



Measuring local food environments: An overview of available methods and measures

Bridget Kelly*, Victoria M Flood, Heather Yeatman

School of Health Sciences, Faculty of Health and Behavioural Sciences, University of Wollongong, NSW 2522, Australia

ARTICLE INFO

Article history:

Received 14 January 2011

Received in revised form

15 August 2011

Accepted 24 August 2011

Available online 3 September 2011

Keywords:

Food environments

Measurement

Survey

Instrument

ABSTRACT

Reliable and valid measures of local food environments are needed to more fully understand the relationship between these environments and health and identify potential intervention points to improve access to, and the availability of, healthy foods. These measures also inform policy making, including the zoning of food outlets and food labelling/information requirements. A literature review was undertaken using health, behavioural and social sciences, nutrition and public health databases and grey literature, to determine available information on the measurement of local food environments. Included articles were those measuring aspects of food environments published from 2000 to 2010. A range of tools and methods are available to measure different components of food environments. Those focusing on community nutrition environments record the number, type and location of food outlets. The tools that focus on the consumer nutrition environment incorporate other factors, such as available food and beverage products, their price and quality, and any promotions or information to prompt consumers to make purchasing decisions. A summary and critique of these measures are provided.

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1. Introduction

Food selection is influenced by many factors, including taste, price, convenience, knowledge and availability (Glanz et al., 1998). Understanding how these factors affect food selection may offer important insights into strategies to achieve improvements in population health and nutrition. The interplay between

these factors is complex, and can be considered using social ecological models, whereby personal factors and the environment interact to influence behaviour. One part of this environment includes the settings where people procure food, such as workplaces, schools, restaurants and supermarkets. This physical environment influences the types of food and beverages that are available, and any barriers or opportunities for the consumption of a healthy diet (Story et al., 2008).

Local food environments have been shown to be an independent predictor of individuals' food choice and diet quality in developed countries (Moore and Diez Roux, 2006; McKinnon et al., 2009). This

* Corresponding author. Tel.: +61 2 4221 1340; fax: +61 2 4221 5945.
E-mail address: bridget.kelly@sydney.edu.au (B. Kelly).

has been most clearly demonstrated in observational studies of food outlets and nutrition outcomes in the United States of America (USA), where there is more obvious residential segregation by income and ethnicity (Moore and Diez Roux, 2006). Specifically, studies have demonstrated better access to supermarkets and the provision of a wider variety of healthy foods in higher income areas, while a greater density of convenience stores and smaller grocery stores that sell a more limited range of healthy items often at higher prices, are found in more socially disadvantaged areas (Morland et al., 2002; Moore and Diez Roux, 2006).

In 2007, US researchers developed a list of food environment constructs considered to impact on individuals' food behaviours (Saelens and Glanz, 2009). This list was designed to highlight priority areas for further research and assist in developing a universal tool that could be applied across different settings and populations. These constructs included: (i) access to, pricing and quality of healthy versus unhealthy foods; (ii) advertising; (iii) density of fast food restaurants and other stores; (iv) non-traditional food stores; (v) nutrition information or labelling at the point-of-purchase; (vi) portion size; (vii) pricing in vending machines (Saelens and Glanz, 2009).

These measures of local food environments can be grouped into three major categories, comprising: (i) the *community nutrition environment*, including the number, type, location and accessibility of food outlets that are available to the general population; (ii) the *organisational nutrition environment*, relating to food outlets within settings, such as schools and workplaces; (iii) the *consumer nutrition environment*, including the availability, cost and quality of food and beverage products (Glanz et al., 2005), as indicated in Table 1. These categories reflect the work of Farley and Rice et al. (2009) who found that measures of actual food and beverage products provide a more discrete indicator of the local food environment and are likely to have a greater impact on food purchasing decisions than the spatial availability of food outlets alone (Farley et al., 2009). Notably, these measures relating to food products can be applied to food outlets within communities and organisational settings.

Understanding how local food environments, and the modification of these environments, impact on nutrition is necessary to address the current high rates of obesity and diet-related diseases (Glanz, 2009). This literature review aims to identify and appraise the range of data collection methods and measurement instruments and indices available for assessing local food environments internationally. Measures relating to the community and the consumer nutrition environment were included, as these aspects of food environments have been identified as priority research areas with potentially broad effects (Glanz et al., 2005). Understanding how such tools have been used and any identified limitations of their use, is an important basis on which to devise a systematic approach to quantifying these environments. This manuscript is not intended to be a systematic review of all evidence relating to food environments, but rather it aims to

provide an indication of the types of measures that can be used to assess these settings, with a view to assisting researchers to develop comprehensive and evidence-based tools.

2. Methods

A literature review was undertaken of the measures and methods used to assess food environments. Peer-reviewed journals were identified by searching health science, behavioural and social science, nutrition and public health databases, including MEDLINE, CINAHL, Educational Resources Information Center, PsychINFO and Emerald Full Text. Search terms were also used in a GOOGLE search to identify grey literature. Reference lists of retrieved articles were scanned for relevant papers.

Search terms included: (Food OR beverage OR drink) AND (food environment OR food outlet OR food store OR vending machine OR market basket) AND (price* OR access* OR availability). Where the initial search yielded large volumes of material with varying relevance, additional search terms were included to narrow the search to measuring food environments in different settings, including: supermarket OR public place* OR school* OR sporting venue* OR hospital* OR health service* OR workplace* OR public transport OR public facilities. The search was restricted to articles published in English between 2000 and 2010 to capture the most current measurement tools that have been used to assess food environments. Papers included measures of at least one aspect of community or consumer nutrition environments (relating to food outlets in both communities and organisational settings), including measures of availability and accessibility of food outlets and/or availability and accessibility of food products and other aspects of food environments that may contribute to broader food related cues. Retrieved articles were scanned for relevance and then grouped according to the main environmental construct being measured (community or consumer nutrition environment).

The method and/or measures used to assess food environments were reviewed for reported validity and reliability and their usefulness in defining local food environments. Assessment of the use of using geocoding to analyse the density and proximity of food stores is not discussed as this method has recently been reviewed elsewhere (Charreire et al., 2010). Studies measuring food that could be procured through non-commercial means, such as community gardens, not-for-profit food programs were excluded. Our search identified 179 articles, of which 63 were included in this review to illustrate the range of measurement methods and measures available to assess food environments. Remaining articles either did not meet inclusion criteria or used a method/measure that was already examined from another paper.

3. Results

A description of studies measuring local food environments is provided below, together with a summary table providing examples of available survey methods and tools for a range of food environment measures (Table 2). This includes available data collection techniques, measurement instruments or surveys, and indices that summarise information from a range of different indicators pertaining to the local food environment.

3.1. Measuring the community nutrition environment

3.1.1. Location of food outlets

The identification of food outlets has been used to describe two aspects of community nutrition environments: proximity of

Table 1
Community and consumer nutrition environments (modified from Farley et al., 2009; Glanz et al., 2005).

Community nutrition environment	Consumer nutrition environment
Food store number, type and location within a defined geographical area	Food product availability; prominence (e.g. information and promotions and the store space that they comprise); and accessibility (e.g. how easily consumers can locate items within stores and their cost).
Organisational nutrition environment Food outlets in organised settings (e.g. schools, workplaces)	

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