Measures of the Food Environment
A Systematic Review

Rebeccah Sokol, B.S.
Leslie Lytle, Ph.D.
University of North Carolina, Gillings School of Global Public Health
Overview

I. Introduction of the question
II. Systematic review methods
III. Results
IV. What we learned
V. Moving forward
Why care about the food environment?
Food environment

Behavioral choice
Consolidating the measures

• McKinnon and colleagues systematically reviewed the food environment literature from 1990-2007
  • Created a consolidated list of measures
  • Compared/contrasted them
  • Reported on psychometrics properties

Purpose

• Update McKinnon’s review
  • Assess the change in the state of food environment measurement from 2007-2015 relative to 1990-2007

• Expanded data extraction
  • Specific type of validity/reliability
  • Study design
## Instruments and Methodologies

<table>
<thead>
<tr>
<th>Time Period</th>
<th>INSTRUMENTS</th>
<th>METHODOLOGIES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Questionnaire</td>
<td>Geographic analysis</td>
</tr>
<tr>
<td>McKinnon's Review (1990-2007)</td>
<td></td>
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</tr>
</tbody>
</table>

**Instruments**: standardized assessment tools completed by subjects or trained observers

**Methodologies**: numerical processes for assessment
Location

School

Workplace

Restaurants

Food stores
## Psychometric properties

<table>
<thead>
<tr>
<th>Time Period</th>
<th>PSYCHOMETRIC PROPERTY</th>
<th>% of papers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reliability (% of papers)</td>
<td>Validity (% of papers)</td>
</tr>
<tr>
<td>McKinnon’s Review (1990-2007)</td>
<td></td>
<td></td>
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</tbody>
</table>

### Psychometric property

<table>
<thead>
<tr>
<th>Reliability</th>
<th>Inter-rater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cites external source</td>
<td>Test-retest</td>
</tr>
</tbody>
</table>

### Validity

<table>
<thead>
<tr>
<th>Internal consistency</th>
<th>Criterion-related</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face</td>
<td>Construct</td>
</tr>
<tr>
<td>Convergent</td>
<td>Content</td>
</tr>
<tr>
<td>Discriminate</td>
<td></td>
</tr>
</tbody>
</table>
Study design

- Cross-sectional
- Longitudinal

Legend:
- Orange: Cross-sectional
- Red: Longitudinal
The search strategy

• Databases
  
  *Keywords: food, nutrition, diet, environment, community, neighborhood, neighborhood, school, worksite, basket, assess*, measure*, and instrument*
  
  – PubMed
  
  – Embase
  
  – Web of Science
  
  – PsycINFO
  
  – Global Health databases

• Table of contents of relevant journals

• NCI’s *Measures of the Food Environment*
Inclusion criteria

1. Employed food environment measures for:
   - Food stores
   - Restaurants
   - Schools
   - Worksites
2. Peer-reviewed
3. Published between January 2007 and April 2015
Exclusion criteria

1. Discussed food environment measures for an environment other than schools, restaurants, workplaces, or stores
2. Focused solely on individual-level psychosocial factors
3. Measured the food environment based solely on prices
Figure 1. PRISMA flow diagram.

Database search: 17,098

Duplicates: 5,386

Articles assessed for full-text eligibility: 498

Articles screened: 11,928

Articles excluded after initial screen: 11,429

Articles excluded after full text review: 66

44 Does not measure the food environment
8 Discusses food environment measures for other environment
5 Discusses the food environment based solely on prices
3 Discusses food environment measure development without testing the measure
3 Is a review article
2 Focuses solely on individual-level psychosocial factors related to the food environment
1 Is a policy brief on the issue

Articles included in review: 432

NCI measures of the food environment website: 205

Relevant journals’ table of contents: 11

17,098 citations

432 studies
Data extraction

• We randomly selected a subset of the 432 papers (~10%) for review
  • Two reviewers dually extracted data
  • Compared results
  • Resolved discrepancies by discussion and consensus
• Primary reviewer extracted data from remaining papers
Results

432 studies → 489 measures

Number of journal articles measuring the food environment published by year

- McKinnon’s review
- Current review

Results:

- **432 studies**:
  - 489 measures

- **Average**: 8
  - **Total**: 137

- **High**: 67

- **Low**: 34
  - **Total**: 432
Results: Instruments

Percent of papers that employed each instrument*

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Inventory</td>
<td>9% (n=12)</td>
<td>4% (n=17)</td>
</tr>
<tr>
<td>Market basket</td>
<td>21% (n=29)</td>
<td>5% (n=22)</td>
</tr>
<tr>
<td>Checklist</td>
<td>14% (n=19)</td>
<td>30% (n=131)</td>
</tr>
<tr>
<td>Questionnaire</td>
<td>25% (n=34)</td>
<td>20% (n=85)</td>
</tr>
</tbody>
</table>

*Note: Papers could use one, multiple, or no instruments
## Results: Methodologies

<table>
<thead>
<tr>
<th>Methodology</th>
<th>Percent</th>
<th>(n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrient analysis</td>
<td>12%</td>
<td>17</td>
</tr>
<tr>
<td>Menu analysis</td>
<td>8%</td>
<td>11</td>
</tr>
<tr>
<td>Sales analysis</td>
<td>18%</td>
<td>24</td>
</tr>
<tr>
<td>Geographic analysis</td>
<td>50%</td>
<td>68</td>
</tr>
<tr>
<td>Current Review</td>
<td>65%</td>
<td>282</td>
</tr>
<tr>
<td>McKinnon's Review</td>
<td>3%</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>4%</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>1%</td>
<td>3</td>
</tr>
</tbody>
</table>

*Note: Papers could use one, multiple, or no methodologies*
Results: Location

Percent of papers that measure each context*

<table>
<thead>
<tr>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Food store</td>
<td>8% (n=11)</td>
<td>2% (n=9)</td>
</tr>
<tr>
<td>Restaurant</td>
<td>27% (n=37)</td>
<td>15% (n=63)</td>
</tr>
<tr>
<td>School</td>
<td>19% (n=26)</td>
<td>50% (n=215)</td>
</tr>
<tr>
<td>Workplace</td>
<td>58% (n=80)</td>
<td>73% (n=314)</td>
</tr>
</tbody>
</table>

*Note: Papers could measure more than one context
Results: Psychometric properties

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<td>McKinnon’s Review (1990-2007)</td>
<td></td>
<td>14</td>
<td>6</td>
</tr>
</tbody>
</table>
Results: Study design for current time period*

- Cross-sectional: 86%
- Longitudinal: 14%

*Data not available from McKinnon’s Review (1990-2007)
What did we learn?
Use of checklists more than doubled...

- Nutrition Environment Measures Survey (NEMS)
- Observational measurement tool
  - Availability
  - Price
  - Quality
- Alternate forms for different settings
  - Food stores
  - Restaurants
  - Vending machines
  - International contexts
Among studies that use checklists, very few have evaluated the relationship between the food environment and dietary intake of populations.
What did we learn?
Domination of geographic analysis...

- Sophisticated analytic software
- Large, nationally representative data
- Secondary data
  - No costly data collection
  - Data easily accessible
When measured via geographic analysis, the evidence for a relationship between the food environment and dietary intake has been mixed or nonexistent.


What did we learn?

Most research assessed food stores and restaurants

• Decline in reporting school and worksite food environment assessment

• Schools and worksites remain important environments impacting individual food choices
What did we learn?
Psychometric testing improved, but...

- **Construct validity**: the extent to which the measure behaves in a way consistent with theoretical hypotheses
  - Does the food environment impact eating behavior in the expected direction?
  - Only 3% reported construct validity
What did we learn?
Cross-sectional studies predominate

• 86% of the studies were cross-sectional/14% were longitudinal
• Restricts our ability to:
  1. Examine stability of food environments
  2. Evaluate change in environments due to natural or planned experiments
  3. Assume causality
Moving forward

- Understand how individuals decide where to purchase their food
  - Proximity to stores may be important, but is not the sole determinant
Moving forward

• Understand how individuals decide where to purchase their food
  • Proximity to stores may be important, but is not the sole determinant

• Increase research on school and worksite food environments
  • Develop tools to assess these contexts
Moving forward

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  • Proximity to stores may be important, but is not the sole determinant

• Increase research on school and worksite food environments
  • Develop tools to assess these contexts

• Establish minimum standards for reliability and validity of food environment measures
Moving forward

• Understand how individuals decide where to purchase their food
  • Proximity to stores may be important, but is not the sole determinant
• Increase research on school and worksite food environments
  • Develop tools to assess these contexts
• Establish minimum standards for reliability and validity of food environment measures
• Conduct longitudinal studies
  • Monitor food environments over time
Moving forward

• Understand how individuals decide where to purchase their food
  • Proximity to stores may be important, but is not the sole determinant
• Increase research on school and worksite food environments
  • Develop tools to assess these contexts
• Establish minimum standards for reliability and validity of food environment measures
• Conduct longitudinal studies
  • Monitor food environments over time
• Prioritize funding for testing/evaluating food environment measures
Acknowledgements

• The authors of “Measures of the Food Environment: A Compilation of the Literature, 1990–2007”
  • Robin McKinnon
  • Jill Reedy
  • Amy Yaroch
  • Meredith Morrissette
Thank you

Contact Information
Rebeccah Sokol
rwoodke@live.unc.edu

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- Cross-sectional 86%
- Longitudinal 14%
Appendix Slides
##Psychometric properties

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<thead>
<tr>
<th>Psychometric property</th>
<th>% of papers (n)</th>
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<tbody>
<tr>
<td><strong>Reliability</strong></td>
<td></td>
</tr>
<tr>
<td>Inter-rater</td>
<td>16.7 (72)</td>
</tr>
<tr>
<td>Cites external source</td>
<td>9.5 (41)</td>
</tr>
<tr>
<td>Test-retest</td>
<td>4.4 (19)</td>
</tr>
<tr>
<td>Internal consistency</td>
<td>3.5 (15)</td>
</tr>
<tr>
<td><strong>Validity</strong></td>
<td></td>
</tr>
<tr>
<td>Cites external source</td>
<td>28.2 (122)</td>
</tr>
<tr>
<td>Criterion-related</td>
<td>10.6 (46)</td>
</tr>
<tr>
<td>Face</td>
<td>5.1 (22)</td>
</tr>
<tr>
<td>Construct</td>
<td>3.2 (14)</td>
</tr>
<tr>
<td>Convergent</td>
<td>3.2 (14)</td>
</tr>
<tr>
<td>Content</td>
<td>2.1 (9)</td>
</tr>
<tr>
<td>Discriminate</td>
<td>0.6 (3)</td>
</tr>
</tbody>
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Journal’s Tables of Contents searched

• Journal of Nutrition Education and Behavior
• American Journal of Preventive Medicine
• Health Education and Behavior
• Journal of the Academy of Nutrition and Dietetics (formerly Journal of the American Dietetic Association)
• Preventive Medicine
Popularity of NEMS

- Checklists: 73%
- NEMS: 27%
- Other: 73%