The food environment, diet and health:
What do we know from the existing evidence?

SHARON KIRKPATRICK
SCHOOL OF PUBLIC HEALTH AND HEALTH SYSTEMS
UNIVERSITY OF WATERLOO

WITH THANKS TO ROBIN MCKINNON AND JILL REEDY
NATIONAL CANCER INSTITUTE
Name of Speaker: Sharon Kirkpatrick

No Relevant Financial Relationships
Outline

• Background – what is the potential relevance of the food environment to health and to the prevention of cancer?

• Considerations in assessing exposures and outcomes in food environment research

• Synthesizing the existing science – what do we know?

• Summary and implications
The food environment as a potential influence on health
What are food environment ‘exposures’?

- **Macro level**
  (community environment):
  - Type and spatial location of food outlets (stores, restaurants, and other food environments)

- **Micro level**
  (consumer environment):
  - Characteristics of foods within environments – availability, quality, price, promotion
Growing interest in the food environment

Based on the NCI Measures of the Food Environment web compilation (http://appliedresearch.cancer.gov/mfe/)
Policymakers are ready to act and hungry for evidence on the food environment!
Initiatives planned or underway to create food environments conducive to health

- Introduction of supermarkets and farmers’ markets to areas with a lack of opportunities to purchase healthy foods
- Healthy corner store initiatives to improve the balance of healthy to unhealthy options
- Moratoriums on new fast food restaurants
- Restrictions on the sale of certain items in particular settings (e.g., soda in schools)
- Calorie labeling on restaurant menus
What is the potential relevance of the food environment to cancer prevention?

Commentary
Consideration of the Food Environment in Cancer Risk Reduction
REBECCA A. KRUKOWSKI, PhD; DELIA SMITH WEST, PhD


Reflection

Reducing Cancer Risk in Rural Communities Through Supermarket Interventions
Barent N. McCool · Conrad P. Lyford · Natalie Hensarling · Barbara Pence · Audrey C. McCool · Janani Thapa · Eric Belasco · Tyra M. Carter
Hypothesized influence of the food environment on incidence of cancer and other diseases
Hypothesized influence of the food environment on incidence of cancer and other diseases

- Food environment
- Diet
- Body weight and other risk factors
- Incidence of cancer and other diseases
How might the food environment influence diet, body weight, and health?

Availability of low-fat milk relative to high-fat milk in a store

Purchases of low-fat milk relative to high-fat milk

Consumption of low-fat milk relative to high-fat milk

Fat content of the diet of store customers

Population-level disease related to fat in the diet

Lytle L, AJPM 2009
How might the food environment influence diet, body weight, and health?
Describing food access

- **Food deserts**: Neighborhoods and communities, especially low-income communities, with limited access to affordable and nutritious foods.

- **Food swamps**: Geographic areas where the overabundance of high-energy foods (for example, energy-dense snacks sold at convenience stores) inundates healthy food options (Rose et al., 2009).

→ Importance of considering access to and availability of a range of food outlets and foods.
Describing food access

Figure 1. Racial composition of study neighborhoods and healthy food availability index of the 226 food stores in the study

Franco et al, AJPM 2008
Are food deserts a problem in the US?

- USDA, 2009:
  - A small proportion of the population (~8%) lives in low-income neighborhoods and has to travel more than a mile to get to the nearest supermarket
  - 2.2% live more than a mile from a supermarket and do not have access to private transportation
Do disadvantaged areas in the US have poorer access to healthy food?

- More supermarkets in wealthier and White neighborhoods compared to poorer and Black neighborhoods in several states (Morland et al., 2002)

- Nearest supermarket farther away in neighborhoods with more African-American residents and in poorest neighborhoods in metropolitan Detroit (Zenk et al., 2005)

- Greater exposure to fast food outlets in areas with more African-Americans in New Orleans (Block et al., 2004)
Do disadvantaged areas in the US have poorer access to healthy food?

- Relative distance to grocers and fast food in Chicago (Gallagher)
Do disadvantaged areas in the US have poorer access to healthy food?

- Some areas have poorer access to supermarkets and other opportunities to obtain healthy foods
  - E.g., rural areas, neighborhoods characterized by racial/ethnic minorities and low-income populations

- Fast food restaurants and other outlets characterized by less healthy food offerings are more concentrated in some areas
  - E.g., around schools, neighborhoods characterized by racial/ethnic minorities and low-income populations

- A form of ‘deprivation amplification’? (Macintyre, 2007)
  - Poorer neighborhoods more likely to lack health promoting resources but have more health damaging resources
Implications for health?

- Population health
- Food environment
- Health disparities
Examining relationships between food environment exposures and health

- How does proximity to a supermarket or shelf space allocated to fruits and vegetables in a corner store relate to fruit and vegetable consumption?
Examining relationships between food environment exposures and health

- How does density of fast food outlets near homes or schools relate to area-level rates of obesity?
Examining how modifications in the food environment influence diet and health

- How does the introduction of a new food retail outlet affect dietary intakes or weight status of the community?
  - Taking advantage of ‘natural experiments’

**EVIDENCE BASED PUBLIC HEALTH POLICY AND PRACTICE**

Large scale food retailing as an intervention for diet and health: quasi-experimental evaluation of a natural experiment

Steven Cummins, Mark Petticrew, Cassie Higgins, Anne Findlay, Leigh Sparks

CONSIDERATIONS IN ASSESSING EXPOSURES AND OUTCOMES IN FOOD ENVIRONMENT RESEARCH
Linking food environment exposures to outcomes
Linking food environment exposures to outcomes
Complexities at the macro level

- What is the relevant exposure?
  - Which food outlets?
  - Proximity, density?
  - Ratio of ‘healthy’ to ‘unhealthy’?

- What boundaries and thresholds should be used to define the areas of interest and to demarcate ‘good’ or ‘poor’ access to food outlets?

- How can we account for ways in which individuals interact with the food environment?
  - Near home, school, work?

- Objective and/or perceived?
Complexities at the micro level

- What features of the food environment are most salient?
  - Availability (e.g., variety, shelf space)
  - Quality
  - Price

- What foods should be assessed?
  - ‘Total diet’ versus ‘indicator foods’

- Objective and/or perceived?

- What is the most appropriate assessment tool?
Metrics used to assess exposures

- **Macro level**
  - Spatial/geographic analyses
    - Commercial datasets
    - Yellow Pages
    - Groundtruthing
    - Perceived
Metrics used to assess exposures

- **Macro level**
  - Spatial/geographic analyses
    - Commercial datasets
    - Yellow Pages
    - Groundtruthing
    - Perceived
  - Checklists
  - Inventories
  - Interviews/questionnaires
  - Shelf space
  - Menu analyses
  - Sales and receipt analyses

- **Micro level**
Linking food environment exposures to outcomes
Complexities in assessing outcomes (e.g., diet)

• What foods should be assessed?
  ○ ‘Total diet’ versus ‘indicator foods’

• What is the most appropriate assessment tool?
Metrics used to assess outcomes (e.g., diet)

• Commonly-used dietary assessment measures:
  ○ 24-hour recalls
  ○ Food records
  ○ Food frequency questionnaires
  ○ Brief instruments (screeners)

• Each has advantages and disadvantages and all measure dietary intake with some bias
Metrics used to assess outcomes (e.g., diet)

Recall or record

Bias

Time

[Cost]

Food frequency questionnaire

Brief instrument (screener)
Assessment of diet in food environment research

• Dietary assessment instruments used in food environment studies (n=51)

<table>
<thead>
<tr>
<th>24-hour recall</th>
<th>Record/Diary</th>
<th>Food frequency questionnaire</th>
<th>Screener</th>
<th>Two Items</th>
<th>Single Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>4%</td>
<td>27%</td>
<td>27%</td>
<td>6%</td>
<td>35%</td>
</tr>
</tbody>
</table>

• Relationships between food environment features and dietary outcomes more consistent in studies using less error-prone measures

Kirkpatrick et al., In press
Metrics used to assess outcomes (e.g., diet)

- Review of food environment and diet literature, Caspi et al., 2012 (n=38):
  - No comprehensible relationship between quality of measures used for food environment exposures and dietary outcomes
Other considerations in examining relationships between food environments and diet/health

- **Temporality**
  - Predominantly drawing upon cross-sectional data
    - Disease develops over time
    - Individuals are mobile
    - Food environments change over time

- **Context**
  - Generalizability of small-scale studies
  - Generalizability between settings
SYNTHESIZING THE EXISTING SCIENCE
Recent reviews highlight the lack of consensus in the existing literature

Obesity Prevention

A systematic review of environmental factors and obesogenic dietary intakes among adults: are we getting closer to understanding obesogenic environments?

K. Giskes¹, F. van Lenthe², M. Avendano-Pabon² and J. Brug³
Do features of the food environment have an influence on diet?

- Systematic review (international), Caspi et al., 2012:
  - Significant associations between the environment and fruit and vegetable consumption:
    - 12/18 studies using GIS measures to assess environmental exposures
    - 5/8 studies using survey measures to assess environmental exposures
  - Fast food:
    - 4/8 found a relationship between environmental exposures and intake
Do features of the food environment have an influence on diet?

- Bodor et al, 2008:
  - Cross-sectional survey of 102 households in New Orleans
    - Mapping of food stores and measures of shelf space allocated to fruits and vegetables
    - Diet measured using a targeted 24-hour recall
  
- Key finding:
  - Vegetable intake associated with fresh vegetable availability within 100 metres and in-store shelf space allocated to vegetables
Do features of the food environment have an influence on diet?

- Boone-Heinonen et al, 2011:
  - Longitudinal study of 5115 young adults
    - Mapping of food stores and restaurants
    - Diet measured using diet history

- Key findings:
  - Greater fast food availability related to higher fast food intake, particularly among lower-income individuals
  - Mixed findings for relationships between grocery store and supermarket access and diet (diet quality, fruit and vegetable intake)
Do features of the food environment have an influence on diet?

• An & Sturm, 2012:
  ◦ Cross-sectional study of 5-17 year olds
    ✷ Mapping of food stores and fast food restaurants around home and school
    ✷ Diet measured using a screener

  ◦ Key finding:
    ✷ No evidence that improved access to supermarkets or less access to fast food and convenience stores is associated with improved diet quality (or lower BMI)
Do features of the food environment have an influence on **body weight**?

**Systematic review (international)** – Giskes et al., 2011:

- 4/5 studies found that those with greater **supermarket** access had lower BMI/prevalence of overweight or obesity

- 5/8 studies found that greater access to **fast food** was associated with greater BMI/prevalence of overweight or obesity

+ More consistent evidence of associations between food environment features and weight compared to diet
Do features of the food environment have an influence on body weight?

- **Lamichhane et al., 2012:**
  - Cross-sectional survey of 845 youths with diabetes in South Carolina
    - Mapping of food stores and restaurants
    - Measured height, weight and waist circumference
  
  - **Key findings:**
    - Density of chain *supermarkets* negatively associated with BMI z-score and waist circumference
    - Density of *fast food restaurants* not associated with adiposity measures
Do features of the food environment have an influence on **body weight**?

- **Shier et al., 2012:**
  - Longitudinal study of 6260 children
    - Mapping of food stores and restaurants
    - Measured height and weight
  - **Key findings:**
    - More food outlets in an area overall, including supermarkets, associated with higher BMI
    - No evidence that access to **supermarkets** is associated with reduced odds of obesity or that access to **fast food or convenience stores** heightens risk of obesity
Do features of the food environment have an influence on other health outcomes?

- Cardiovascular disease
- Diabetes
- Birth outcomes
- Cancer?
SUMMARY AND IMPLICATIONS
Summary: Assessing the influence of the food environment on diet and health is complex!

- The food environment is dynamic and context-specific.

- The field is nascent and research frameworks and methods are continuing to evolve.

- Important to consider methods, setting, generalizability, etc., in interpreting findings.
Summary: What do we know from the existing evidence on food environments, diet and health?

- Evidence that in the US, food environment exposures are distributed differentially in relation to income, race/ethnicity, etc.

- Suggestive evidence that food environment exposures are associated with dietary intakes and body weight
  - Need to consider BOTH ‘healthy’ and ‘unhealthy’ exposures
Implications for interpreting the food environment literature

• Evaluate the metrics used to assess both environmental exposures and outcomes

• Consider the study design: cross-sectional, ecologic, longitudinal

• Assess the scale and context of the study and the generalizability of the findings

• Consider the effect size – meaningful?

• Reflect on how the findings fit with the existing literature
Implications for policy and programs

- Creating food environments that are more supportive of healthy eating may have positive effects on population health and disparities
  - Impetus for a range of innovative strategies

- In the context of the existing data, essential to:
  - Carefully evaluate interventions, with attention to potential unintended consequences
  - Not lose sight of other important influences on diet and health, such as socioeconomic status
  - Continue to call for rigorous research that can inform effective policies and programs
Other factors influencing diet

- Evidence from elsewhere:
  - Food environment features do not explain socioeconomic differences in diet (e.g., Giskes et al., 2009)
  - High rates of food insecurity among low-income families even in neighborhoods with very convenient supermarket access (Kirkpatrick et al., 2010)

- Can initiatives to create more favorable food environments overcome other influences on diet and health, such as income?
Moving forward to inform policy and programs: Challenges to be addressed

- Heterogeneity and lack of precision in exposure and outcome measures
- Lack of research examining a combination of different constructs/levels within a single study
- Most research operates under assumption that people use what is geographically proximate (Mhurchu et al, In press)
- Lack of longitudinal research
- Unexplored pathways by which food environment might influence diet (‘black box’, Thompson et al., 2013)
Moving forward to inform policies and programs

Review
Monitoring the availability of healthy and unhealthy foods and non-alcoholic beverages in community and consumer retail food environments globally
C. Ni Mhurchu¹, S. Vandervijvere², W. Waterlander³, L. E. Thornton⁴, B. Kelly⁵, A. J. Cameron⁶, W. Snowdon⁷ and B. Swinburn⁸ for INFORMAS²

RESEARCH
Characterising food environment exposure at home, at work, and along commuting journeys using data on adults in the UK
Thomas Burgoin⁹ and Pablo Monsivais¹²

Employment status, residential and workplace food environments: Associations with women’s eating behaviours
Lukar E. Thornton¹⁰, Karen E. Lamb¹, Kylie Ball¹

¹ Centre for Physical Activity and Nutrition Research, School of Exercise and Nutrition Sciences, Deakin University, Australia
² Clinical Epidemiology & Biostatistics, Dept. Murdo Children’s Research Institute, Australia
³ Department of Paediatrics, The University of Melbourne, Australia
Moving forward to inform policies and programs
Hypothesized influence of the food environment on incidence of cancer and other diseases
Hypothesized influence of the food environment on incidence of cancer and other diseases

- Food environment
- SES
  - Car access
  - Stress
  - Attitudes and norms
- Diet
- Body weight and other risk factors
- Incidence of cancer and other diseases
Recent opportunities for research funding

- NIH Program Announcements:
  - Obesity Policy Evaluation Research
  - Time-Sensitive Obesity Policy and Program Evaluation
  - School Nutrition and Physical Activity Policies, Obesogenic Behaviors and Weight Outcomes

- Johns Hopkins Global Center on Childhood Obesity (www.jhgcco.org)

- Robert Wood Johnson Foundation Healthy Eating Research (www.healthyeatingresearch.org)

- Up-to-date information on funding opportunities:
  - National Collaborative on Childhood Obesity Research (nccor.org)
Questions or comments?

sharon.kirkpatrick@uwaterloo.ca