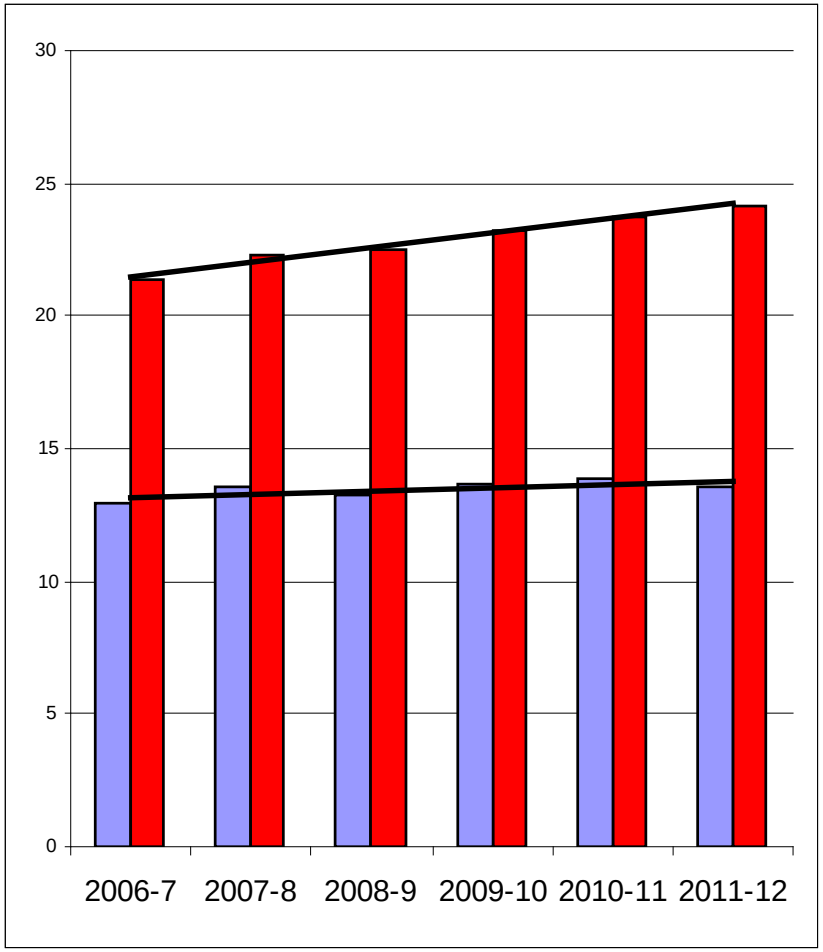
Potential for increased inequalities

- With the turn of the epidemic, an in increase in inequalities is likely
- UK trends in 11 year olds, less deprived (blue) vs more deprived (red) (Lobstein et al forthcoming)



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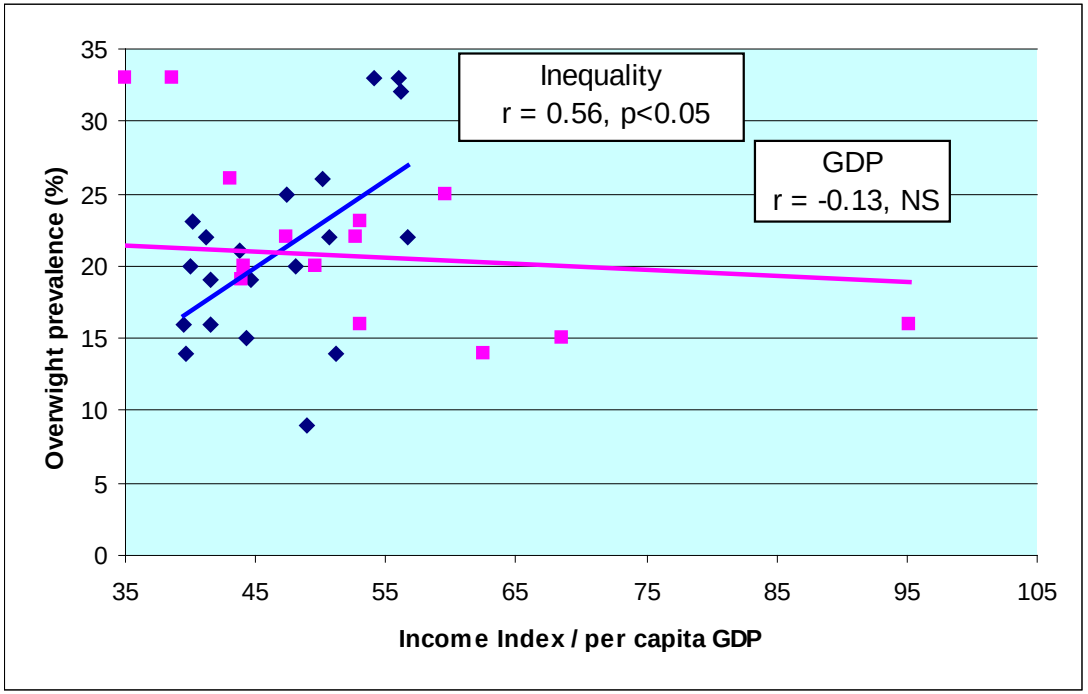
Income inequalities

- Same pattern as adults
  - Relationship with income distribution not income itself
- Childhood overweight vs GDP and GINI in 22 European countries (Lobstein et al forthcoming)



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Summary on trends

- Overnutrition is swapping with undernutrition in disease burden in LMICs
- Increasing prevalence globally
  - More rapid in LMICs
  - Slowing, plateauing or decreasing in some high income countries
  - Potential for increasing inequalities
- Patterns
  - Similar to adults
  - Insights from different populations
    - Influence of cuisine and culture
    - Influence of SES and income inequalities

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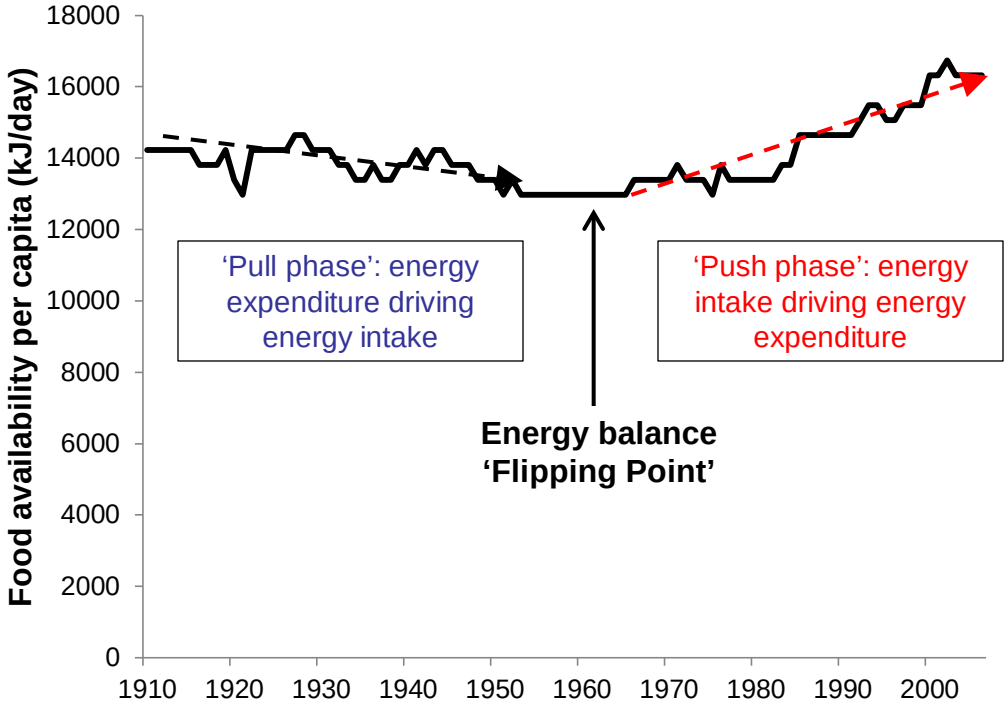
Energy Balance Flipping Point



US Food availability data, 1910-2000

- 1st half of 20th Century: ↑mechanization and motorization, but no ↑obesity because ↓energy intake
- 2nd half of 20th Century: Increasing food supply driving up obesity
- 'Flipping Point': Change from EI (via appetite) matching EE to EE (via weight gain and ↑RMR) matching EI

Swinburn et al Lancet Obesity Series, 2011

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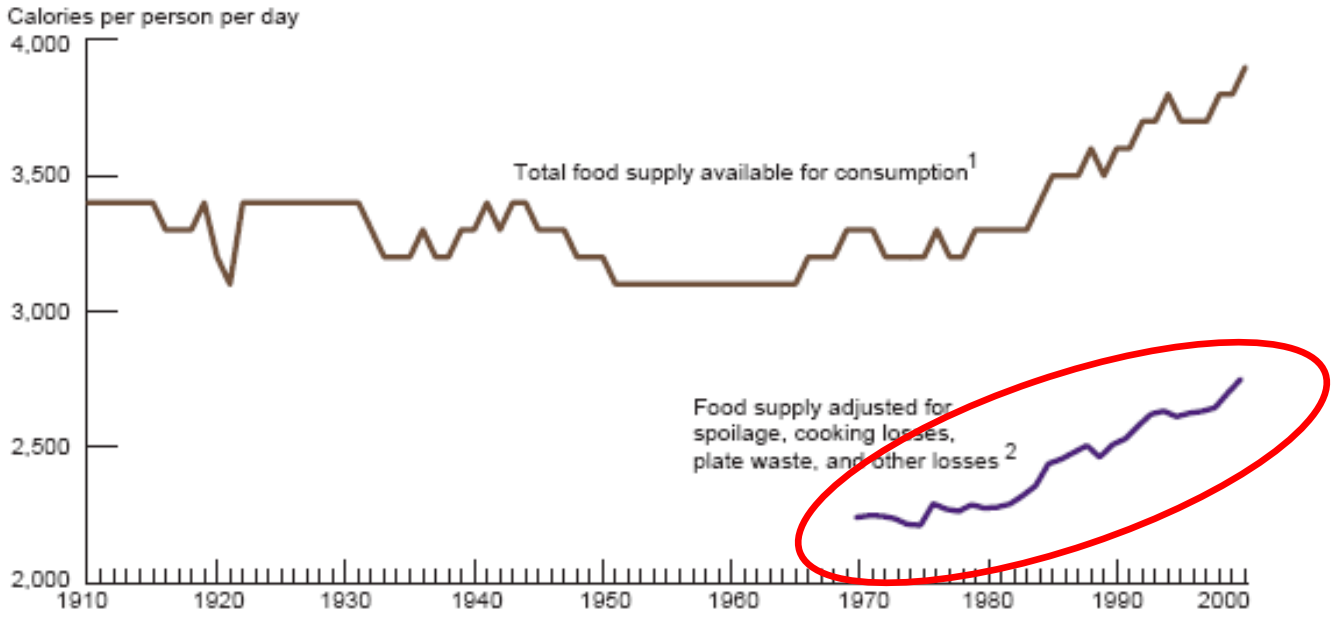
Food energy supply, USA 1910-2000

Figure 1—Calories From the U.S. Per Capita Food Supply, Adjusted for Losses, Increased 20 Percent Between 1982 and 2000



[1]Rounded to the nearest hundred.
[2]Not calculated for years before 1970.
Source: USDA's Center for Nutrition Policy and Promotion; USDA's Economic Research Service.

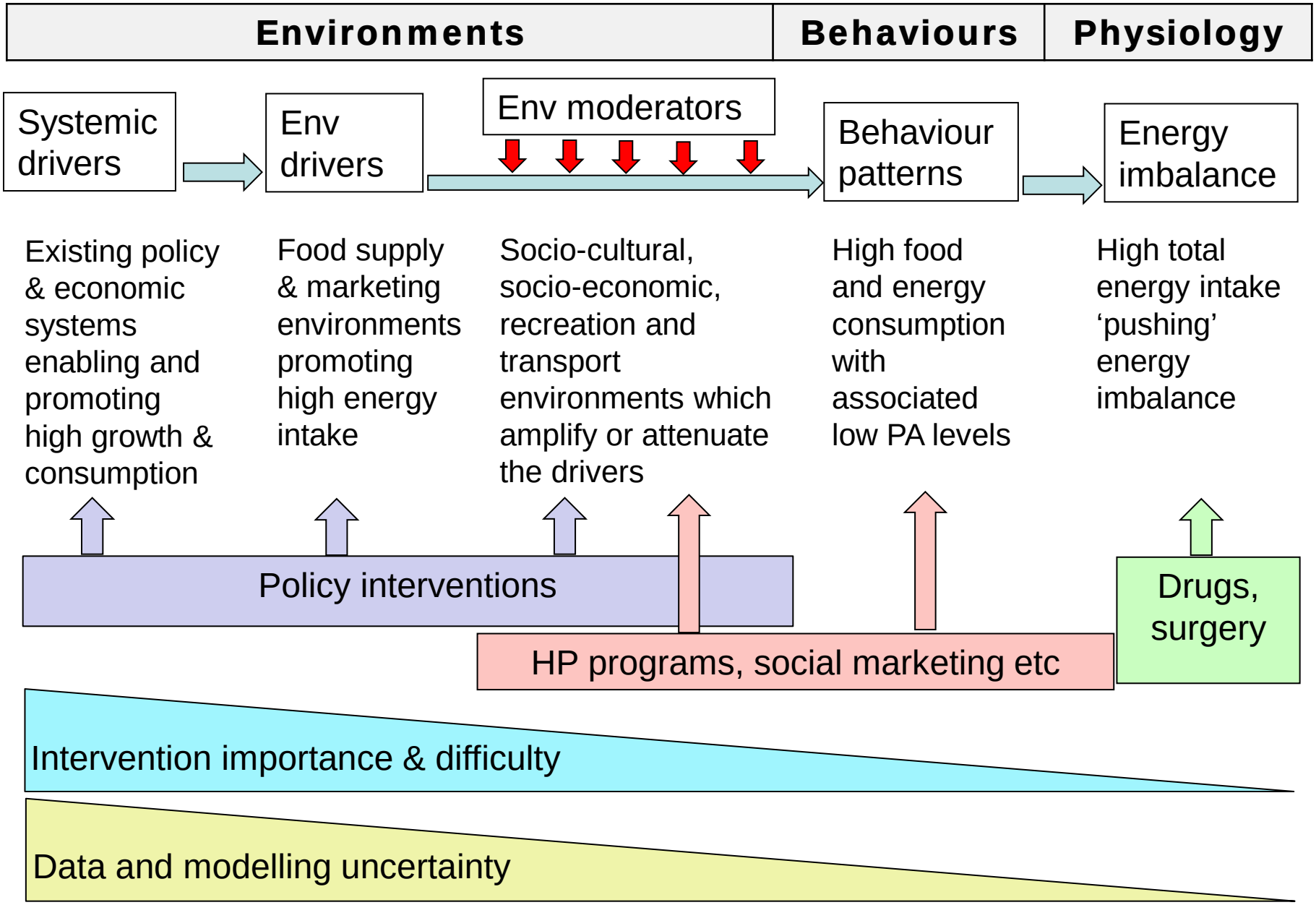
Economic Research Service, USDA

FoodReview, Winter 2002 3

Rise in food energy supply is more than enough to explain the rise in body weight in the US (and increase in food waste).

Swinburn B et al AJCN 2009
Hall KD PLoS ONE 2009

Obesity Determinants and Solutions Pathways



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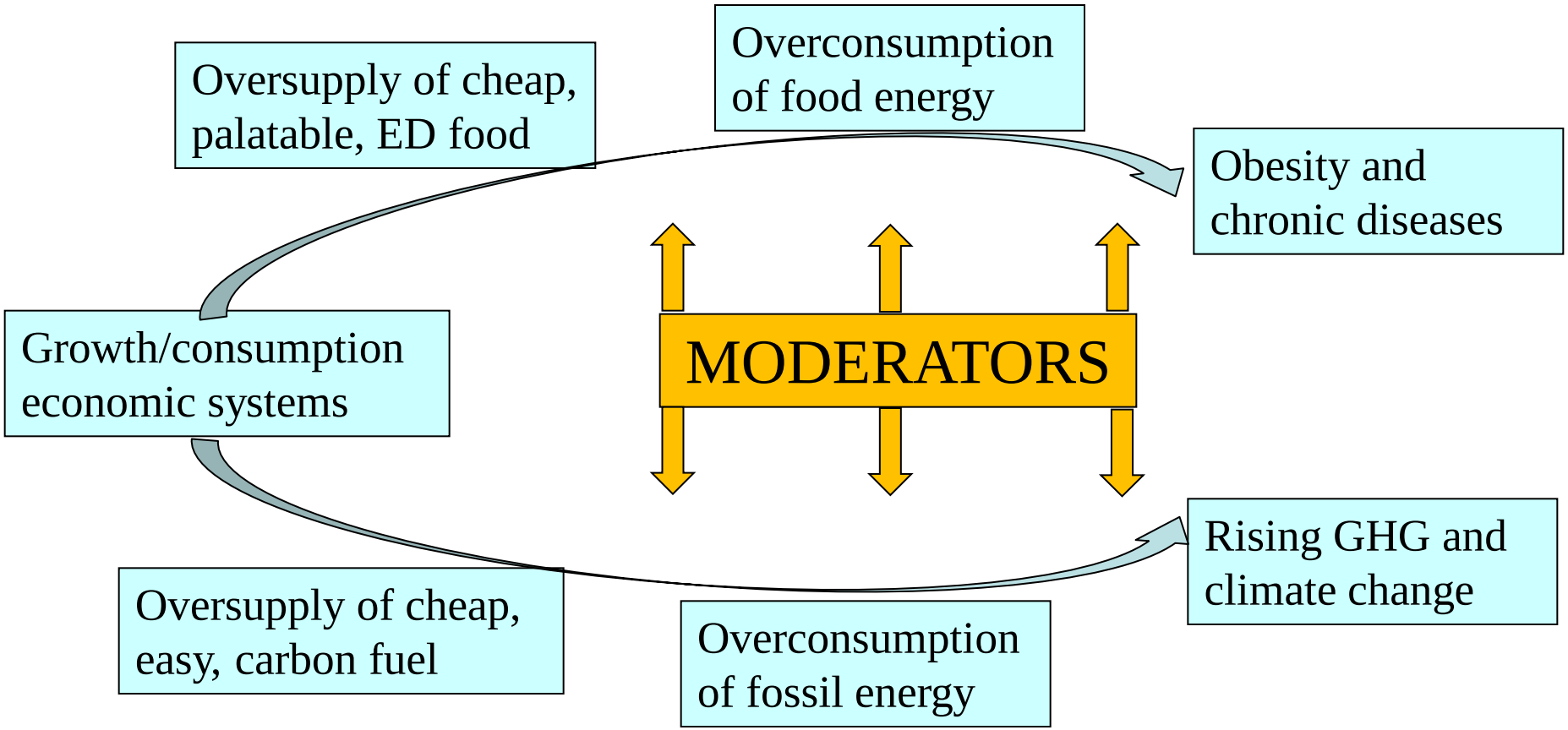
Common drivers of obesity & climate change



Egger G, Swinburn B Planet Obesity

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Global epidemic, global drivers

- Simultaneous global rise in obesity from ~1970s
  - High, middle & increasingly low income countries
- Points to global drivers
- Globalised food systems
  - Increasingly processed, affordable, available and promoted tasty food
  - 'Push effect' from the environment
  - 'Passive overconsumption' by the population

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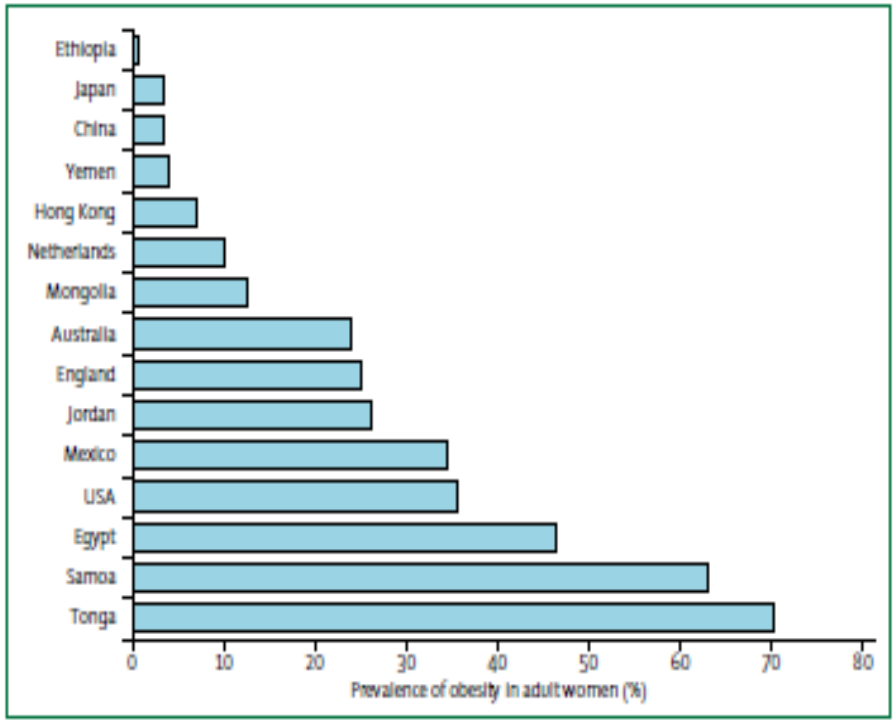
Shaped by local environments



Obesity prevalence in women

- Economic environments
  - Income
  - Income disparities
- Physical environments
  - Food
  - Physical activity
- S-cultural environments
  - Food, PA, body size
- Policy environments
  - Market regulations

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How can science contribute to obesity prevention?

- WHO targets and monitoring framework
  - Reduce NCD mortality by 25% by 2025
  - No rise in adult and adolescent obesity by 2025
  - No target for childhood obesity
  - Targets & indicators for policies and environments are virtually absent
- Achieving this modest progress on obesity will not occur without major changes in food policies and environments
- Is science helping to shape policy & practice?

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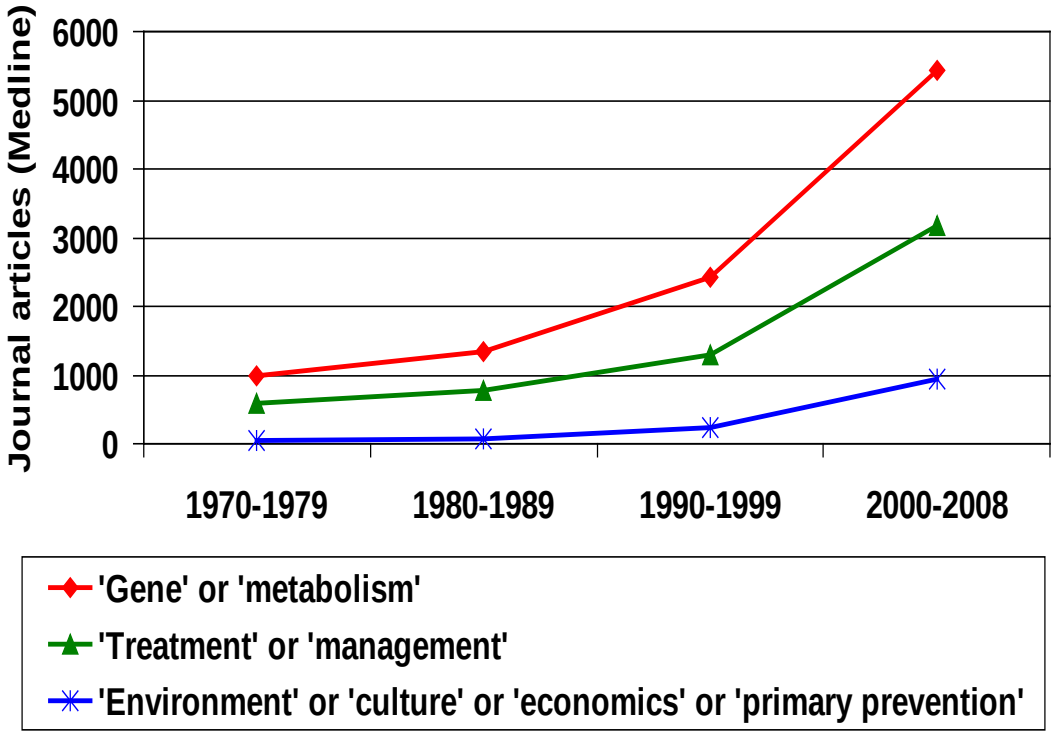
Publications in obesity research

- Mainly basic and clinical sciences
- Mostly understanding mechanisms or ‘causes’ (not solutions)
- Very few have influence on prevention policy or practice

Medline journal article numbers referenced with ‘Obesity’ and other key MeSH headings



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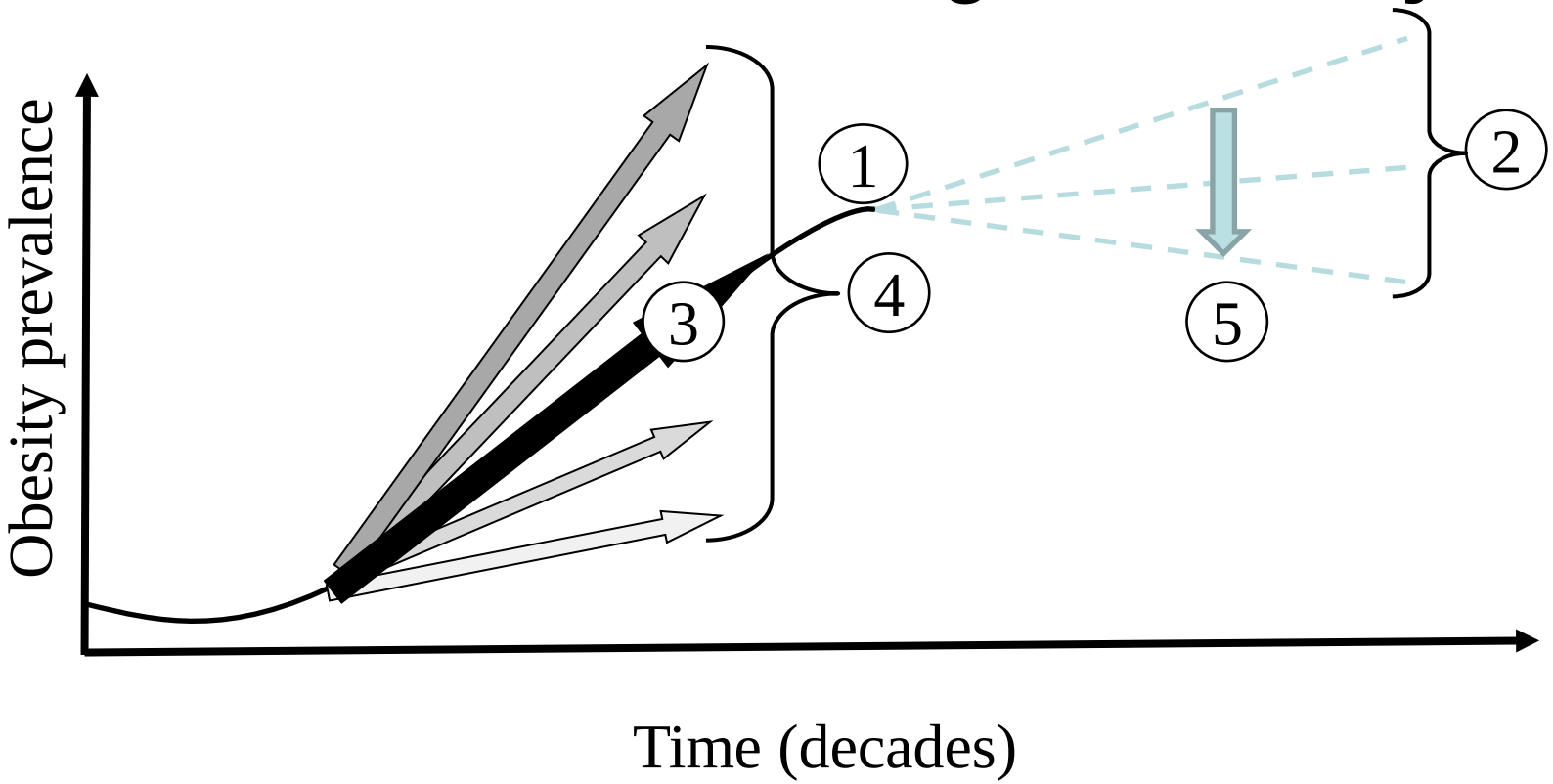
The uses of modelling in obesity



Descriptive: 1. current burden 2. future burden
Explanatory: 3. changes over time 4. differences between populations
Evaluative: 5. effectiveness of interventions

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Conclusions

- The global childhood obesity epidemic is continuing especially rapidly in LMICs
- Even in HICs, it is plateauing at unacceptably high level and creating greater inequalities
- Many cultural, environmental and economic factors are not yet well incorporated into models of determinants
- For modelling science to be useful to policy-makers, it needs to answer the questions that they have about how to reverse the epidemic and its inequalities