The Buffet: An Overview of Measures of the Food Built Environment

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Why measure food built environments?

Food environments are complex - and different

Types of measures and data sources

Past and current measures of different food environments

Future needs and challenges
Environments are believed to be important among the multiple levels of determinants of nutrition and physical activity.

Environmental Causes of Obesity & Chronic Diseases

- Increased eating
- Decreased energy expenditure
To make significant progress in the area of eating & nutrition environments…

* we need valid, reliable measures of nutrition environments and policies… that are also practical

The balance between scientific rigor and practicality is challenging
An Ecological Framework Depicting the Multiple Influences on What People Eat

- Individual Factors (personal)
  - Cognitions (e.g. attitudes, preferences, knowledge, values)
  - Skills and behaviors
  - Lifestyle
  - Biological (e.g. genes, gender, age)
  - Demographics (e.g. income, race/ethnicity)

- Social Environment (networks)
  - Outcome expectations
  - Motivations
  - Self-efficacy
  - Behavioral capability
  - Role modeling
  - Social support
  - Social norms

- Physical Environments (settings)
  - Access
  - Availability
  - Barriers
  - Opportunities

- Macro-level Environments (sectors)
  - Practices
  - Legislative, regulatory, or policy actions

- Home
- Worksites
- School, Afterschool
- Child-care
- Neighborhoods & Communities
- Restaurants & fast food outlets
- Supermarkets
- Convenience & corner stores

- Societal and cultural norms and values
- Food and beverage industry
- Food marketing and media
- Food and agriculture policies
- Economic systems
- Food production & distribution systems
- Government & political structures and policies
- Food assistance programs
- Health care systems
- Land use and transportation

Story et al., ARPH, 2008
Social Environment (networks)

Macro-level Environments (sectors)

Physical Environments (settings)

Social Environment (networks)

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- Role modeling
- Social support
- Social norms

- Family
- Friends
- Peers

*Story et al., ARPH, 2008*
Macro-level Environments (sectors)
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Story et al., *ARPH*, 2008
Model of Community Nutrition Environments
[Glanz, Sallis, Saelens, & Frank 2005]

Policy Variables

Environmental Variables

Individual Variables

Behavior

Government and Industry Policy

Community Nutrition Environments
- Type & Location of Food Outlets (stores, restaurants)
- Accessibility – hours of Operation, drive-thru

Organizational Nutrition Environments
- Home
- Work
- School
- Other

Consumer Nutrition Environment
- Available healthy options
- Price, promotion, placement
- Nutrition Information

Socio-demographics
Psychosocial Factors
Perceived Nutrition Environments
Information Environment (Media, Advertising)
Eating Patterns
Nutrition/Food vs PA Environments

Food is a commodity
Food products are big business
Food is highly regulated
(safety, taxation, hygiene)
Complex (nutrients, foods)
Organizational environments play a large role
More recent development than PA environment measures
Food Environments & Policies: How do they go together?

Policies can shape environments → school food policies, catering policies, price supports, food assistance policies

BUT

Environments often evolve in the absence of specific policies

AND

Policies can be health-promoting or not
Reasons for Measuring Food & Nutrition Environments Related to Obesity

Observation
Explanation
Evaluation
Advocacy/Action
Surveillance
Ideally, measurement involves...

Data source(s)
- Existing data OR
- New data collection OR both

Definition of boundaries &/or sampling

Sound psychometric properties

Metrics and plans for analysis

“Packaging,” dissemination

Adaptability
Types of Measures & Data Sources

Self-report (surveys)

Observation/Audit

Archival, Existing Databases
Often developed for purposes other than health research

GIS-based Measures/Spatial
Most-used indicators: density, proximity

Combinations
Past and Current Measures of Different Food Environments*

- Macro level: food and agriculture policies
- Economics and pricing
- Food marketing and media influences
- Organizational food environments & policies
- Community food environments
- Consumer food environments

* U.S.-focused summary for macro policies
Government and Industry Policy

- Macro level food & agriculture policy data systems
- Economic and pricing data
Macro Level:
Food & Agriculture Policies

Public source: US Department of Agriculture

- Crop production, food disappearance data, price supports
- Regulations for food assistance programs (Food Stamps, WIC, School lunches, etc.)
- Since…. 1895 [began collecting milk and fat production records; 1925 tabulated electronically]
Economic & Pricing Data (and sales data)


Commercial sources: food industry – corporations, industry groups and tracking services, ACCRA/C2ER
Soft Drink Single Serving Size, 1950 - 2002

- 8 ounces: 5¢ per oz.
- 12 ounces: 4¢ per oz.
- 20 ounces: 2.3¢ per oz.
- 42 ounces: 2.3¢ per oz.
Consumer Use of Low-Calorie, Sugar-free foods & beverages
(in millions of adult Americans consuming these products)


Source: Calorie Control Council National Consumer Surveys
Information Environment (Media, Advertising)
Media Use by Food Manufacturers, 1997

- Television ($5.5 billion) - 78%
- Magazines ($1.2 billion) - 17%
- Radio ($0.26 billion) - 1%
- Newspapers ($0.56 billion) - 4%

Source: USDA/ERS, 1999
Total Food-Related Advertising, 1999

- **Processed Food**: $7.2 billion (63%)
- **Eating / Drinking Places**: $3.4 billion (29%)
- **Food Stores**: $0.9 billion (8%)

Source: USDA/ERS, 2001
Food Marketing and Media Influences

Television & other broadcast media: tracked by Nielsen Media Research - since the 1920’s

Print and electronic media: 111 media tracking services currently active (a growing business)

Food advertising: tracked by USDA’s Economic Research Svc

Puppets as Fast Food Promotion in 1960-70’s
Organizational Nutrition Environments

- Home
- Work
- School
- Other
School Health Policies & Programs Study (SHPPS) [CDC]

- Since 1994; all states
- Elementary/ middle/ senior high schools
- **Environment issues assessed**: vending machines;
  - offerings of fruit, vegetables, french fries, high-fat baked goods

M-SPAN, CATCH, & other studies

- Surveys of food svc managers
- Observations/ analyses of student lunches
- Food service sales data

**Limitations (historically):**
- Manual recording of on-site data
- Details of instruments & protocols not disseminated (part of larger studies)
Worksite Food Environments & Policies

Mainly used in intervention studies

**Example:** Working Well Trial (Biener, Glanz et al. 1998)
- Multicomponent assessment
- Access to healthy food, nutrition information
- Found to be associated with intervention + self-report

**Example:** Section of CHEW (Australia) (Oldenburg, Sallis, et al. 2002; dev 1995)
- Audit tool, included nutrition information, canteen (cafeteria), vending machines
- Used NHF ‘tick’ to indicate healthful choices
- High inter-rater reliability (0.8-1.0)
Community & Consumer Nutrition Environments

**Community** nutrition environments =
- Type & location of food outlets
- Accessibility (e.g., hours, drive-thru)

**Consumer** nutrition environments =
- Availability of healthful food choices
- Pricing, promotion, placement
- Information availability
Self-Reported Measures of Consumer Nutrition Environments

- **Reports [‘factual’]** - e.g., how far to nearest store, where do you shop, where do you eat out?
- **Perceptions [‘opinion/ attitude’]** - how easy/hard is it to find...? How expensive are...?
- **Sources of measures/ scales:** not too ‘old’ – Echeverria et al. 2004 (4 items); NQLS study (unpublished)
- **Important distinction!** *Report vs perception*
Community Nutrition Environments

- Type & Location of Food Outlets (stores, restaurants)
- Accessibility – hours of Operation, drive-thru)
GROCERY STORE Category

Supermarkets
Convenience Stores
Farmer’s Markets
Vending Machines
Snack Shops
Internet Groceries
Restaurants
The RESTAURANT Category

Restaurants
Fast-food restaurants
Cafeterias – including schools, worksites, hospitals
Food courts
Deli, take-out
Bars serving food
Food service, catering
“Catering establishments”
Community Food Environments: Objective Data Sources
Or, ‘where are places to get food’?

Public Sources
Government: Food licenses (retail & food service)
Other: Yellow Pages, Online directories, etc.

Commercial Sources
Dun & Bradstreet, InfoUSA, others

Issues: Completeness? Up-to-date? Accuracy? High turnover
Wang et al. [IJ BNPA, 2007] –
• compared sources of historical data on food stores
• State Board vs business directories: 127 vs 351 food stores
• State Board had 36 added stores, directories showed 260 more
GIS Data Sources and Food Built Environment Measures

**Sources of Inputs:**
- Government license data
- Regional land use data
- Commercial sources
- Observations/ground truthing

**Issues to consider:**
- Validity/currency of data source
- Classifications
- Meaning – how to define populations’ food environment “reach” (e.g. buffers)
Consumer Nutrition Environments

- Available healthy options
- Price, promotion, placement
- Nutrition Information
Early Observational Measures of Food Store Environments

- San Diego Food Availability Survey
- Supermarkets, groceries, convenience stores
- Inventory of 71 ‘heart-healthy’ foods
- 78-99% interobserver agreement
- Documented more HH foods in supermarkets (m=56.7) than neighborhood groceries (m=25.7) and convenience stores (m = 12.2)

Cheadle et al. (1989, 1990, others)
- Evaluation of Kaiser Family Fdn healthy communities
- Focused on small # of items (e.g. skim milk); compared healthy to less healthy
- Examined shelf space
Understanding People in Their Environments

- Measuring built environments
- Linking surveys to environment data
- Assessing how people relate to their environments
- New technologies, assessment tools, and data systems
NIK & NIK Parents Study -- NI EHS, B Saelens PI; USDA, K Glanz PI
TEAN (Teen Environments, Activity & Nutrition) - NHLBI, J Sallis PI

Neighborhood Impact on Kids (NIK) Project

TEEN ENVIRONMENT AND NEIGHBORHOOD

Nutrition Environment Measures Survey (NEMS) – RWJ F, K Glanz PI
Nutrition Environment Measures Survey (NEMS)
NEMS is/are research-tested measurement tools (NEMS-S and NEMS-R)

NEMS...
* was originally developed for research
* can be used for community assessment, advocacy, and intervention
Community & Consumer Nutrition Environments

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- Information availability
Measures of Nutrition Environments in Stores
< Grocery Stores & Convenience Stores >

- Availability (of healthful choices)
- Prices (compare healthy to less healthy; grocery to convenience stores)
- Quality (for fresh produce)
Measures of Nutrition Environments in Stores
< Grocery Stores & Convenience Stores >

Core Categories of Foods

- Milk
- Fruits
- Vegetables
- Ground Beef
- Hot Dogs
- Frozen Dinners
- Fruit Juice
- Baked Goods
- Bread
- Baked Chips
- Cereals
Measures of Nutrition Environments in Restaurants

< Fast-Food & Sit-Down Restaurants >

Sources of Information

• Internet
• Menu
• Visit, observation
• Interview manager
Measures of Nutrition Environments in Restaurants
< Fast-Food & Sit-Down Restaurants >

- Availability (of healthful choices)
- Prices (compare healthy vs. less healthy; fast-food vs. sit-down)
- Promotion, Information
- Facilitators & Barriers
- Kid’s Menus
Research Status and Gaps Related to Environment, Policy and Nutrition

- A review of reviews – research on food & nutrition environments and policies (FNEP) – and obesity
  - Correlates & determinants
  - Environment & policy interventions
- Summary of methods & key findings
- Highlight gaps in design and analyses
- Identify research priorities
The reviews and what they focus on

- 19 reviews: 10 correlates, 9 interventions
- 1988 to 2008 (12 since 2004)
- Mostly covering research in the US, Canada, UK, Australia
- Narrative to semi-quantitative
- Review data supplemented by new studies
What the reviews examine

• Many definitions of FNEP’s (independent variables)
• Varied outcomes – fat intake, calories, fruits & vegetables, BMI
• Populations – none; adults; children; adolescents
Research Designs & Data Sources

Study designs
cross-sectional, correlational; experimental/pre-post

Studies without people
Spatial analyses, Census data, analyses of environments (e.g., prices; menu items, food sales); policy analysis; combinations

Studies with people
Surveys, interviews, linked to non-human-subjects data, experiments, observations (few), anthropometrics (few)
What we know from available research

Robust findings

- Low SES and minorities have poorer FNE’s
- Rural FNE’s have limited healthy food available
- Restaurant point-of-purchase information works (short-term)
- Restaurant/vending price reductions promising (short-term, aggregate)
What we know from available research

 Emerging findings

- Environment-diet quality associations
- Environment-BMI associations
- Limited healthy choices in neighborhood eating-out FNE’s
- Policy implementation varies
Assessing Food Environments and Policies in Large and Population-Based Programs
CDC's Common Community Measures for Obesity Prevention Project (Khan et al., *MMWR*, 2009)

Strategies and associated measures that communities & local governments can use to plan & monitor environmental and policy-level changes for obesity prevention

**Examples--food related measures**

- Policy to apply DGA in government facilities & large school district
- # of full service groceries per 10,000 in 3 largest underserved census tracts in jurisdiction
- Government offers incentives to retailers to offer healthy food/beverages
Logic Model Approach
(Cheadle, Samuels et al., AJPH 2010)

✓ Describe steps to change environs & individual health impacts

✓ Indicators for each step, assessing those most directly exposed

✓ Attribute outcomes to interventions if they are:
  ❖ preceded by meaningful change in short-term and intermediate outcomes
  ❖ in a plausible temporal sequence
Philadelphia CPPW Enhanced Evaluation

**Healthy Corner Stores (n=200)**
- Pre-post assessments
- Low vs high intensity

*Environment*
- NEMS-CS mobile

*Individuals*
- Intercept interviews
- Calories purchased

**School Wellness Policies**
- Pre-post assessments
- n=100 K-8 schools

*Environment*
- Competitive food environs
- Documentation/validation

*Individuals*
- BMI measures (standard)
Research Design

Study designs:
- cross-sectional, correlational
- comparative
- longitudinal/prospective
- experimental/pre-post
- quasi-experimental
To evaluate environmental strategies, the RCT is not always the “gold standard”

- May not be appropriate/feasible
- Helpful but not essential
- Can have threats to internal/external validity
Natural Experiments: Considerations

- Plausibility of hypotheses/effects
- Does the intervention ‘happen’?
- Time and geographic links
- Industry, organizational, government partnerships and access to data
- Contingencies
Planning & Evaluation Cycle

How do environment measures function throughout the cycle?

Grocery store food environment vs. individual level surveys (Cheadle et al.)

CROSS-SECTIONAL
Significant associations (1991)

TRACKING CHANGE
Correlations weaker over time (1993)

EVALUATION OVER 3 TIME POINTS
Inconsistent & contradictory results (1995)
Unanswered research questions

- *How much* environmental change is needed?
- *How long* will it take to improve behavior AND health?
- *Who changes* after environment/policy interventions?
Limitations of measures for accelerating progress

- Complex nature of food/nutrition environments
- Variable rigor in measures development
- Practical limits of field-based measures
- Too little dissemination of measures
- Lack of common metrics
- Limited real-time (archival) measures
- Unknown sensitivity to change
LEAD Framework

Locate evidence
Evaluate it
Assemble it
Inform Decisions

Recommendations
- Build resource base
- Standards for evidence quality
- Support generation of evidence
What We Need to Accelerate Progress

- **Core toolkit of measures:** well-tested, valid, feasible, adaptable, disseminable
- **Common metrics** to compare studies and populations
- **Measures at multiple levels:** settings/organizations, communities, states, regions, national
- **Measures tied to calories** and major sources of fat and calories in diets
- **Designs** that permit reasonable inferences about impact
To make significant progress in the area of eating & nutrition environments... we need...

* collaboration & coordination
* to balance internal & external validity
* to address supply AND demand
* to study individual & aggregate effects
Linking Survey Data To Environment Data

Most likely to be useful if….

- Item/concepts match at individual & environment levels
- Surveys ask about how people relate to their environments
  - where they shop, eat out
  - where they go most often (work, school, recreation, etc.)
The primary aim of the project is to use novel research methods from multiple disciplines to measure and model access to healthy foods and active living for residents in an urban environment and to engage community members in designing policy and environmental changes to prevent or reduce obesity.

Funded by USDA
A Hillier & K Glanz et al.
Study area

median household income (2000)
- $0 - 14,999
- $15,000 - 19,999
- $20,000 - 24,999
- $25,000 - 39,999
- $40,000 - 200,001
Door to door survey sample

all occupied homes on 30 randomly-chosen blocks
Survey Questions

Food shopping
Where do you do most of your food shopping?
Why do you choose to shop there?
Where do you get fresh fruits and vegetables?

Neighborhood food environment
What specific foods would you like to be able to buy that you are not currently able to buy in your neighborhood?

Food and meals in your household
What foods do you have in your home?
How often do you eat together?
How often do you eat take out or fast food?
Do you worry about running out of food?

Physical Activity
How often are you physically active (walking, moderate, vigorous)?
Where are you physically active?
Food store survey

- Staff visited all food stores in the 5 ZIP code areas to confirm location, take a photo.

- Returned to complete inventory of healthful food items (availability, quality, price) using Nutrition Environment Measure Survey for Corner Stores (NEMS-CS).
NEMS-CS

- Based on foods that contribute calories to typical US diet.
- Trained researchers looks for typical item (whole milk) and healthful alternative (reduced fat milk).
- Includes milk, fruits, vegetables, hot dogs, beef, cereal, baked goods, chips, soda.
- Scores assigned to each store based on availability, price and quality.

Welcome to NEMS

The food, or nutrition environment, is widely believed to contribute to the increasing epidemic of childhood and adult obesity in the United States.

Nutrition environments are the places in a community where people buy or eat food. In order to identify and describe community nutrition environments, there is a need for well-defined and reliable tools to measure these environments, and for trained observers who can use the measures in their communities.

With the support of our funders, we have developed a training program on the Nutrition Environment Measures Survey for Stores (NEMS-S) and Restaurants (NEMS-R) for researchers and community advocates and leaders so they can use the tools for research and action in their own communities.

On this web site, you can learn more about the NEMS measures and options for training.

Funding

NEMS is funded with support from the National Johnson Foundation, and the Center for Health Pennsylvania.
Innovations: PDA’s & mobile devices

For personal measures, to assess environments, or as interventions

Can integrate with wireless Phones, GPS, etc. to collect data, give feedback, etc.
RESOURCES

McKinnon, Reedy, Handy & Rodgers Eds. – 2009 AJPM Supplement Website compilation of measures and articles
https://riskfactor.cancer.gov/mfe/

NCCOR CATALOGUE OF SURVEILLANCE SYSTEMS
http://tools.nccor.org/measures/
{there are no comprehensive self-report measures of food environments}

Healthy Eating Research website: www.healthyeatingresearch.org
The Fork in the Road...
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