What Behavioral and Environmental Interventions Among Children Are Effective in Reducing Overweight?

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Overview

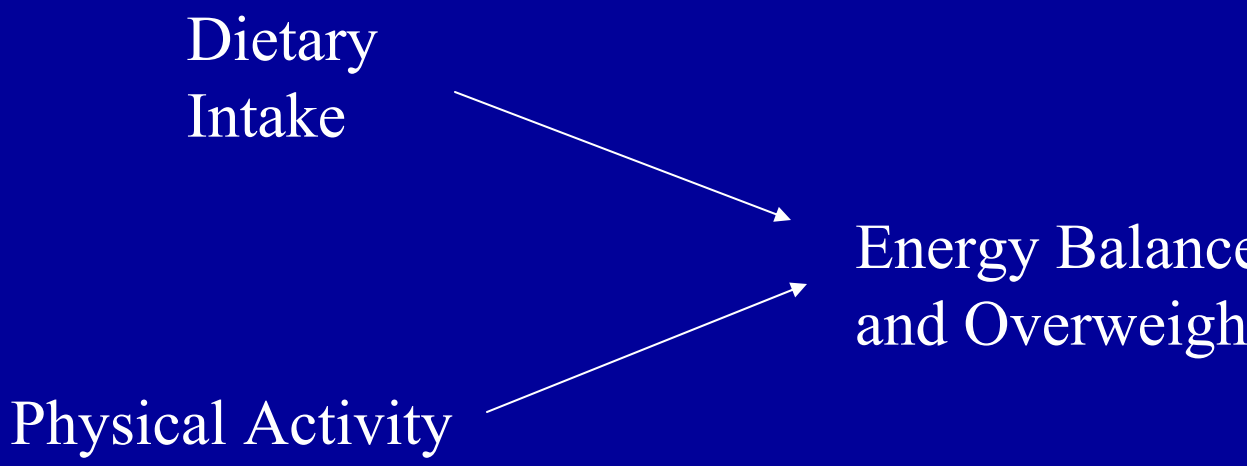
- Evidence from randomized behavioral and environmental interventions to reduce overweight among children and youth
- One person's view of the most important interventions that are influencing overweight among children and youth
- Some questions for future funded research

Overweight Fundamentals

- **Overweight is caused by excess Energy Intake over Energy Expenditure**
- **Daily imbalance is on average small: lots of small seemingly inconsequential accumulate over time - the "fat ratchet"**
- **Individual behaviors are strongly influenced by their context**

Koplan JP,Dietz WH. Caloric imbalance and public health policy. JAMA. 1999;282:1579-81.

Hypothesized Impact of Dietary Intake and Physical Activity on Overweight



Intensive clinical interventions can alter dietary intake and physical activity levels and reduce overweight

Intensive Clinical Interventions: Some evidence for efficacy among overweight children and youth

- Epstein LH, Valoski MS, Wing RR, McCurley J. Ten-year follow-up of behavioral, family-based treatment for obese children. J Am Med Assoc. 1990;264:2519-2523
- Epstein et al Health Psychol. 1995; Arch Pediatr Adolesc Med.2000;154:220-226. Intervention with dietary change and reductions in sedentary behavior

Interventions to reduce physical activity alone have not yet produced significant effects on overweight among children and youth

With exceptions:

Lee L, Kumar S, Leong LC. The impact of five-month basic military training on the body weight and body fat of 197 moderately to severely obese Singaporean males aged 17 to 19 years. Int J Obes Relat Metab Disord 1994 Feb;18(2):105-9.

But More Physical Education in Schools & More Active PE can be Useful

- **Randomized controlled trials indicate effectiveness in increasing activity levels in Physical Education (PE) classes**
- **Randomized controlled trial indicates no negative test score impact of active PE**

Luepker RV, Perry CL, McKinlay SM, et al. Outcomes of a field trial to improve children's dietary patterns and physical activity: the Child and Adolescent Trial for Cardiovascular Health (CATCH). JAMA. 1996;275:768-76.
Sallis JF, MCKenzie TL, Kolody B, Lewis, M, Marshall S, Rosengard P. Effects of health-related physical education on academic achievement: project SPARK. Res Q Exerc Sport. 1999;2:127-34.

Dietary interventions alone should show some effects in reducing overweight - but limited evidence

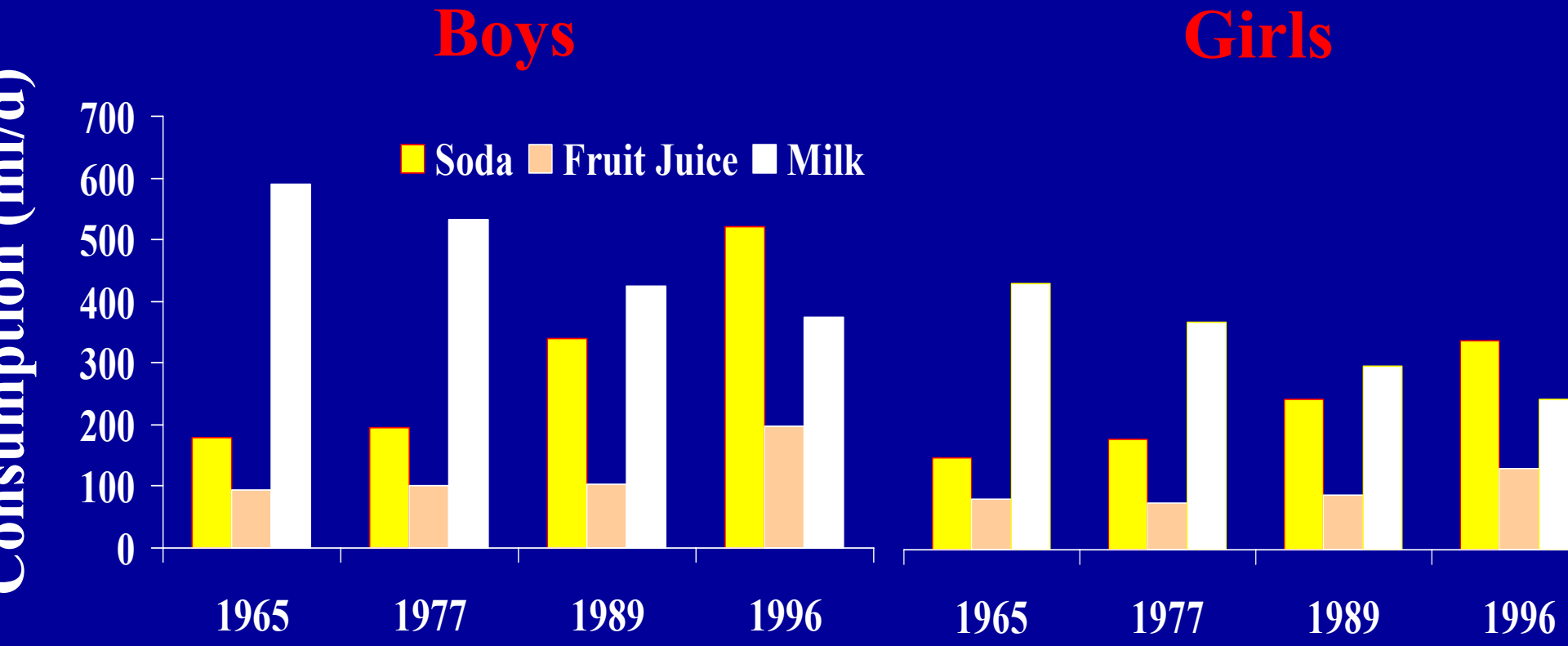
For Example: Among Overweight Youth: A Reduced-Glycemic Load Diet

- Ebbeling CB, Leidig MM, Sinclair KB, Hangen JP, Ludwig DS. A reduced-glycemic load diet in the treatment of adolescent obesity. Arch Pediatr Adolesc Med. 2003 Aug;157(8):773-9.

Evidence grows that sugar-sweetened beverages contribute to childhood overweight

Trends in Beverage Consumption Among US Adolescents, USDA 1965-96

Cavadini et al. Arch Dis Child 2000



A prospective study: soft drink consumption overweight

"For each additional serving of sugar-sweetened beverage consumed, both BMI (0.243 kg/m2; P=0.03), and incidence of obesity (odds ratio 1.60; P=0.02) increased."

Ludwig DS, Peterson KE, Gortmaker SL. Lancet 2001, 357:505-8

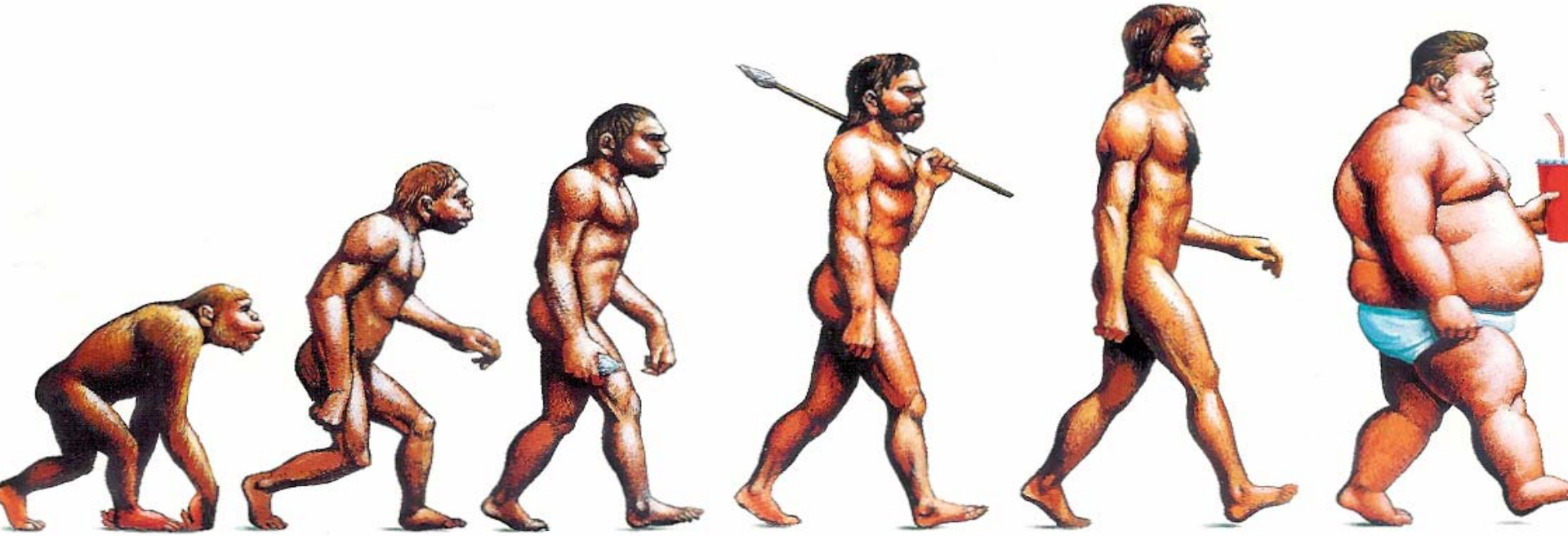
A cluster-randomized trial

Decreased consumption of carbonated drinks (intervention versus control)

Reduction in overweight (-7.7%; 95% CI 2.2% – 13.1%)

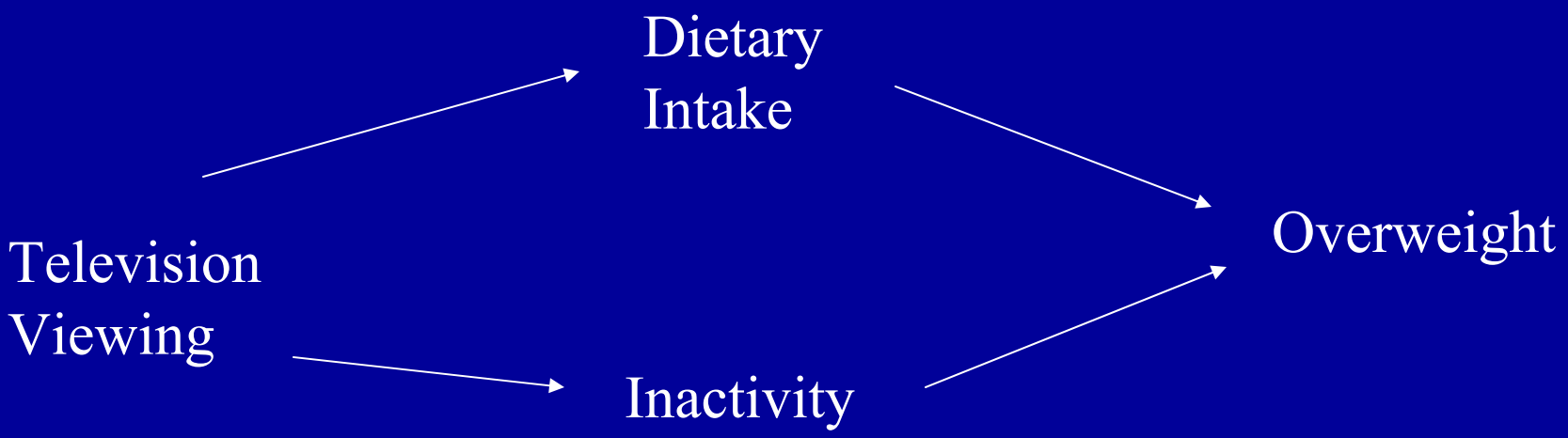
James J, Thomas P, Cavan D, Kerr D. Preventing childhood obesity by reducing consumption of carbonated drinks: cluster randomised controlled trial. BMJ. 2004 May 2;328 (7450):1237.

The shape of things to come



Evidence grows that television viewing influences childhood overweight

Hypothesized Impact of Television Viewing on Overweight



Randomized Controlled Trials: Television and Obesity

- **Most direct study: School-based intervention**: **primary grades;** impact on mean BMI (Robinson. JAMA.1999.)
- **Studies that focused on both improving diet and reducing television and increasing physical activity**
  - **Clinical Intervention:** Obese children and youth; impact of reducing inactivity on overweight (Epstein et al. Health Psychol. 1995; Arch Pediatr Adolesc Med.2000;154:220-226.)
  - **School-based intervention**; Planet Health in **middle school;** reduced television predicts reduced obesity among girls (Gortmaker et al. Arch Pediatr Adolesc Med. 1999)

An intriguing cost-effectiveness study

An independent economic analysis of Planet Health found:

- **An estimated program cost of $14/student/year**
- **Planet Health is more cost-effective than commonly accepted preventive interventions, such as screening and treatment for hypertension.**
- **$4300 per QALY (quality adjusted life year)**

Wang LY, Yang Q, Lowry R, Wechsler H. Economic analysis of a school-based obesity prevention program. Obes Res. 2003 Nov;11(11):1313-24.

What is the relative effect: intake versus expenditure?

- **In a small RCT (N=13) of non-obese youth ages 8-12, Epstein et al (J of Pediatrics. 2002;140:334-339)**
  - **Successfully increased sedentary behavior (mainly TV) by 80 min/day - later decreased this behavior**
  - **Observed a subsequent increase of energy intake (250 kcal/day) and decrease in activity (100 kcal/day) for a total imbalance of 350 kcal./day**
- **They found smaller (insignificant) changes when TV was reduced**
- **This small study provides some sense of magnitude of TV effect on imbalance via diet and inactivity**

Empirically there is little relationship between the measured amount of time spent on moderate and vigorous physical activity and the amount of time spent watching television.

Empirical Relationship of Time Spent in Moderate/Vigorous Activity and Time Spent Viewing Television

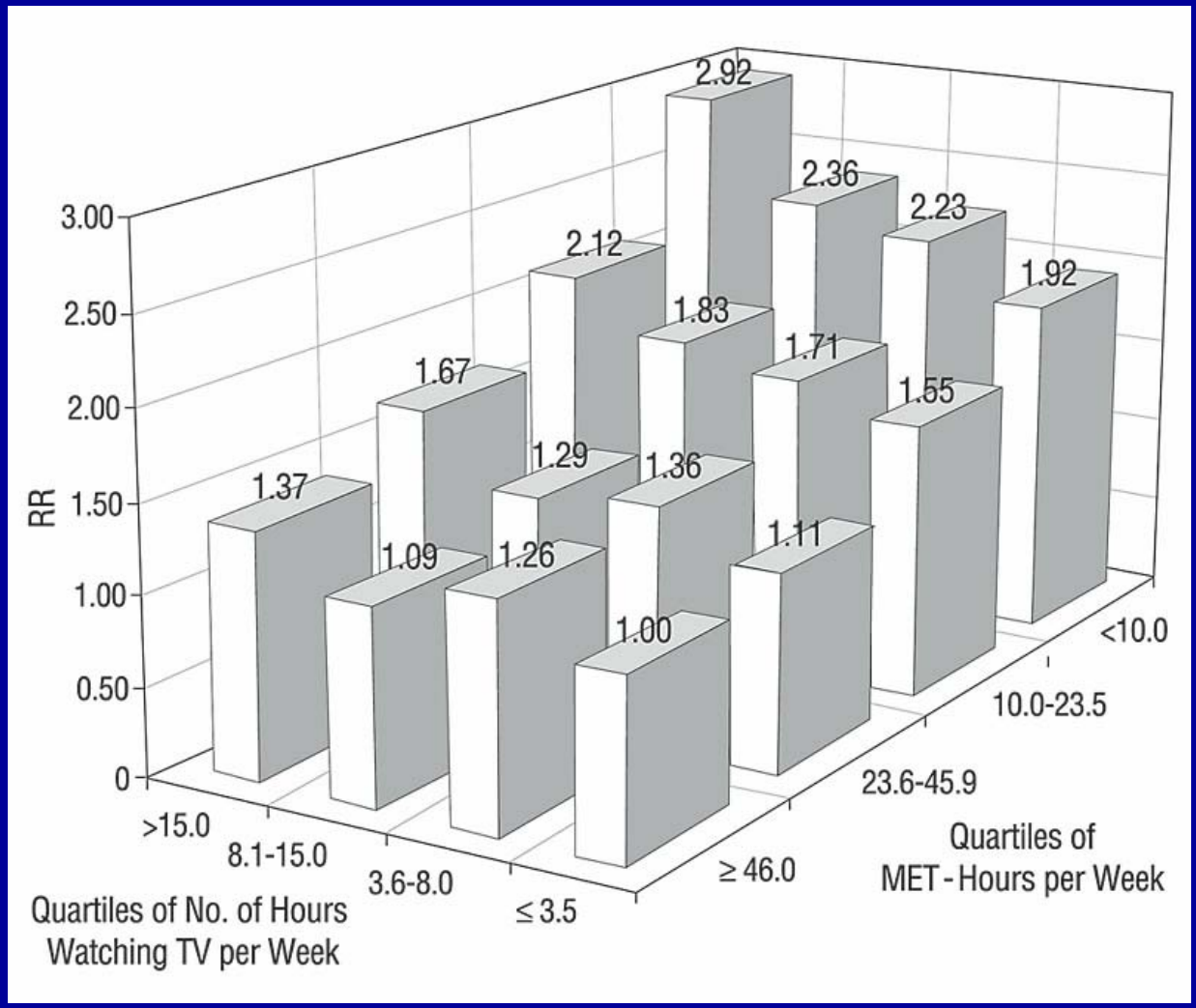
Heath et al, 1994. National sample of high school youth.	No relationship between TV hours & vigorous activity
Robinson et al, 1993. Sixth and seventh grade students in CA	Weak inverse association of TV hours and physical activity
Durant et al, 1994. Three and four year old children using observations	Weak inverse association of TV hours and physical activity
Gortmaker et al, 1991. Adults in university	R = - 0.04 TV hours and physic activity
Ching et al, 1996. Male Health professionals	Weak inverse association of TV and physical activity
Gortmaker Planet Health	R=-0.04
Hu et al studies 2001; 2003	Weak negative; e.g. R=-0.03

Why is this?

1) There is much sedentary time to allocate;

2) There is very little moderate and vigorous activity time (on average);

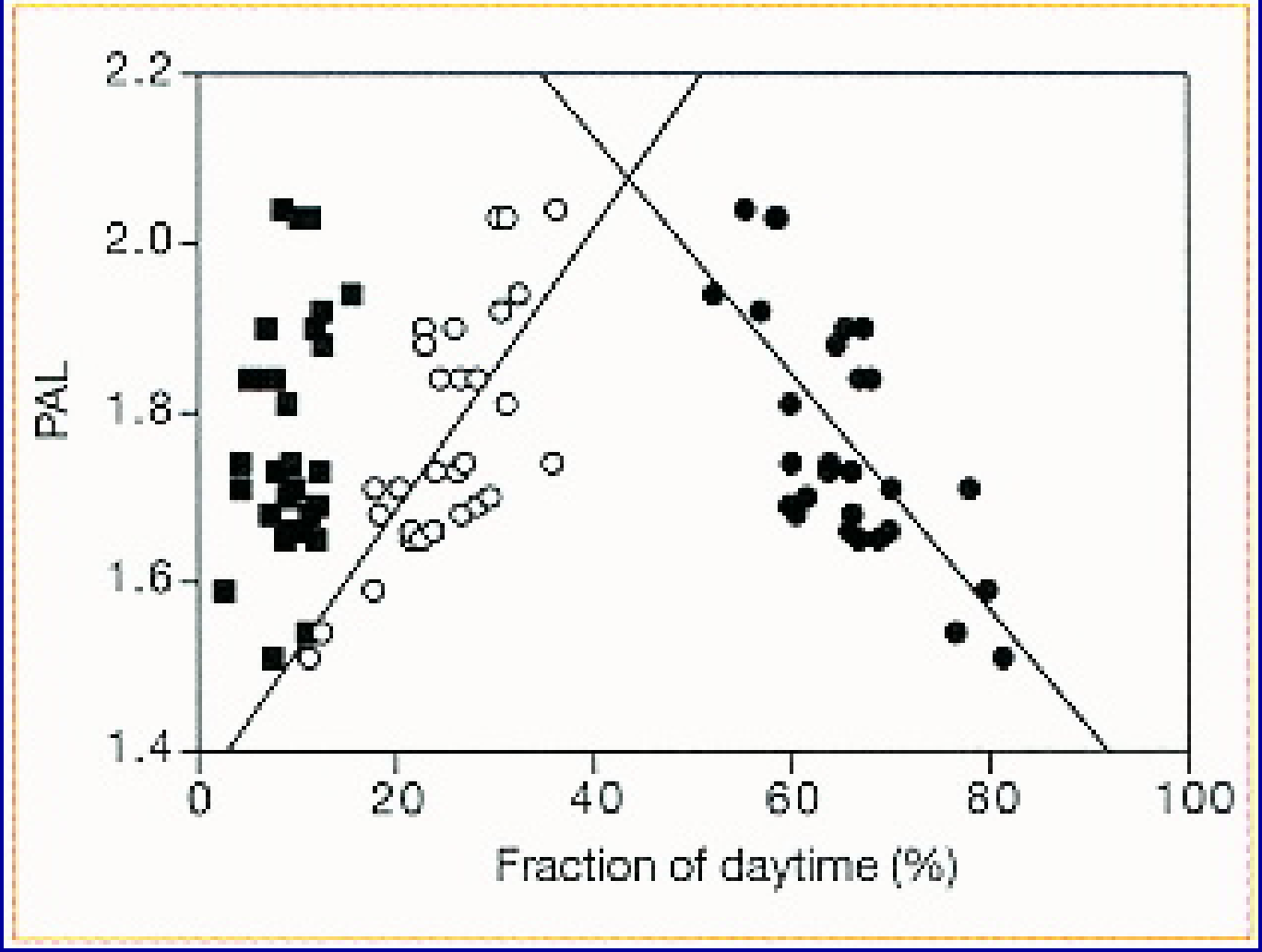
Conclusion: There is little or no association of vigorous activity levels and TV viewing time - these should be seen as distinct constructs - not as functional opposites



Independent relationship of TV viewing and physical activity to diabetes incidence; males

(Hu et al, Arch Intern Med. 2001;161:1542-8)

From: Westerterp: Nature, Volume 410 (6828).March 29, 2001.539



gure 1 Physical activity levels (PAL) as a function of the fraction of daytime hours spent
30 healthy subjects (with body-mass indices within the normal range) on activities of low
lled circles), moderate (circles) and high (squares) exercise intensity. Linear regressions ar
own for low- and moderate-intensity activities: subjects spending more time on moderate-
tensity exercise and less on low-intensity activity can improve their PAL values. Time spe
high-intensity exercise does not appear to influence total energy expenditure.

My personnel assessment:

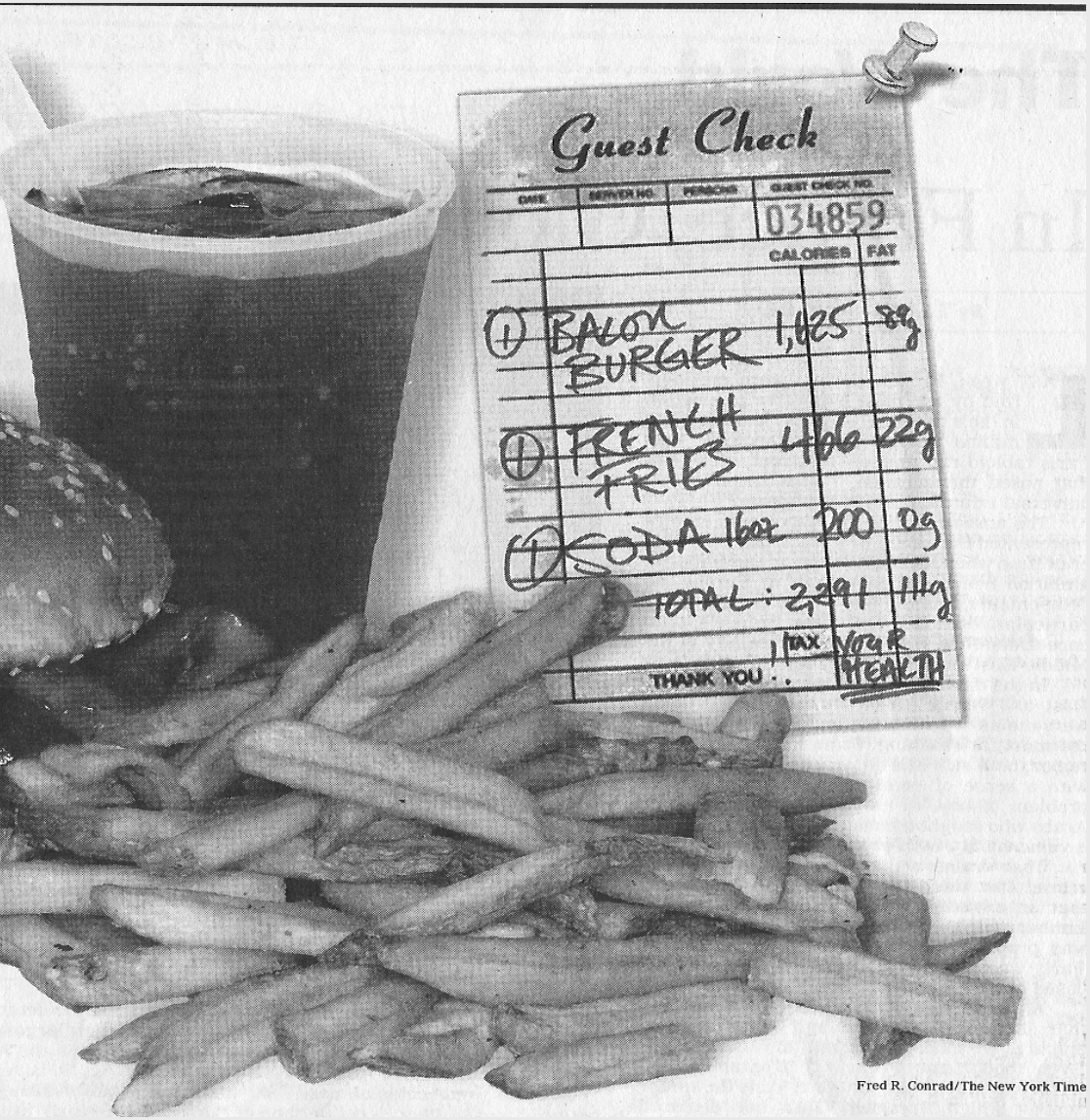
- The interventions we've just described are very small pieces of the overweight epidemic among children and youth
- The really powerful interventions have been and continue to be implemented by other organizations

The Important Forces:

- **F**ood producers and the "Fast Food" industry - if they're successful, we all eat more
- **A**dvertisers for food and video/film industries - if they're successful, we all buy more
- **T**elevision and video/film production and distribution industry - if they're successful we all watch more

The growth of the fast food industry and increasing portion sizes make it easy for children to overeat - and TV advertising drives this growth


Dollar Menu
Add something to your Extra Value Meal®
$1 each Every Day!



Fred R. Conrad/The New York Time

"A large fast food mea
(double cheeseburger,
french fries, soft drink
desert) could contain
2200 kcal, which…
would require a full
marathon to burn off"

Ebbeling CB, Pawlak DB, Ludwig DS
Childhood obesity: public health
crisis, common sense cure. Lancet
2002;360:473-82.

"Can Johnny come out and eat?"

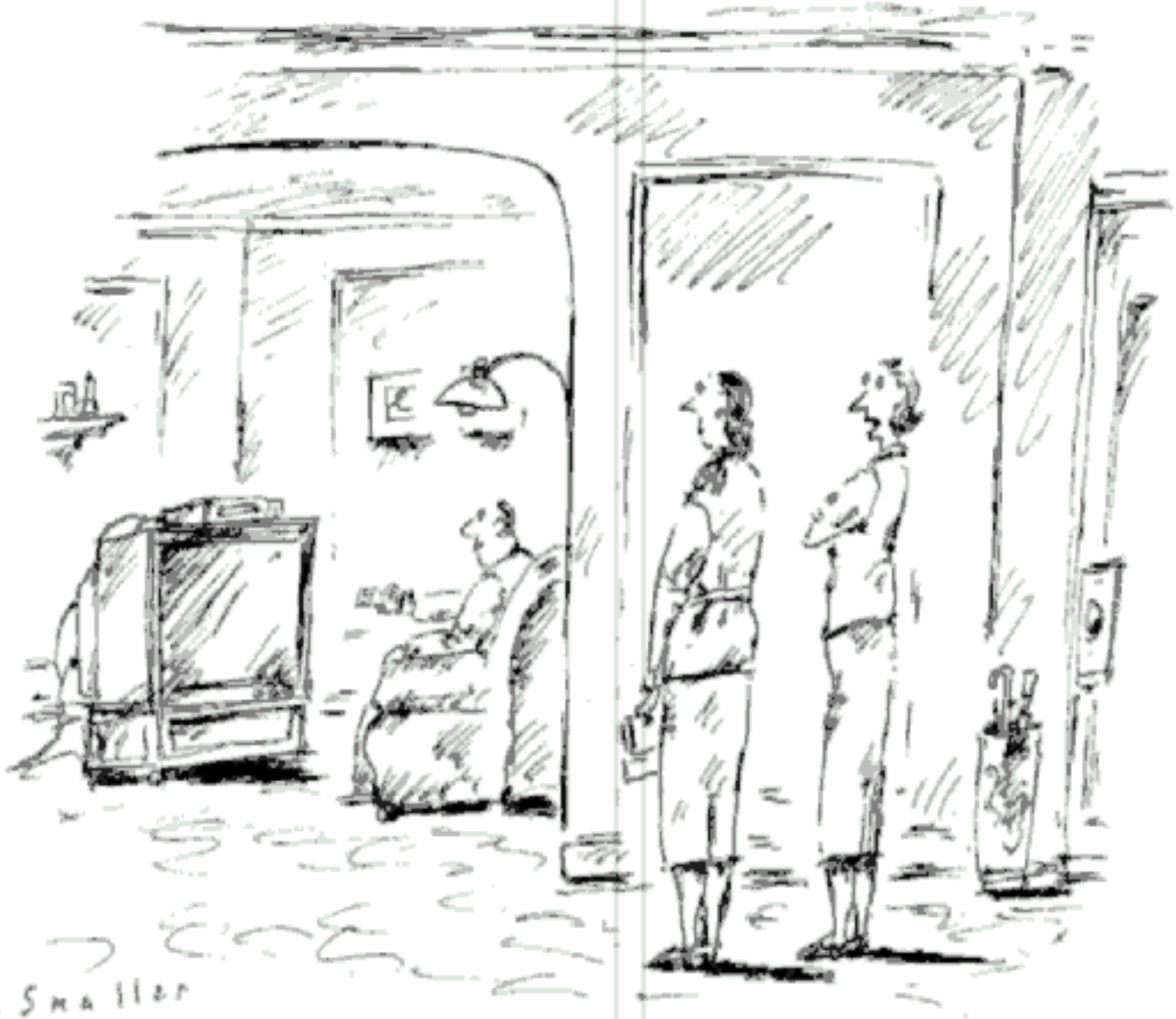
Foods Advertised on Television

- 95% of fast food restaurants ad budget spent on television
- 75% of manufacturer's budgets spent on TV
- Foods most advertised by manufacturers are
  - Confectionary, snacks, prepared convenience foods and soft drinks
  - Foods advertised on television budget was $11b in 1997

USDA ERSAIB750. 1999

The growth of "video screen" industries - broadcast TV, cable TV, VCR, DVD, videogames, computer games, the internet, and the coming merger of all the above - is continually changing the lives of our children - with no evidence that it's good for anyone

Imagine a future with even more effective advertising to children - via broadband where each "commercial" is personalized to appeal to *your* child



"Every few years, Gordon and the TV get a couple of inches wider."

Is there synergy between environmental forces and social and behavioral interventions to reduce energy imbalance?

There must be - you have a genetically susceptible segment of the population, and "toxic food," and "sedentary built" environments and an ever expanding media environment

These environments are generally not supportive

- We can encourage children to ride bikes for transportation, but spend 99.9% of transportation resources on infrastructure for cars
- We work to limit TV, but the media environments keep changing and becoming more attractive
- We encourage better diet, but poor quality food and drink become more efficiently available

These environments are potentially changeable

- The food environment may change most rapidly - but thus far we don't see much evidence for effect
- The media environment is constantly innovating - and this may mean more effectiveness at inducing sedentary behavior and targeting advertising
- The built environment will change most slowly - like the population DNA.

A prediction: disparities in overweight prevalence will continue to grow (income,ethnicity)

- As wealthier households can select communities with better food and physical activity environments
  - no fast food
  - in and out of school recreational opportunities
- As wealthier communities implement interventions to improve nutrition and physical activity and reduce TV/video exposure

Some Questions

- **How can we make our interventions more relevant to the corporate and institutional environmental forces driving the epidemic?**
- **Example: in studying the impact of fast food environments on energy imbalance in children, we can study mediating mechanisms such as portion size (Orlet Fisher J, Rolls BJ, Birch LL. Children's bite size and intake of an entree are greater with large portions than with age-appropriate or self-selected portions. Am J Clin Nutr. 2003 May;77(5):1164-70.)**
- **However don't we also need more interdisciplinary study of economic factors if we want profit-focused industries to change? (**Cutler D, Glaeser E, Shapiro J.Why have Americans become more obese? Journal of Economic Perspectives 17(3), Summer 2003, 93-118.)

Some More Questions

- **If a researcher partners with industry, can this research be accepted by other scientists? Is there a way to make such work possible?**
- **Clearly much synergy between environmental contexts and behavioral interventions is possible, but if our impact on the broader environment is minimal via interventions (e.g. we don't have the $$ for large scale changes), do we need to be using quasi-and natural experimental designs to study this synergy? (recent NIH conference:** "Fine, Lawrence (NIH/OD)" <FineL@OD.NIH.GOV)

The Important Forces:

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