The Overweight Epidemic Among Children and Youth in the United States: Causes and Opportunities for Prevention

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Supported by the Centers for Disease Control and Prevention
(Prevention Research Centers Grant U48/CCU115807)

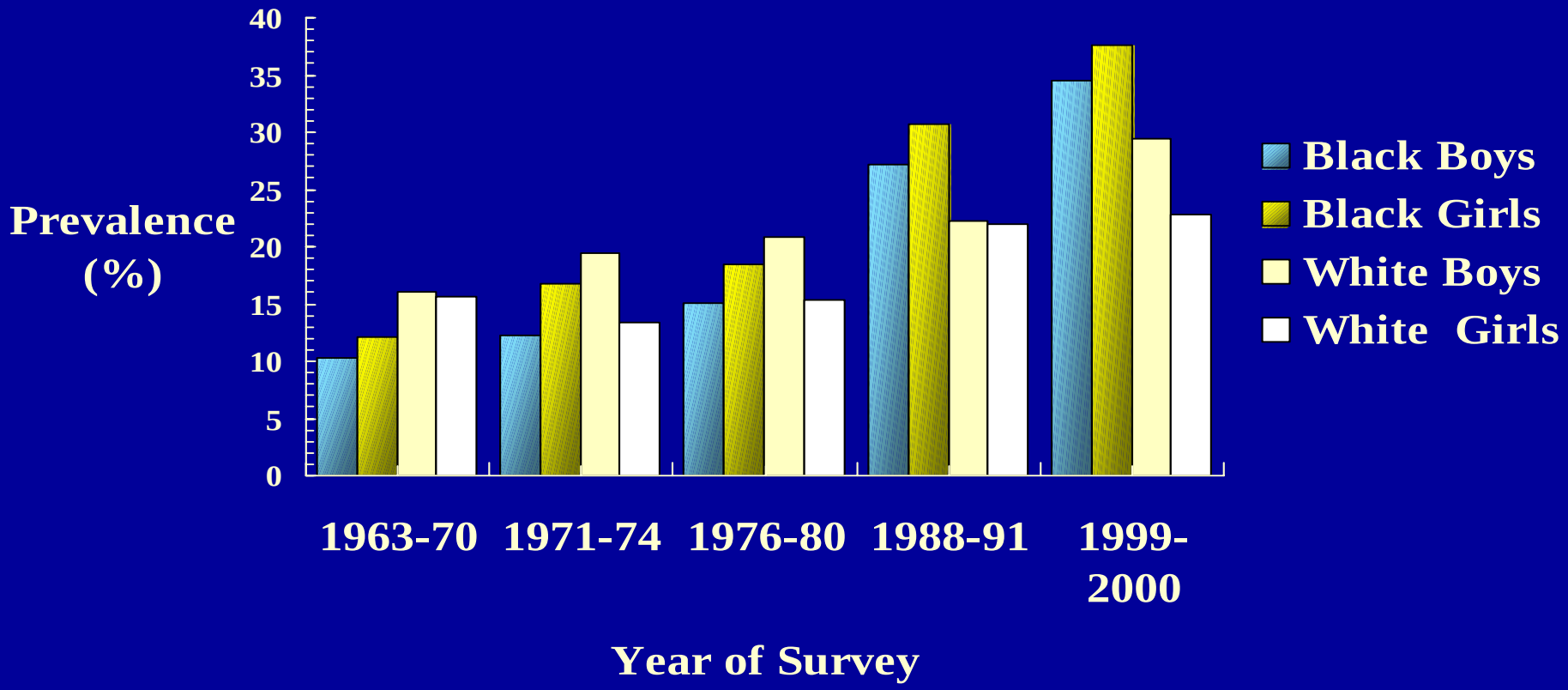
Overview

- What we know about the causes of the epidemic
- Why the environments of children and youth are so important – this includes homes, schools, communities, the food industry and mass media
- What science tells us: some of the best opportunities for prevention of overweight

The Problem:

- **Overweight and obesity are increasing rapidly among children, youth and adults in the US**
- **Increases are found in all regions of the country, urban/rural, both sexes, all ethnic groups, rich and poor**

Prevalence of Overweight Among U.S. Boys and Girls by Race/Ethnicity, Ages 6-11, 1963-2000



Overweight defined as a BMI at the 85th percentile or higher (for age and sex)

Troiano RP et al. Arch Pediatr Adolesc Med 1995;149:1085-1091. Ogden et al. JAMA 2002;288:1728-32.

Causes of the Overweight Epidemic

Overweight Fundamentals

- **Overweight is caused by excess Energy Intake over Energy Expenditure**
- **Daily imbalance is on average small: an extra can of soda per day (150 kcal) can add 15.6 pounds per year**
- **Individual behaviors are strongly influenced by their context**

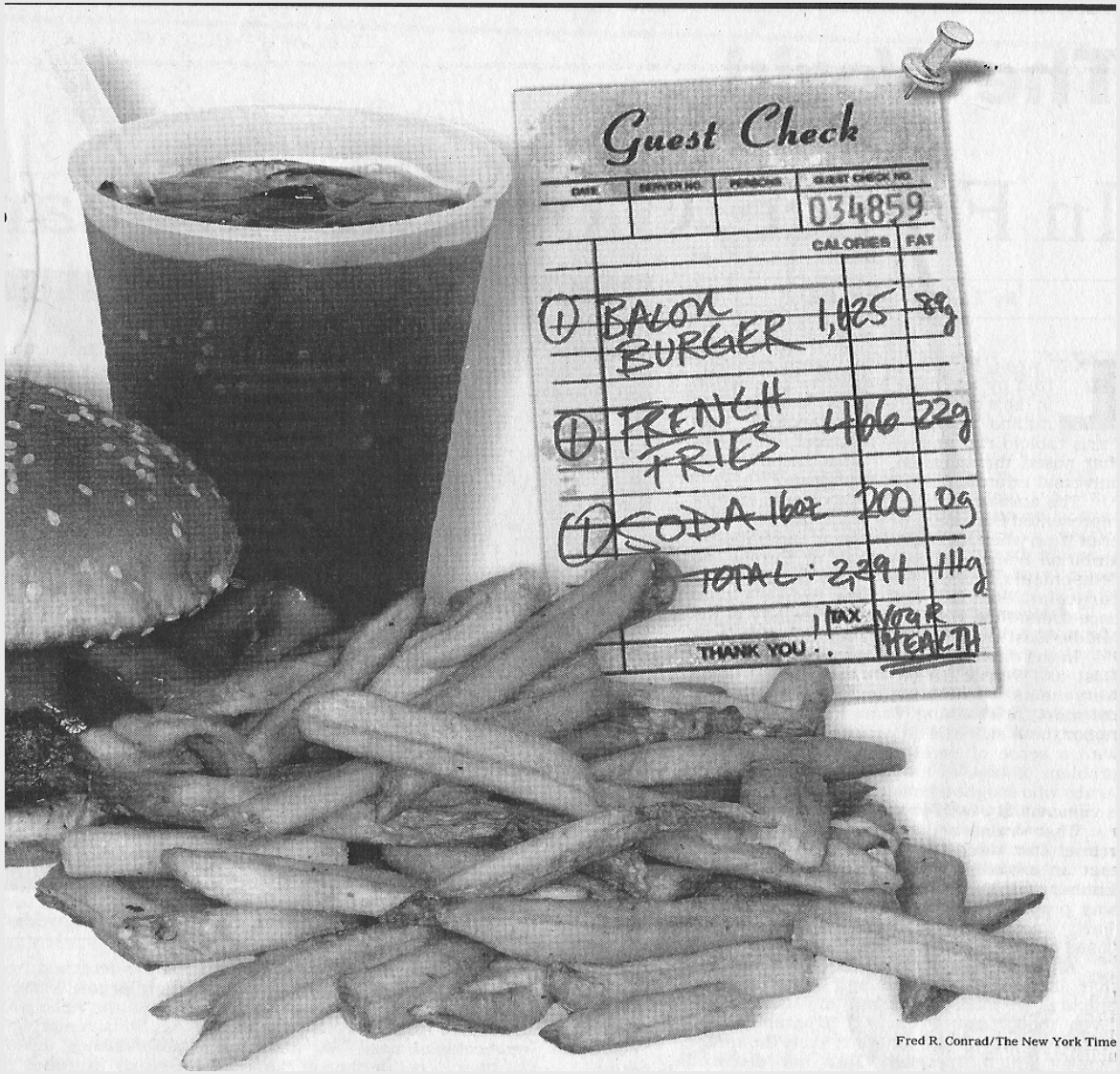
Koplan JP,Dietz WH. Caloric imbalance and public health policy. JAMA. 1999;282:1579-81.

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


Dollar Menu
Add something
to your
Extra Value Meal®
$1 each
Every Day!
Products featured are the Small Soft Drink, McValue® Fries, Side Salad, Big N' Tasty® or Big N' Tasty® Classic,* Snack Size Fruit 'n Yogurt** Parfait, 2 Pies and McChicken® or Hot 'n Spicy McChicken® Sandwich.
Current prices and participation based on independent operator decision. Products and prices may vary.
* weighs before cooking 3.9 oz. ** made with low-fat yogurt.



"A large fast food meal (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.

Fast Food and Diet of Children and Youth

On days that children and youth eat fast food – they consume an extra 126 kcals/day (P<0.0001)

Bowman S, Gortmaker SL, Ebbeling CB, Pereira MA, Ludwig DS. Effects of fast food consumption on energy intake and diet quality among children in a national household survey. Pediatrics, in press.

Sugar-sweetened beverages contribute to childhood obesity incidence

Soft Drink Consumption and 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

The Important Forces:

- Food producers and the "Fast Food" industry - if they're successful, we all eat more
- Advertisers for food and video/film industries - if they're successful, we all buy more
- Television and video/film production and distribution industry - if they're successful we all watch more

Television Viewing and Energy Balance: The Science

- **How can television viewing cause obesity?**
- **Evidence in support of hypothesis**

Hypothesized Impact of Television Viewing on Obesity

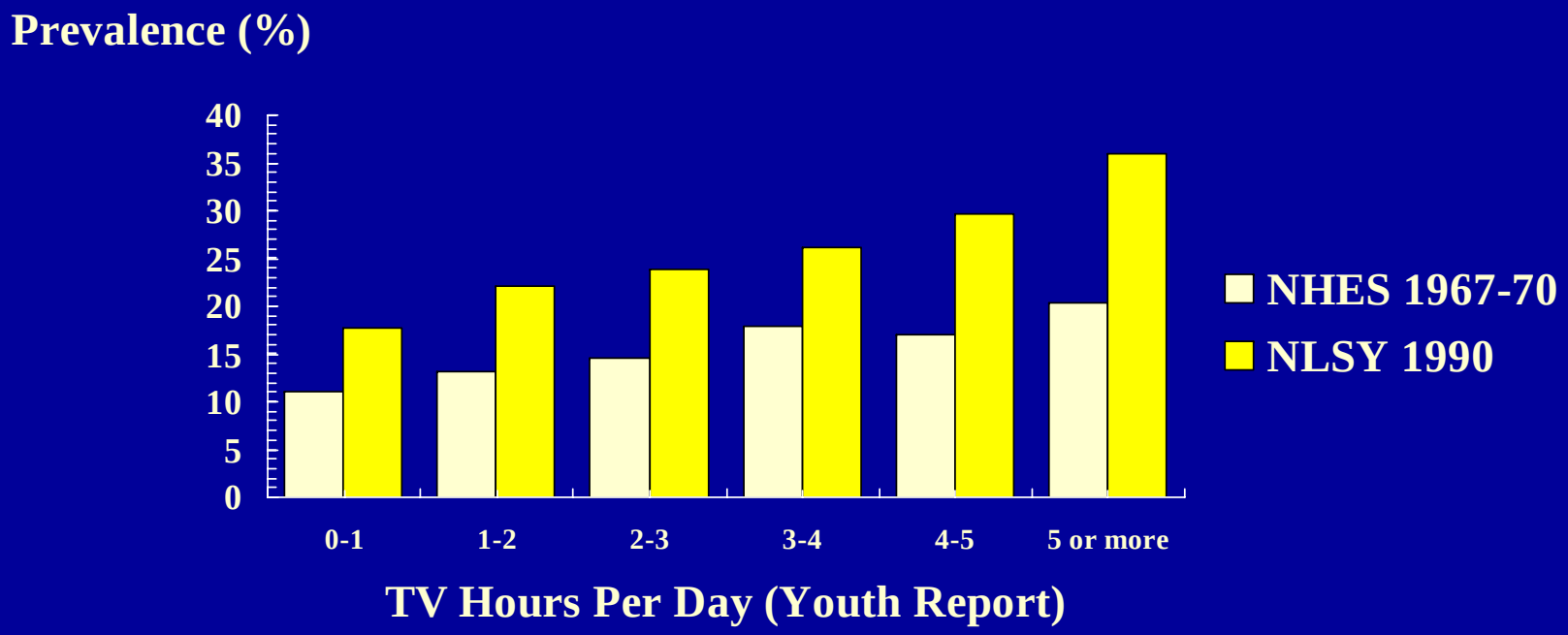
Evidence for the Impact of Television Viewing on Obesity

Population-Based Epidemiological Data

13 studies in United States

9 studies in other countries

Prevalence of Obesity by Hours of TV per Day; NHES Youth Aged 12-17 in 1967-70 and NLSY Youth Aged 10-15 in 1990



Dietz WH, Gortmaker SL. Do we fatten our children at the tv set? Obesity and television viewing in children and adolescents. Pediatrics, 1985; 75:807-812.

Gortmaker SL, Must A, Sobol AM, Peterson K, Colditz GA, Dietz WH. Television viewing as a cause of increasing obesity among children in the United States, 1986-1990. Archives of Pediatrics and Adolescent Medicine, 1996;150:356-362.

Evidence for the Impact of Television Viewing on Obesity

4 Randomized Controlled Trials

1) Epstein et al. Health Psychol 1995.
2) Robinson. JAMA.1999.
3) Gortmaker et al. Arch Pediatr Adolesc Med. 1999.
4) Epstein et al. Arch Pediat Adolesc Med 2000.

The Important Forces:

- **F**ood producers and the "Fast Food" industry - if they're successful, we all eat more
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The Consequences?

- **Clear evidence for increasing risk of cardiovascular disease, diabetes, adult obesity and cancer**

- **But we don’t really know the magnitude: never before have our children and youth been so overweight (and we don’t know consequences for adults either)**

Freedman DS, Dietz WH, Srinivasan SR, Berenson GS . The relation of overweight to cardiovascular risk factors among children and adolescents: the Bogalusa Heart Study. Pediatrics 1999 Jun;103(6 Pt 1):1175-82

Must A, Spadano J, Coakley EH, Field AE, Colditz G, Dietz WH. The disease burden associated with overweight and obesity. JAMA. 1999 Oct 27;282(16):1523-9.

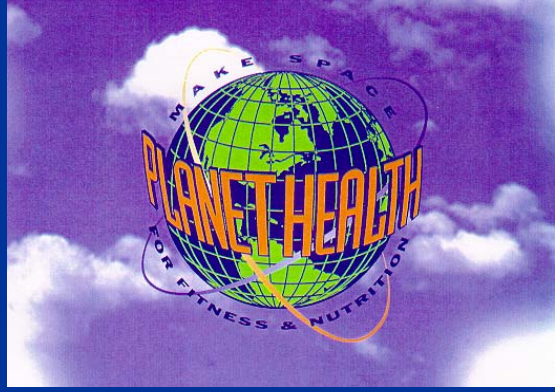
Can the Epidemic be Halted?

- Limited evidence for effective treatment of overweight
- The causes of the epidemic are rooted in the success of the food, television/video/movie/game and advertising industries.
- But we do have some scientific evidence that we can initiate change among children and youth

Strategy: Implement Effective School Based Programs to Reduce Overweight

- Planet Health
- Eat Well and ***Keep Moving***

Planet Health



An Interdisciplinary curriculum for 6th-8th grade students

Carter J, Wiecha J, Peterson KE, Gortmaker SL. Planet Health. Champaign, Illinois: Human Kinetics Press, 2001.

Behavioral Targets

- Reduce TV viewing to less than two hours per day
- Decrease consumption of high fat/saturated fat/trans fat foods
- Increase moderate and vigorous activity
- Increase consumption of fruits and vegetables to five-a-day or more

Effects of Planet Health

- **Obesity among females in intervention schools was reduced compared to controls (OR 0.48; P=0.03)**
- **Reductions in TV; both boys & girls**
- **Among girls, each hour of TV => reduced obesity (OR 0.86/hour; P=0.02)**
- **Increases in fruit and vegetable intake and less increment in total energy intake among girls (P=0.003 and P=0.05)**

- Gortmaker SL, Peterson K, Wiecha J, Sobol AM, Dixit S, Fox MK, Laird N. Reducing obesity via a school-based interdisciplinary intervention among youth: *Planet Health*. Archives of Pediatrics and Adolescent Medicine. 1999;153:409-18.

Safety: Females

- **Evidence for lower incidence of disordered eating behaviors among girls in intervention schools**
- **Among nondieting girls, onset of these behaviors was 11 times more likely in control versus intervention schools (odds ratio: 10.9; 95% confidence interval: 1.1, 112)**

Austin SB, Field AE, Gortmaker SL, 1992. Abstract; Academy for Eating Disorders

Cost Effectiveness

- An economic analysis of Planet Health indicates an estimated cost of $4305 per QALY and a net saving to savings to society of $7313 under base case assumptions (cost of $33,677 or $14 per student per year)

Wang LY, Yang Q, Lowry R, Wechsler H. Economic analysis of a school-based obesity prevention program. Obesity Research 2003;Vol 11, No 11: 1313-1324.

Planet Health: From Research to Practice

- **Project began working with 4 school systems (Cambridge, Somerville, Lynn, Framingham)**
- **Expanded to Boston Public Schools**
- **Studies document curriculum is well liked, and sustainable**
- **Curriculum now distributed in 48 states, 20 countries**

Eat Well and Keep Moving

An Interdisciplinary curriculum for 4th and 5th grade students

Cheung PLYH, Dart H, Gortmaker SL. Eat Well and Keep and Moving. Champaign, Illinois: Human Kinetics Press, 2001.

Gortmaker SL, Cheung LWY, Peterson KE, Chomitz G, Cradle JH, Dart H, Fox MK, Bullock RB, Sobol AM, Colditz G, Field A, Laird N. Archives of Pediatrics and Adolescent Medicine 1999;153:975-83.

Strategy: Improve Access of Youth to Opportunities for Physical Activity

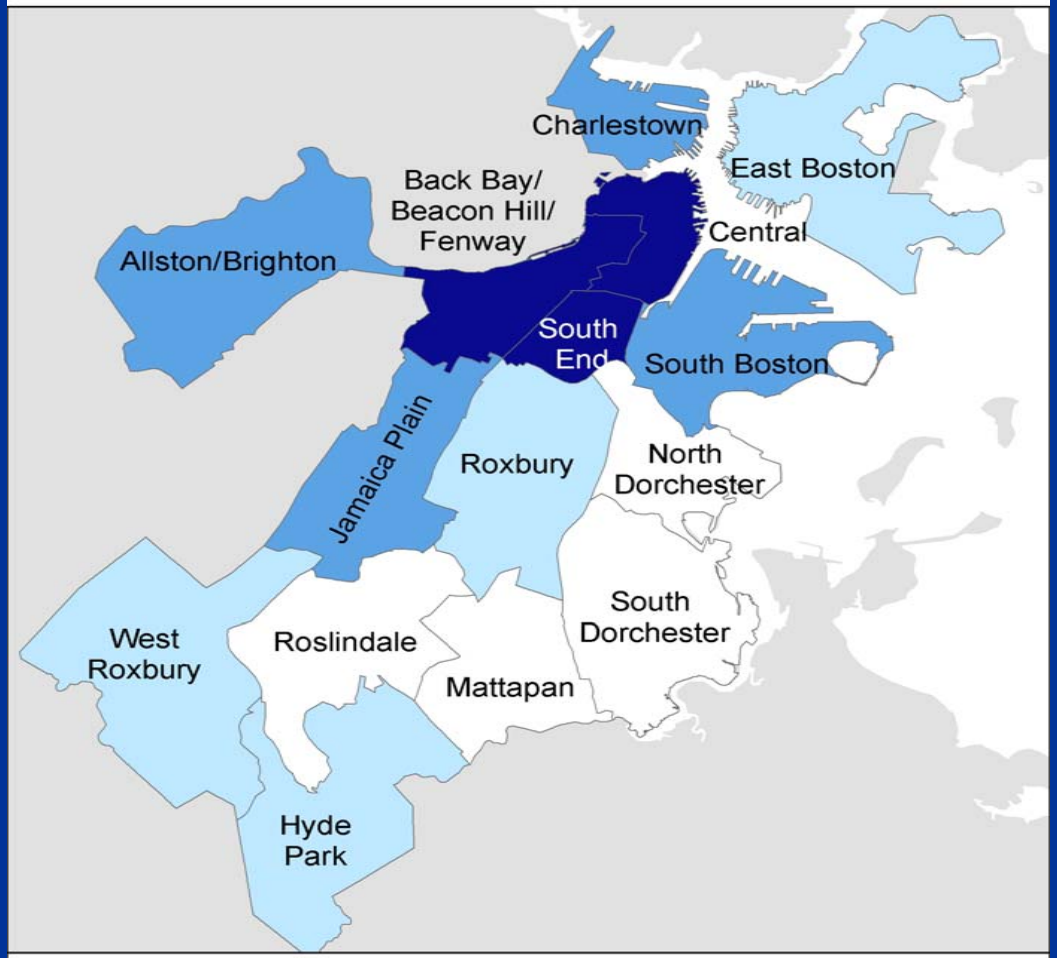
- Increase School PE
- Play Across Boston


Play
Across
Boston

Play Across Boston

- Goal: to increase access to youth physical activity in Boston
- Collaboration between the Harvard Prevention Research Center (HPRC), Northeastern University Center for the Study of Sport in Society (NUCSSS), Boston's Mayor Menino and multiple other community partners

Recreational Facilities per 1000 Children



Facilities per 1000 children

- 2.1 - 4.9
- 5.0 - 5.7
- 5.8 - 10.5
- 10.6 - 26.8

Play Across Boston

Draft November 12, 2001

Sources: Harvard School of Public Health, City of Boston

Environmental Determinants of Youth Physical Activity: Evidence from Chicago Neighborhoods

Harvard School of Public Health:

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Centers for Disease Control and Prevention:

Fiona Bull, Ph.D.

Supported by Centers for Disease Control and Prevention (Prevention Research Centers Grant U48/CCU115807)

Objectives

- Describe data sources
- Sample characteristics
- Results: *Unsafe to Play* study
- Results: *Social Cohesion* study
- Results: *Physical Environments* study
- Conclusions

Project on Human Development in Chicago Neighborhoods

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National Institute of Mental Health (NIMH)
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National Institute for Early Child Development and Education (NIECDE)
The Turner Foundation
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PHDCN Study Design

- Community Design
  - Neighborhood Residents Survey (1995, 2001)
  - Systematic Social Observation (1995)
  - Neighborhood Experts Survey (1995)
- Longitudinal Design (1995-2001)
  - Study of families with children in 7 age cohorts
- Administrative Records
- Ethnographic/Qualitative Studies

PHDCN Longitudinal Design

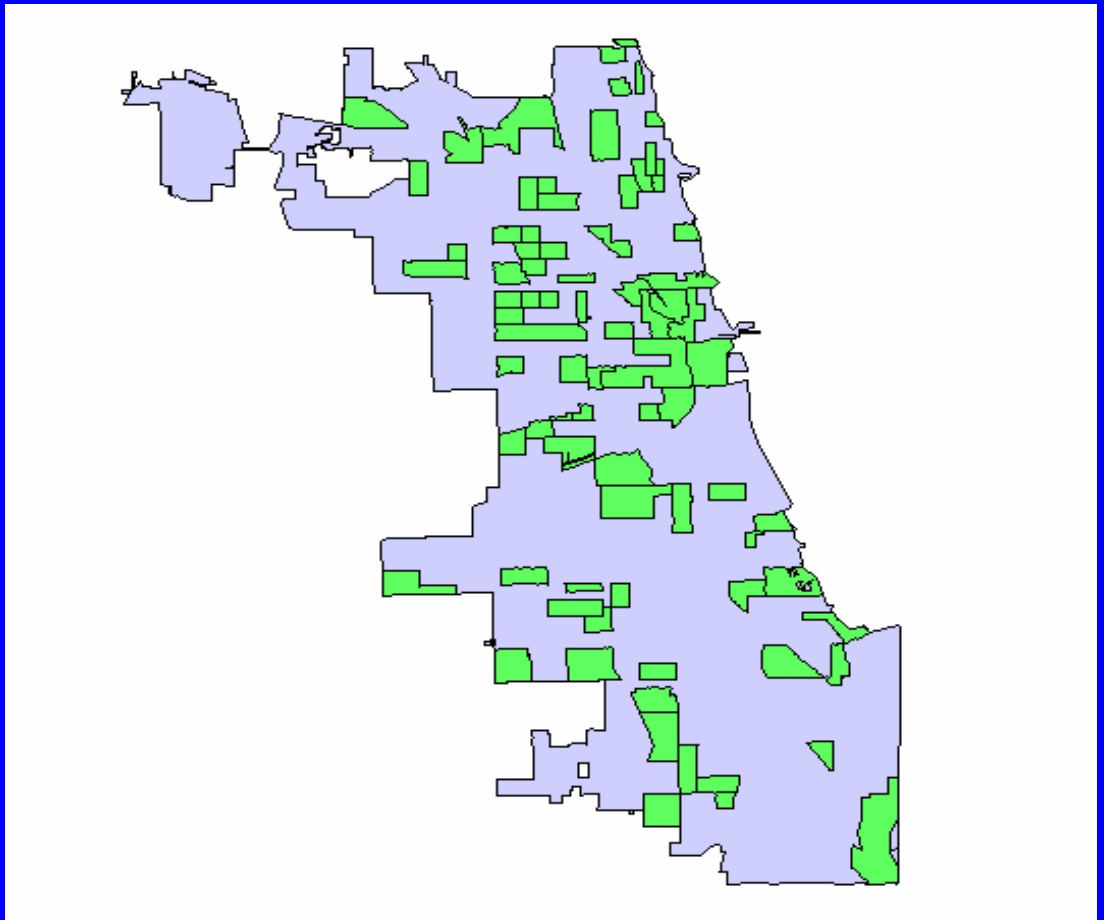
- Screened 32,000 households in 80 neighborhoods (1994-95)
- Selected approximately 1000 children in each of 7 age groups (0-1,3,6,9,12,15,18 years)
- Conducted baseline home-based interviews with children & their primary caregivers (1995-1997)
- Followed families for 7 years studying growth and development over 3 waves (1995-2001)

Racial/Ethnic Composition by SES Strata: Distribution of Neighborhood Clusters

Racial/Ethnic Strata	Low SES	Med SES	High SES	Total
75% African-American+	77 (9)	37 (4)	11 (4)	125 (17)
75% White+	0 (0)	5 (4)	69 (8)	74 (12)
75% Hispanic+	12 (4)	9 (4)	0 (0)	21 (8)
20% Hispanic+ / 20% White+	6 (4)	40 (5)	12 (4)	58 (13)
20% Hispanic+ / 20% African-American+	9 (4)	4 (4)	0 (0)	13 (8)
20% African-American+ / 20% White+	2 (2)	4 (4)	11 (4)	17 (10)
NC's not classified above	8 (4)	15 (4)	12 (4)	35 (12)
All NC's	**114** (27)	**114** (29)	**115** (24)	**343** (80)

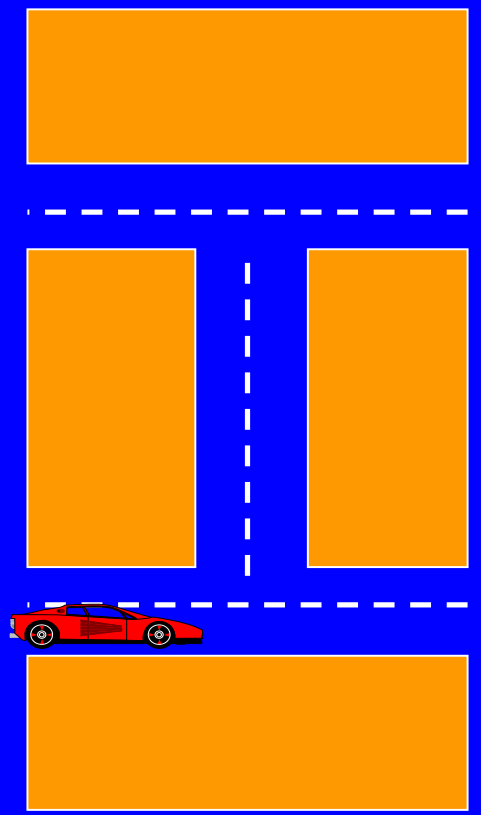
White numbers represent all of Chicago; red numbers in parentheses represent the 80 neighborhood clusters that were sampled for this study

80 Chicago Neighborhood Clusters



Systematic Social Observation

- Observers & videographer were driven 5 mph down the streets of 80 neighborhood clusters in Chicago
- Unit of observation: the face block
- Time: between 7am-7pm, June-October, 1995
- N=23,816 face blocks observed/videotaped (average of 298 per NC and 120 per tract)
- Live observations: land use, traffic, physical condition of buildings
- Random selection of videotaped block faces coded for 126 variables including: physical conditions, housing characteristics, businesses



Unsafe to Play? Neighborhood Disorder Predicts Reduced Physical Activity among Urban Children and Adolescents

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Unsafe to Play

- Using five items from the 1995 Community Survey:
  - You can count on adults in this neighborhood to watch out that children are safe and don’t get in trouble
  - The park or playground closest to where I live is safe during the day
  - The park or playground closest to where I live is safe at night
  - Children around here have no place to play but the street
  - The equipment and buildings in the park or playground closest to where I live are safe during the day

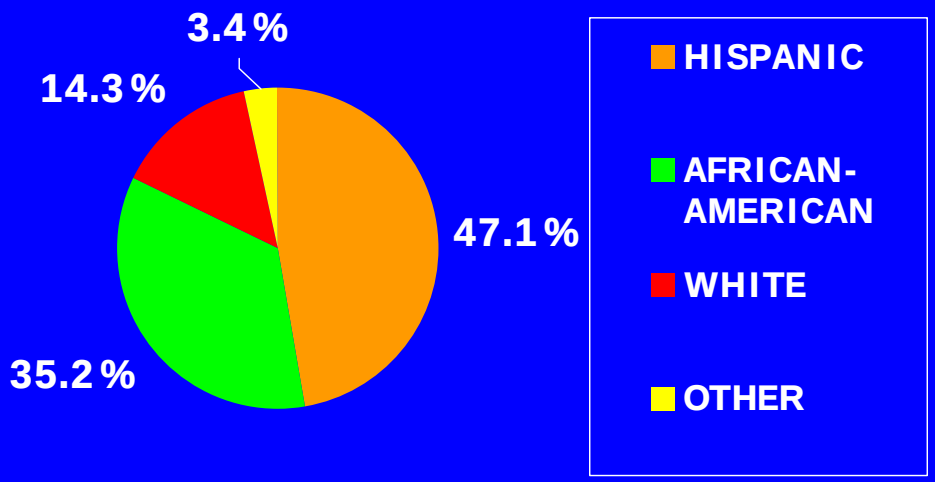
Social Disorder

- Seven items coded from videotapes:
  - Presence/absence of adults loitering or congregating
  - Alcohol drinking in public
  - Peer groups with gang indicators present
  - Public intoxication
  - Adults fighting or arguing in a hostile way
  - People selling drugs
  - Prostitution

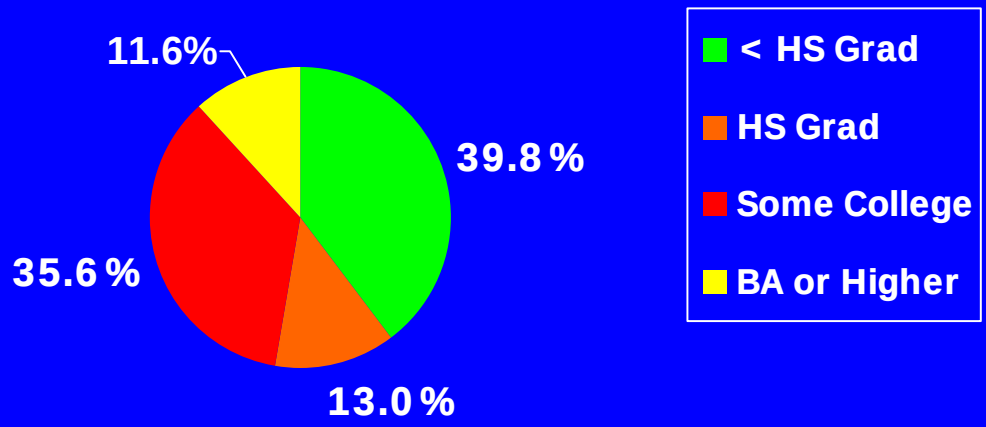
Questions asked of parents to measure physical activity 1995

- **School-Based Recreation:** Was/Is ____ routinely involved in extracurricular activities directly connected with school? How many hours did/does this take place? (hours/week). What kind of program? **(1) Recreational (sports, games, crafts),** (2) artistic, (3) academic enrichment, (4) other
- **Community-Based Recreation:** Was/Is ____ routinely involved in any other kind of after school program? How many hours did/does this take place? ____ hours/week. What kind of program? **(1) Recreational (sports, games, crafts),** (2) artistic, (3) academic enrichment, (4) other

Individual Level Demographics (N=1378, Ages 11-16)

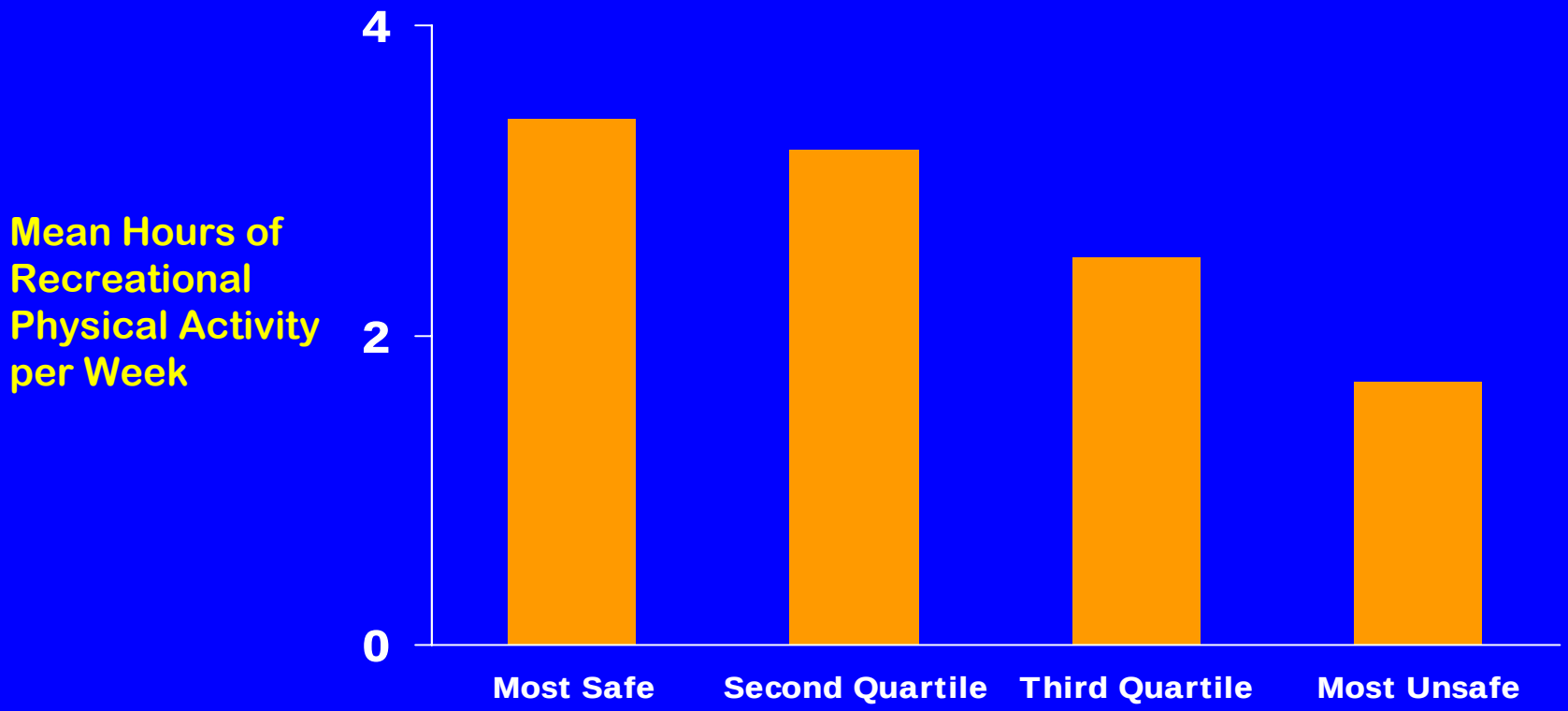


Race/Ethnicity

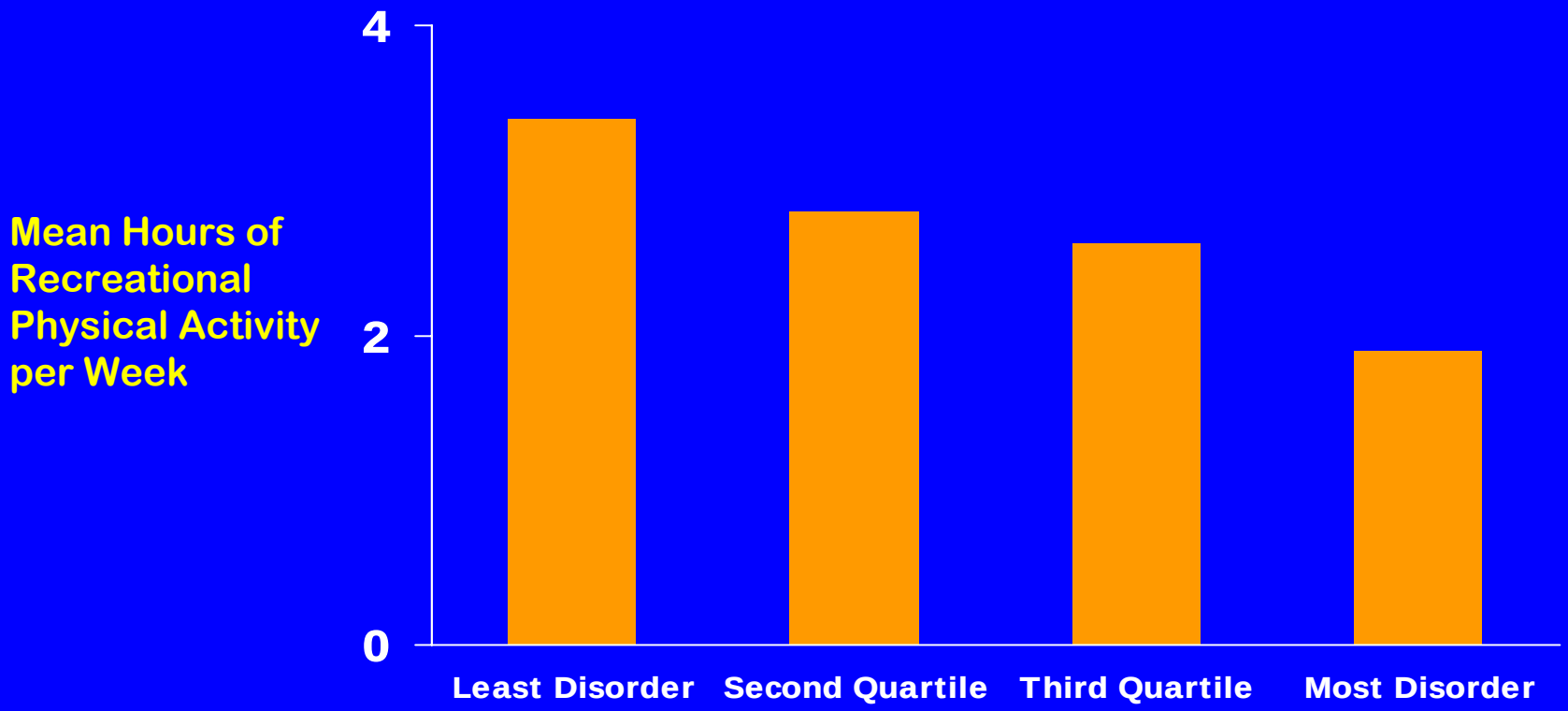


Education of Caregivers

Recreational Physical Activity by Lack of Neighborhood Safety for Children to Play



Recreational Physical Activity by Neighborhood Social Disorder



Multi-level, Multivariate Results

Intercept	2.19*
BMI	-0.04
Family Socioeconomic Status	0.35*
Neighborhood Education	-0.11
Unsafe to Play	-1.44*

Model also includes sex, age, race/ethnicity

Multi-level, Multivariate Results

Intercept	2.28*
BMI	-0.04
Family Socioeconomic Status	0.36*
Neighborhood Education	-0.001
Social Disorder	-0.40*

Model also includes sex, age, race/ethnicity

Neighborhood Context and Youth Participation in Physical Activity in Chicago

Angie Cradock, Ichiro Kawachi, Graham Colditz, Steven L. Gortmaker, Stephen Buka

From the Department of Health and Social Behavior, Harvard School of Public Health (HSPH), Boston, MA, (A.C.; I.K., S.L.G.), the Department of Epidemiology (G.C.), and Department of Maternal and Child Health (S.B.; K.M).

Supported by Centers for Disease Control and Prevention (Prevention Research Centers Grant U48/CCU115807)

Objective

- Examine whether neighborhood social cohesion, youth services, and educational attainment were associated with participation in recreational programs and general physical activity, independent of individual characteristics

Methods

- Longitudinal study of families and youth in 80 neighborhoods of Chicago
- 1043 youth and their primary caregiver
- 12 and 15 year old cohorts
- Surveyed in 1995 with follow-up in 1997

Measures

- Participation in recreational programs
- Primary caregiver report 1995
- Hours per week participation in school-based and community-based recreation
- No participation : 0 hours per week

Measures

- Participation in **general physical activity**
- Question asked of subject in 1997
  - How often do you actively participate in sports, athletics or exercising? (1) never (2) a few times a year (3) once or twice a month (4) at least once a week (5) almost everyday
- No participation (1) and (2)

Measures

- Neighborhood Context
  - Community Survey 1995
- Social Cohesion
  - Example: People willing to help neighbors, close-knit neighborhood
- Youth Services
  - Example: Youth center, community recreation programs, mentoring program

Measures

- Neighborhood Context
  - 1990 US Census
- Neighborhood educational attainment
  - % Less than a high school degree

Measures

Physical Activity Variable	*Number (%)*	
Total Recreational Programming		
Participant	434	(42%)
Non-Participant	609	(58%)
General Physical Activity		
Participant	608	(70%)
Non-participant	257	(30%)

Adjusted OR and 95% CI for Reporting No Participation in Recreational Programs (PHDCN 1995-1997) N=1043

Neighborhood-level characteristics	*% of Sample*		*Adjusted OR (95%CI)*
Neighborhood Social Cohesion			
Low social cohesion	55	1.54	(1.18, 2.01)
High social cohesion	45	1.00	reference
Youth Services			
Low	29	1.64	(1.17, 2.30)
Medium-low	33	1.58	(1.13, 2.21)
Medium-high	19	1.80	(1.18, 2.74)
High	19	1.00	reference
Neighborhood Education Status			
Low Education	89	1.21	(0.75, 1.98)
High Education	11	1.00	reference

Estimates are adjusted for neighborhood social cohesion, youth services, neighborhood education status, race/ethnicity, individual-level education, sex, BMI status, and age cohort

Follow-up

- 912 (87 %) of subjects completed follow-up interview
- 207 (23%) moved from their original neighborhood
  - Low social cohesion, black, less than high school
  - Recreational program participation did not predict
- 680 remained in neighborhood from 1995-97 and reported on general physical activity participation

Adjusted OR and 95% CI for Reporting No Participation in General Physical Activity (PHDCN 1995-1997) n=680

Neighborhood-level characteristics	%	Adjusted OR (95%CI)	
Neighborhood Social Cohesion			
Low social cohesion	56	1.66	(1.16, 2.39)
High social cohesion	44	1.00	reference
Youth Services			
Low	27	0.73	(0.43, 1.27)
Medium-low	36	1.15	(0.70, 1.91)
Medium-high	18	0.96	(0.52, 1.77)
High	20	1.00	reference
Neighborhood Education Status			
Low Education	91	1.94	(1.01, 3.71)
High Education	9	1.00	reference

Adjusted for neighborhood social cohesion, youth services, neighborhood education status, race/ethnicity, household education, sex, BMI status, age cohort and participation in recreational programs

Conclusions

- Low neighborhood social cohesion is associated with a lack of participation in recreational programs and general physical activity
- Neighborhood youth services are important for recreational program participation

Environmental Determinants of Youth Physical Activity: Evidence from Chicago Neighborhoods

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Stephen Buka, Sc.D.
Harvard School of Public Health

Supported by Centers for Disease Control and Prevention (Prevention Research Centers Grant U48/CCU115807)

Sample

- Subjects included 1200 youth 11-16 years of age with complete data at baseline in 1995, and data for 1100 youth in 1997.
- Data were analyzed using multi-level regression models

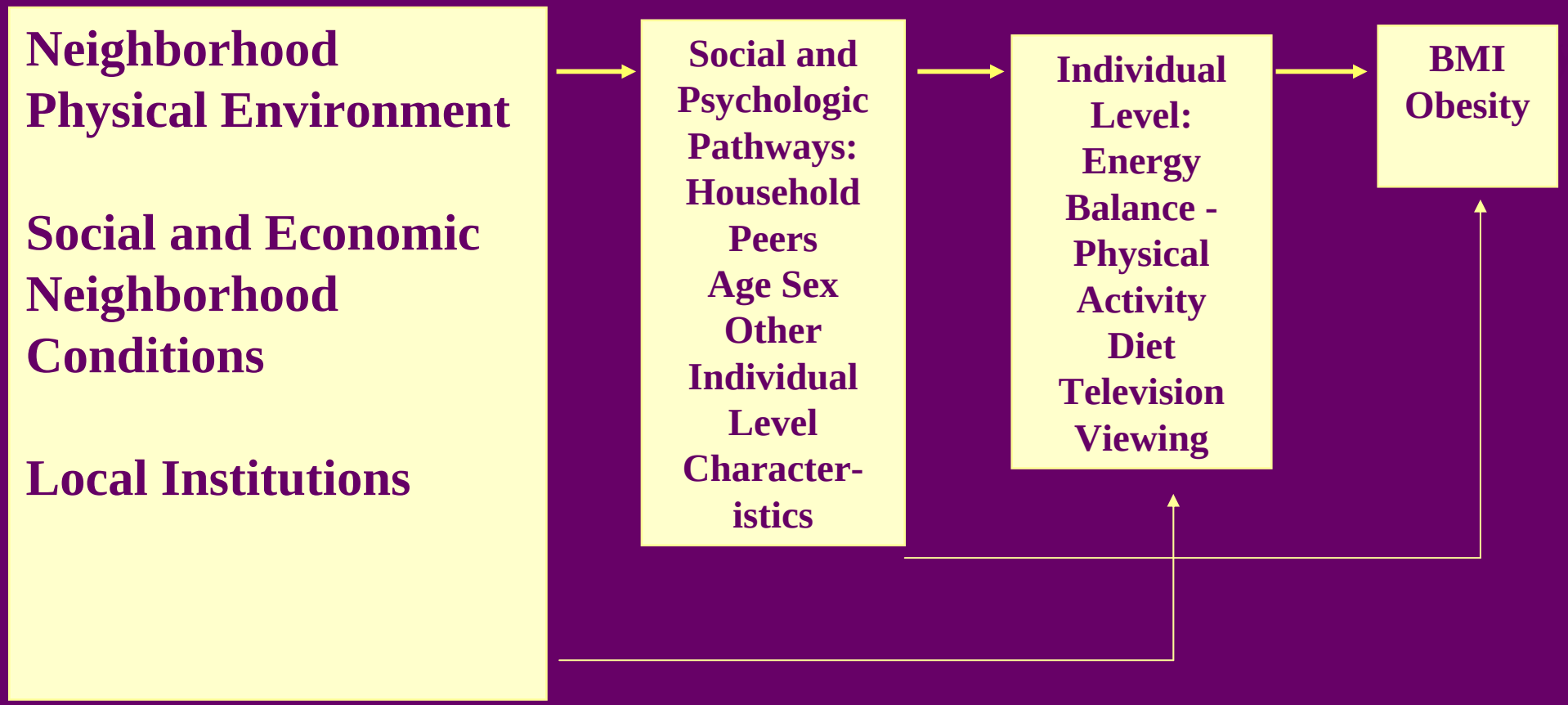
Objectives

- This study examined whether neighborhood-level characteristics are associated with youth physical activity and television viewing, including
  - density of recreational facilities
  - street safety (traffic density, parking on street, condition of street)
  - land use (percent single family homes)
  - street network (percent boulevard/divided highway)

Hypotheses

- We hypothesized youth physical activity will be directly associated (and television viewing inversely associated) with:
  - higher density of recreational facilities
  - indicators of street safety (low traffic density, limited parking on street, good street condition)
  - residential land use (high percent single family homes)
  - street network (low percent boulevard/divided highway)

Hypothesized Influence of the Neighborhood Physical Environment and Household and Individual Factors on Youth Physical Activity, TV Viewing and Obesity



Questions asked of parents to measure physical activity 1995

- **School-Based Recreation:** Was/Is ____ routinely involved in extracurricular activities directly connected with school? How many hours did/does this take place? (hours/week). What kind of program? **(1) Recreational (sports, games, crafts),** (2) artistic, (3) academic enrichment, (4) other
- **Community-Based Recreation:** Was/Is ____ routinely involved in any other kind of after school program? How many hours did/does this take place? ____ hours/week. What kind of program? **(1) Recreational (sports, games, crafts),** (2) artistic, (3) academic enrichment, (4) other

Questions asked of youth to measure physical activity 1997

- **General Physical Activity**: How often do you actively participate in sports, athletics or exercising? (1) never (2) a few times a year (3) once or twice a month (4) at least once a week (5) almost everyday

- **Recoded to approximate times per week:** 1 or 2 coded to 0; 3 coded to 0.05; 4 to coded 2; 5 coded to 6.

Questions asked of youth and parents to measure television viewing in 1997

- **Television Viewing (youth report)**: How often do you watch TV or videos? (1) never (2) a few times a year (3) once or twice a month (4) at least once a week (5) almost everyday. Recoded to times per week.
- **Television viewing (parent report):** On a typical weekday, about how much TV does ___ watch? (1) more than 5 hours (2) 3 to 5 hours (3) 2 to 3 hours (4) 1 to 2 hours (5) less than 1 hour. Recoded to midpoints of hours per day.

Physical Environmental Measures Used From SSO in 1995

- density of recreational facilities
- street safety
  - traffic density
  - parking on street
  - condition of street)
- land use (percent single family homes)
- street network (percent boulevard/divided highway)

Neighborhood Recreation Facilities Variable

- Mean 0.12 (one recreational facility/8 block-faces) SD 0.09; Min 0.01 Max 0.50
- Includes any parks, playground w/ recreational equipment, day care centers/nursery schools, public schools: kindergarten, elementary, junior high/middle, recreational/community centers, parochial/religious schools, schools-private nonparochial.

Neighborhood Traffic Density Variable

- Mean 2.4 SD 0.4; Min 1.4 Max 3.3
- Rated by observer on 6 point scale: How would you rate the volume of traffic on the face-block? (1) No traffic (2) Very light (3) Light (4) Moderate (5) Heavy (6) Very Heavy

Baseline Data: Sample With Complete Data in 1995 and 1997

MEASURE	(N=1043)
Age Cohort	
12	49%
15	51%
Female (%)	49%
Hispanic	41%
Black	39%
Other	3%
White	17%
Parental Education	
Less than HS	15%
Some HS	21%
HS diploma/GED	13%
Some college	51%

Dependent Variables: 1995 and 1997

YEAR/MEASURE		
1995	School/Community Recreation	Mean 2.7 hrs/week 43% any participation
1997	General Physical Activity	Mean 2.6 days/week 57% $\geq$ 1 day/week
1997	Television viewing	Mean 3.0 hrs/day

Multi-level Regression Models

- SAS Proc Mixed
- Control for age, sex, ethnicity, educational level of parent(s), and the neighborhood level covariate.

Results

- No independent relationship of any of the neighborhood physical environmental variables with the physical activity or TV variables in 1995 or 1997
- Individual-level variables independently predicted the dependent variables as expected based on prior studies: e.g. males participated more in after school and community-based recreation than did females, as did youth from more highly educated families; youth from more highly educated families watched less television.

Other Results

- In the other studies our group has completed (Beth Molnar, Angie Cradock, Stephen Buka and others) neighborhood social variables (social cohesion, collective efficacy, youth services, social disorder, perception of neighborhood as unsafe to play) did independently predict youth physical activity variables
- These measures generally come from the community survey, but the social disorder variable comes from the SSO

Limitations

- The dependent variables: capture only some aspects of physical activity and inactivity in youths lives - for example not walking
- The predictor environmental variables: we are now studying these at different levels of aggregation (e.g. the block, census block group, as well as neighborhood). Are there other important environmental constructs we're missing?
- We control for household and neighborhood SES: the physical environment could impact migration patterns and these could be mediating variables
- Limitations of the Chicago neighborhood sample

Conclusions

- In this study, no evidence for independent relationship of any of the neighborhood physical environmental variables with the physical activity or TV variables, although individual-level variables independently predicted as expected
- In other studies of our group, neighborhood social variables (unsafe to play, social and physical disorder, lack of neighborhood social cohesion) did independently predict youth physical activity variables
- It may be that physical environmental variables need to be combined with the social context - e.g. unsafe parks may not generate much youth physical activity

Opportunities for Prevention of Childhood Overweight

- Don’t forget the primary causal role of the food and television industries
- The best opportunities are those where prevention science coincides with community interest and capabilities.
- We have some successful models, but we clearly have a long way to go!