Tools & Methods for Measuring Nutrition Environments

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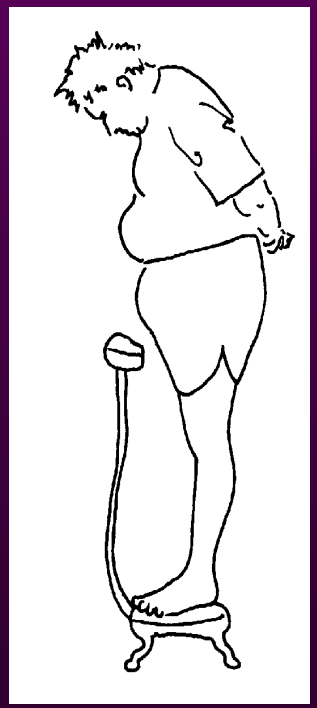
EMORY ROLLINS SCHOOL OF PUBLIC HEALTH

- Why Nutrition Environments Matter
- Conceptual Framework
- Measures and Tools: The Nutrition Environment Measures Study (NEMS)
- Future Directions

Environmental Causes of Obesity



- Increased eating
- Decreased energy expenditure

Soft Drink Single Serving Size, 1950 - 2002

8 ounces

12 ounces

5¢ per oz.

20 ounces

4¢ per oz.

42 ounces

2.3¢ per oz.

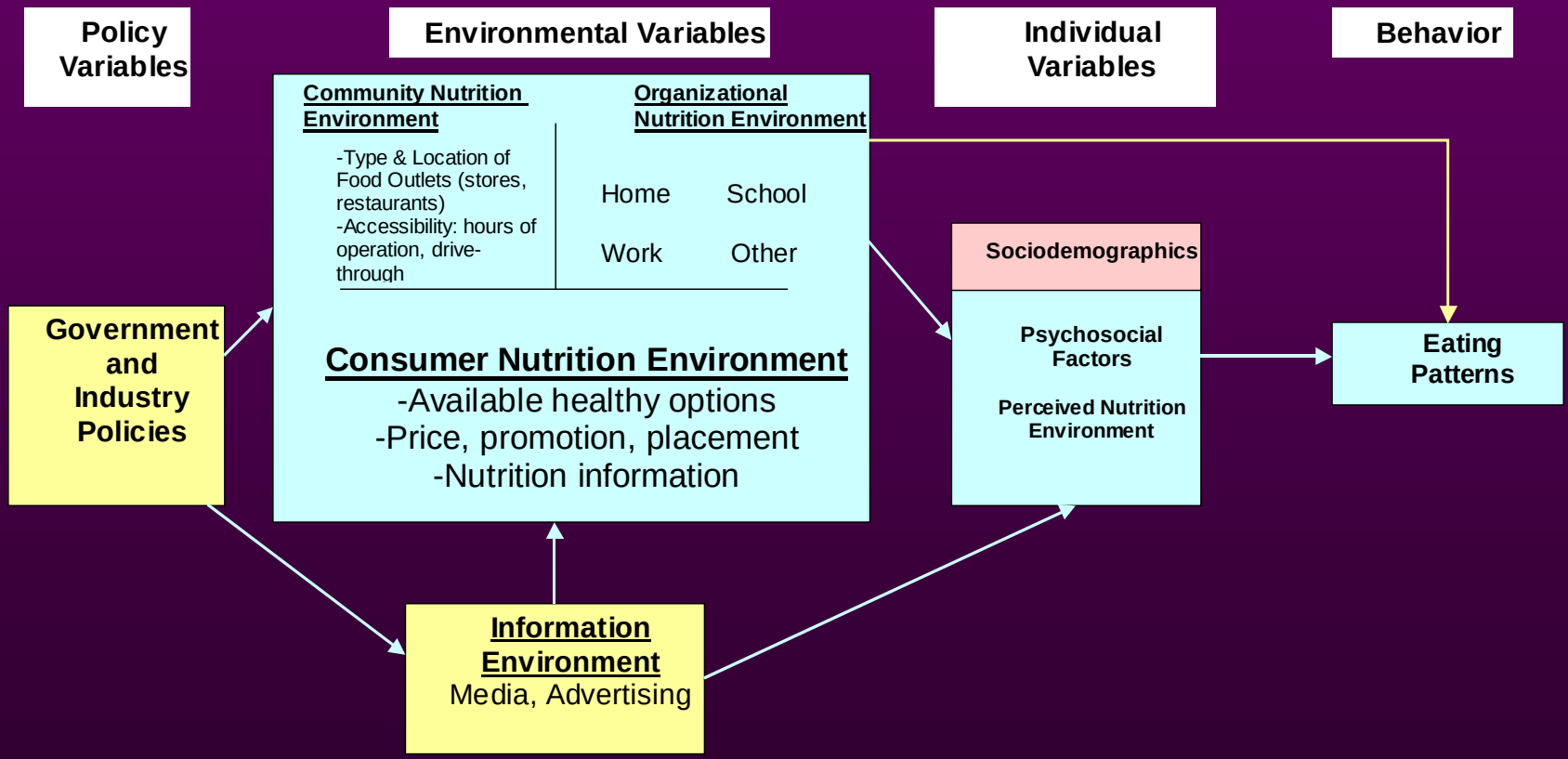
with permission from McDonald's Corporation

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

{Ecological Perspective}

Model of Community Nutrition Environments

[Glanz, Sallis, Saelens & Frank 2005]



- This model blends public health, health psychology, & urban planning perspectives

- Guides developments of measures & research priorities

- 4 types of nutrition environments:
  1. Community *
  2. Consumer *
  3. Organizational
  4. Informational

- Moderating & mediating pathways hypothesized

**** Less studied; may have broad effects***

Community & Consumer Nutrition Environments

Community **nutrition environments** =

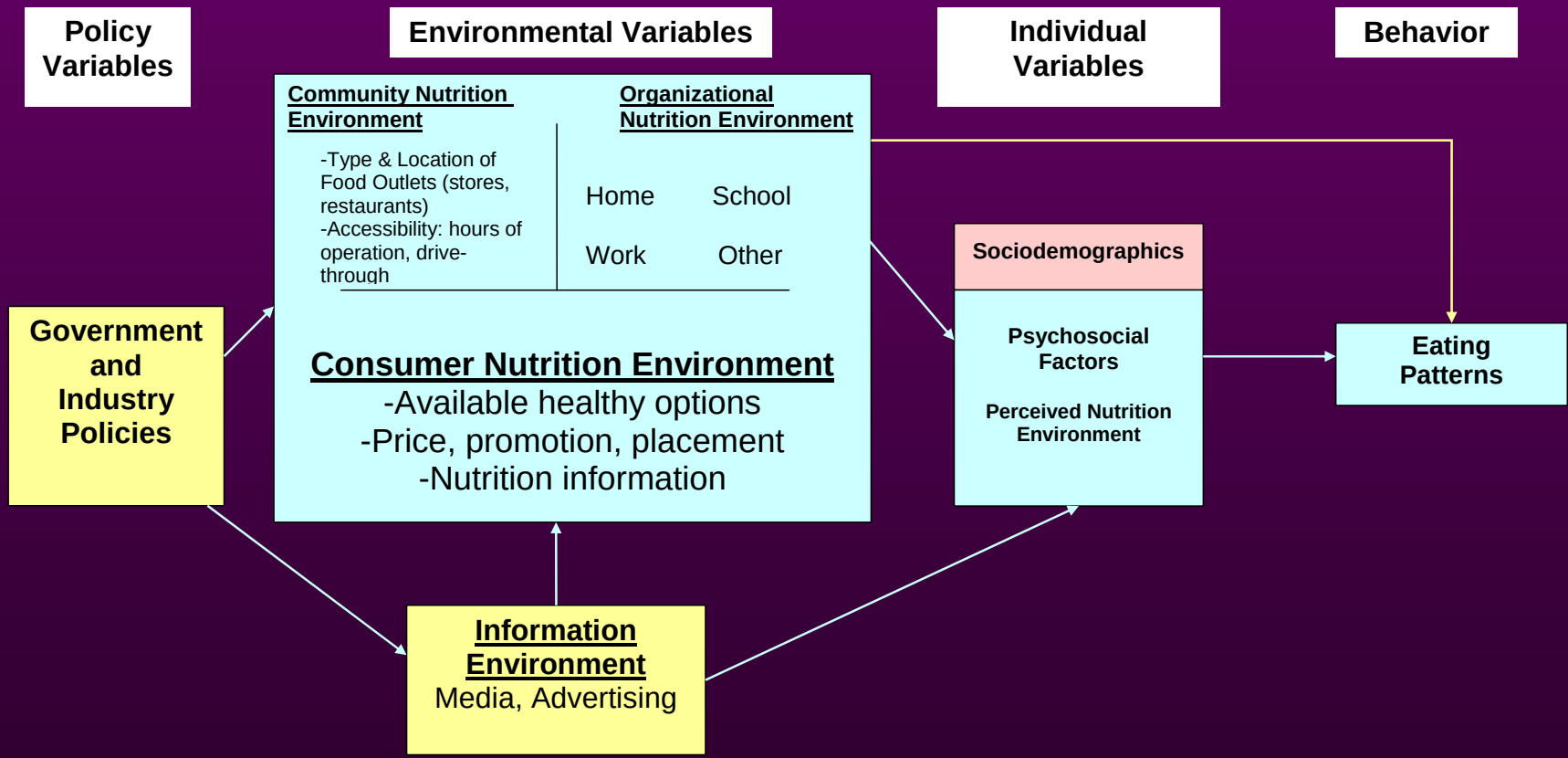
- Type & location of food outlets
- Accessibility (e.g., hours, drive-thru)

Consumer **nutrition environments =**

- Availability of healthful food choices
- Pricing, promotion, placement
- Information availability

Model of Community Nutrition Environments

[Glanz, Sallis, Saelens & Frank 2005]



- This model is a starting point
- Complex research & practice area
- Greater priority is needed for nutrition environments

Nutrition Environment Measures Study (NEMS)

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Funded by the Robert Wood Johnson Foundation

Aims of NEMS

1. Develop measures of nutrition environments – retail & food service outlets (stores, restaurants)

2. Test the inter-rater reliability and test-retest reliability of nutrition environment measures

3. Examine sampling and generalizability issues

Other Examples of Nutrition Environment Measures

Grocery Stores:

Cheadle et al., 1991-94
Horowitz et al. 2004 – *AJPH*
Sloane et al. *JGIM*, 2004
Morland et al. (2001, 2002)
Donkin et al., 2000 (U.K.)

Restaurants:

Cassady et al. 2004, *AJHP*
CSPI reports
Burdette & Whitaker, *Prev Med* 2004

The Most Important Measurement Concepts

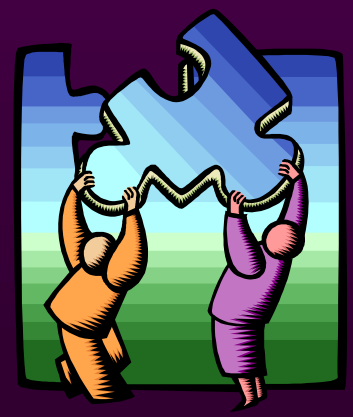
Validity

Reliability

Validity

Whether an instrument measures what it proposes to measure

Measures reflect true differences in the things they intend to measure



Types of Reliability Examined in NEMS

1. Inter-rater reliability (equivalence)
2. Test-retest reliability (stability)

Reliability in NEMS #1

1. **Inter-rater reliability:**
   2 raters go to same store/restaurant, same day (same time)
   Do they get the same results?

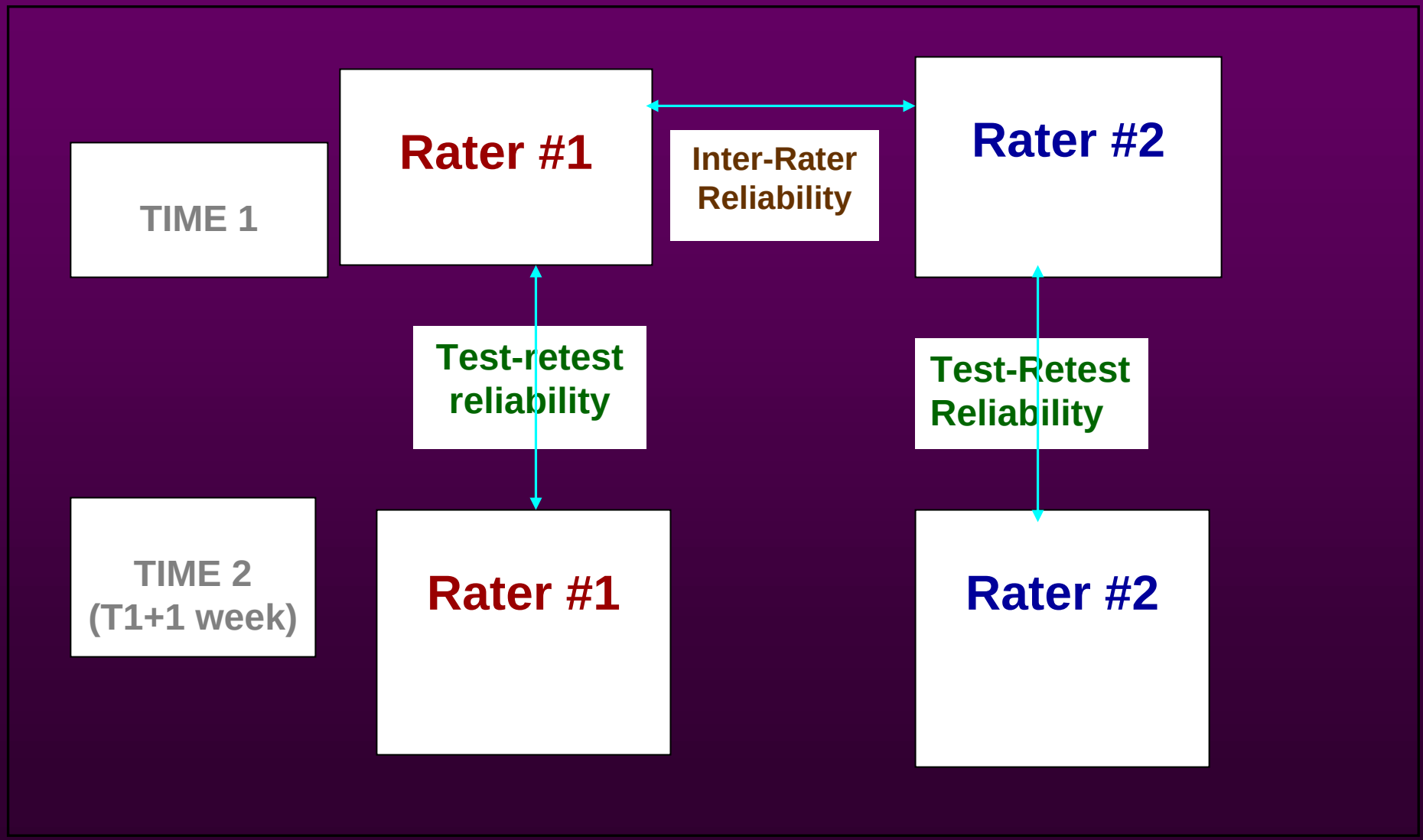
Reliability in NEMS #2

2. **Test-retest reliability:**

   The same rater goes to same store/restaurant, one week apart - ***Does he/she find the same results?***

   This assumes stores don't change that fast, but we're not sure…It depends on measures that aren't too subject to "random error"

Test-Retest Reliability and Inter-Rater Reliability



Phases of the study:

1.Pre-test

Preliminary work:

develop measures, try them out, improve them for formal research purposes

Where? Decatur (hi walk) & Toco Hills (lo walk) neighborhoods

Phases of the study, continued:

2.Main measurement study

Collect data to allow us to calculate test-retest reliability & inter-rater reliability in 4 neighborhoods around schools

Where? High/low walk & High/low SES neighborhoods in metro Atlanta

- ***Hi walk, hi SES***
- ***Hi walk, low SES***
- ***Lo walk, hi SES***
- ***Lo walk, lo SES***

Selection of Communities & Identification of Food Outlets

- Communities selected by LFC using maps, census data, and GIS
- Outlets enumerated by RSPH team – online directories, business directories, health department, etc.

Study Area
I-85
Clairmont Rd NE
Lavista Rd
Lavista Rd NE
Toco Hills
N Druid Hills Rd
Stone Mountain Pwy
Briarcliff Rd NE
North Decatur Rd
Scott Blvd
Church St
Downtown Decatur
W College Ave

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

Grocery Stores: Consumer Nutrition Environment Measures

WHOLE FOODS MARKET

WHEAT
GOLD MEDAL
THE BRAND YOU KNOW
HONEY WHEAT
STONE GROUND WHEAT

Convenience Stores:
Consumer Nutrition Measures

Measures of Nutrition Environments in Restaurants
< Fast-Food & Sit-Down Restaurants >

Sources of Information

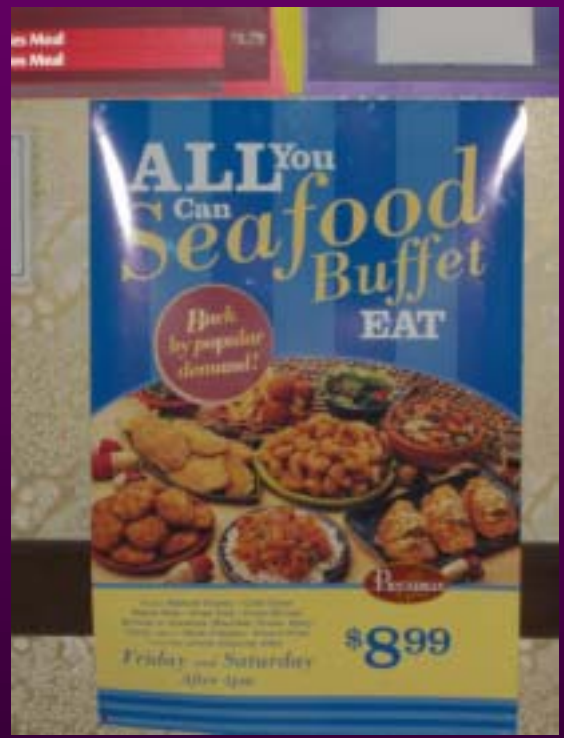
- Internet
- Menu
- Visit, observation
- Interview manager

Measures of Nutrition Environments in Restaurants
< Fast-Food & Sit-Down Restaurants >

- Availability (of healthful choices)
- Prices
  (compare healthy-less healthy; fast-food-sit-down)
- Promotion, Information
- Facilitators & Barriers
- Childrens' Menus

Restaurant Measures

Restaurant Measures: *Eat more!*



Restaurant Measures:
Eat More! Indulge!

Restaurant Measures:
Kids' Menus, Healthy Eating Promotion

NEMS Raters in the Field

Nutrition Environment Measures Study (NEMS)
Food Outlet Cover Page

Rater ID: ☐☐

○ Grocery Store
○ Convience Store
○ Other
_____

Store ID: ☐☐-☐-☐☐-☐☐☐

Date: ☐☐/☐☐/☐☐
Month Day Year

Start Time: ☐☐:☐☐ ○ AM ○ PM

End Time: ☐☐:☐☐ ○ AM ○ PM

Number of cash registers: ☐☐

○ SD ○ FF ○ Specialty ○ Other

Restaurant ID: ☐☐-☐-☐☐-☐☐☐

Site Visit Date: ☐☐/☐☐/☐☐
Month Day Year

Start Time: ☐☐:☐☐ ○ AM ○ PM

End Time: ☐☐:☐☐ ○ AM ○ PM

Menu/Internet Review Date: ☐☐/☐☐/☐☐
Month Day Year

Start Time: ☐☐:☐☐ ○ AM ○ PM

End Time: ☐☐:☐☐ ○ AM ○ PM

Other Visit/Interview Date: ☐☐/☐☐/☐☐
Month Day Year

Start Time: ☐☐:☐☐ ○ AM ○ PM

End Time: ☐☐:☐☐ ○ AM ○ PM

Comments: _____

_____

Nutrition Environment Measures Study (NEMS)
Cover Page

8250013302

Nutrition Environment Measures Study (NEMS)
Measure #2: FRUIT

Rater ID: ☐☐ Store ID: ☐☐-☐-☐☐-☐☐☐

Date: ☐☐/☐☐/☐☐ (Month Day Year)

○ Grocery Store ○ Convience Store ○ Other

Availability and Price

Produce Item		Available Yes	Available No	Price	Unit #	Unit pc	Unit lb	Quality A	Quality UA	Comments
1. **Bananas**		○	○	$☐.☐☐	☐	○	○	○	○	
2. **Apples**	○ Red delicious ○ _____	○	○	$☐.☐☐	☐	○	○	○	○	
3. **Oranges**	○ Navel ○ _____	○	○	$☐.☐☐	☐	○	○	○	○	
4. **Grapes**	○ Red seedless ○ _____	○	○	$☐.☐☐	☐	○	○	○	○	
5. **Cantaloupe**		○	○	$☐.☐☐	☐	○	○	○	○	
6. **Peaches**		○	○	$☐.☐☐	☐	○	○	○	○	
7. **Strawberries**		○	○	$☐.☐☐	☐	○	○	○	○	
8. **Honeydew Melon**		○	○	$☐.☐☐	☐	○	○	○	○	
9. **Watermelon**	○ Seedless ○ _____	○	○	$☐.☐☐	☐	○	○	○	○	
10. **Pears**	○ Anjou ○ _____	○	○	$☐.☐☐	☐	○	○	○	○	

11. **Total Types:** ☐☐

0450176946

Nutrition Environment Measures Study (NEMS)
Measure #3: VEGETABLES

Rater ID: ☐☐ Store ID: ☐☐-☐-☐☐-☐☐☐

Date: ☐☐/☐☐/☐☐ (Month/Day/Year)

○ Grocery Store ○ Convience Store ○ Other

Availability and Price

Produce Item		Available Yes	Available No	Price	Unit #	Unit pc	Unit lb	Quality A	Quality UA	Comments
1. **Carrots**	○ 1 lb bag ○ _____	○	○	$☐.☐☐	☐	○	○	○	○	_____ _____
2. **Tomatoes**	○ Package of 4 ○ _____	○	○	$☐.☐☐	☐	○	○	○	○	_____ _____
3. **Sweet Peppers**	○ Green bell peppers ○ _____	○	○	$☐.☐☐	☐	○	○	○	○	_____ _____
4. **Broccoli**	○ Bunch ○ _____	○	○	$☐.☐☐	☐	○	○	○	○	_____ _____
5. **Lettuce**	○ Green leaf ○ _____	○	○	$☐.☐☐	☐	○	○	○	○	_____ _____
6. **Corn**		○	○	$☐.☐☐	☐	○	○	○	○	_____ _____
7. **Celery**		○	○	$☐.☐☐	☐	○	○	○	○	_____ _____
8. **Cucumbers**	○ Green ○ _____	○	○	$☐.☐☐	☐	○	○	○	○	_____ _____
9. **Cabbage**	○ Green ○ _____	○	○	$☐.☐☐	☐	○	○	○	○	_____ _____
10. **Cauliflower**		○	○	$☐.☐☐	☐	○	○	○	○	_____ _____

11. **Total Types:** ☐☐

6577396766

Nutrition Environment Measures Study (NEMS)
MEASURE #5: HOT DOG

Rater ID: ☐☐ Store ID: ☐☐-☐-☐☐-☐☐☐

Date: ☐☐/☐☐/☐☐ (Month/Day/Year) ○ Grocery Store ○ Convience Store ○ Other

Availability and Price

Item	Available Yes	No	N/A	Price/lb.	Comments
1. Oscar Mayer Fat-free Wieners (turkey/beef) 0g fat, 40 kcal/svg	○	○		$☐.☐☐	
Alternate Items:					
2. Fat-free other brand 0g fat ☐☐☐☐☐☐☐☐☐☐☐☐☐☐ (Brand name) ☐☐☐ (Kcal/svg)	○	○	○	$☐.☐☐	
3. Light Wieners (turkey/pork) 7g fat, 90 kcal/svg	○	○	○	$☐.☐☐	
4. Light beef Franks (1/3 less calories, 50% less fat) 6g, 90 Kcal/svg	○	○	○	$☐.☐☐	
5. Turkey Wieners (1/3 less fat) 8g fat, 100cal/svg	○	○	○	$☐.☐☐	
6. Other ☐☐☐☐☐☐☐☐☐☐☐☐☐☐	○	○	○	$☐.☐☐	☐☐ oz pkg ☐☐ Hot dogs/pkg ☐☐ g fat ☐☐☐ kcal/svg
7. Oscar Mayer Wieners (turkey/pork)-regular 13g fat, 140 kcal/svg	○	○		$☐.☐☐	
Alternate Item:					
8. Beef Franks (regular) 13g fat, 140 kcal/svg	○	○	○	$☐.☐☐	
9. Other ☐☐☐☐☐☐☐☐☐☐☐☐☐☐	○	○	○	$☐.☐☐	☐☐ oz pkg ☐☐ Hot dogs/pkg ☐☐ g fat ☐☐☐ kcal/svg

5986187936

Nutrition Environment Measures Study (NEMS)
MEASURE #10: BAKED CHIPS

Rater ID: ☐☐ Store ID: ☐☐-☐-☐☐-☐☐☐

Date: ☐☐/☐☐/☐☐ (Month/Day/Year)

○ Grocery Store ○ Convience Store ○ Other

Availability & Price

Low-fat chips =<3g/serving

Item	Available Yes	No	N/A	Price	Comments
Healthier Option (select closest matching size available)					List size here if preferred is not available
1. Baked Lays Potato Crisps ○ 1 1/8 oz. ○ 10 oz. ○ 2 1/8 oz. ○ 12 oz. ○ 5 oz.	○	○		$☐.☐☐	_____
Alternate Item: 2. ☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ○ 1 1/8 oz. ○ 10 oz. ○ 2 1/8 oz. ○ 12 oz. ○ 5 oz.	○	○	○	$☐.☐☐	List size here if preferred is not available _____
3. # of varieties of low-fat chips (any brand)	○ 0	○ 1	○ 2	○ 3+	
Regular Option (select closest matching size available)					List size here if preferred is not available
4. Lays Potato Chips Classic ○ 1 1/2 oz. ○ 10 oz. ○ 2 3/4 oz. ○ 12 oz. ○ 5 oz.	○	○		$☐.☐☐	_____
Alternate Item: 5. ☐☐☐☐☐☐☐☐☐☐☐☐☐☐ ○ 1 1/2 oz. ○ 10 oz. ○ 2 3/4 oz. ○ 12 oz. ○ 5 oz.	○	○	○	$☐.☐☐	List size here if preferred is not available _____

Findings

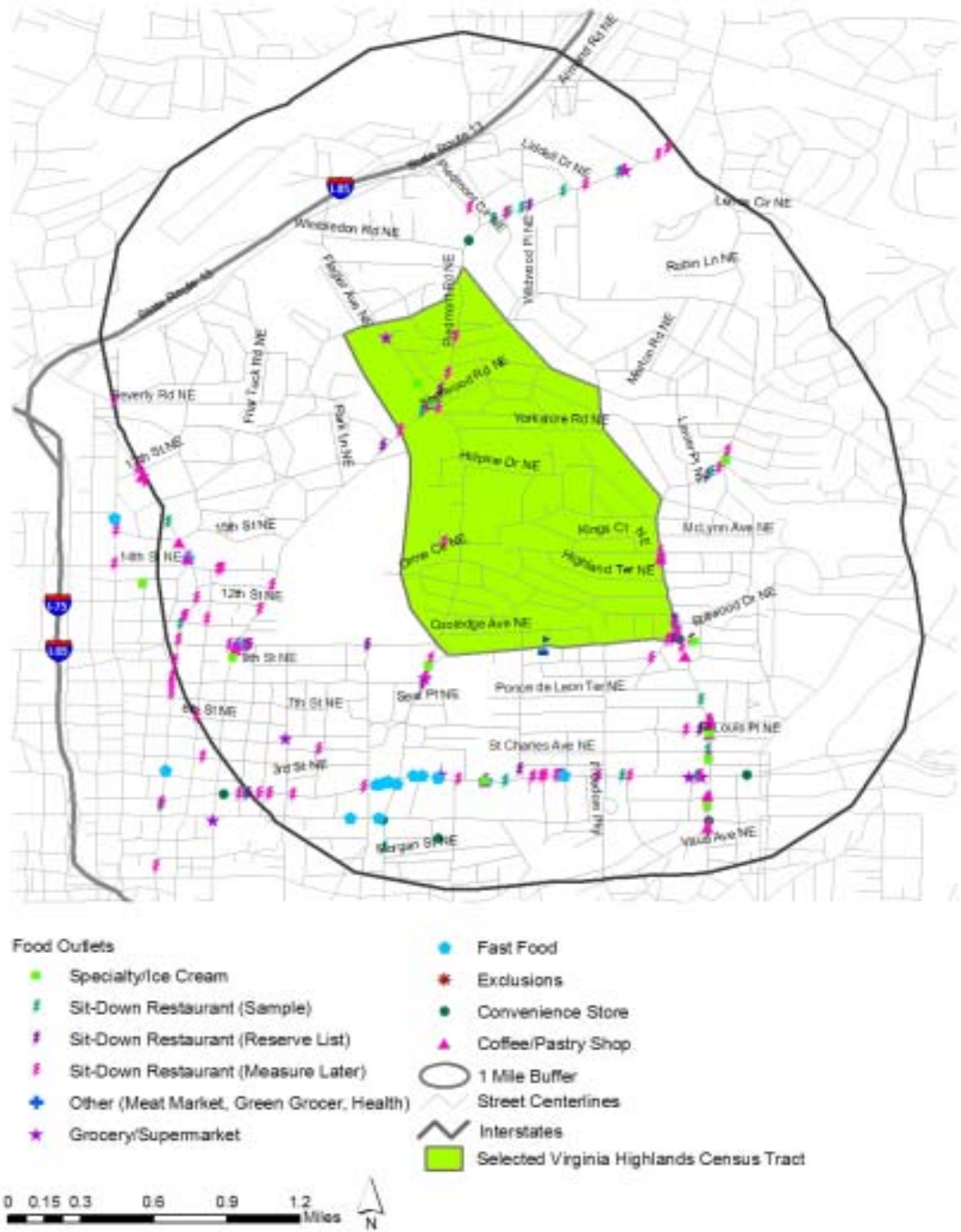
Enumeration and Mapping

- Food licensing lists
- Yellow Pages
- Online sources
- Phone calls and visits
- Geocoding & mapping

88 stores (93% completion rate)

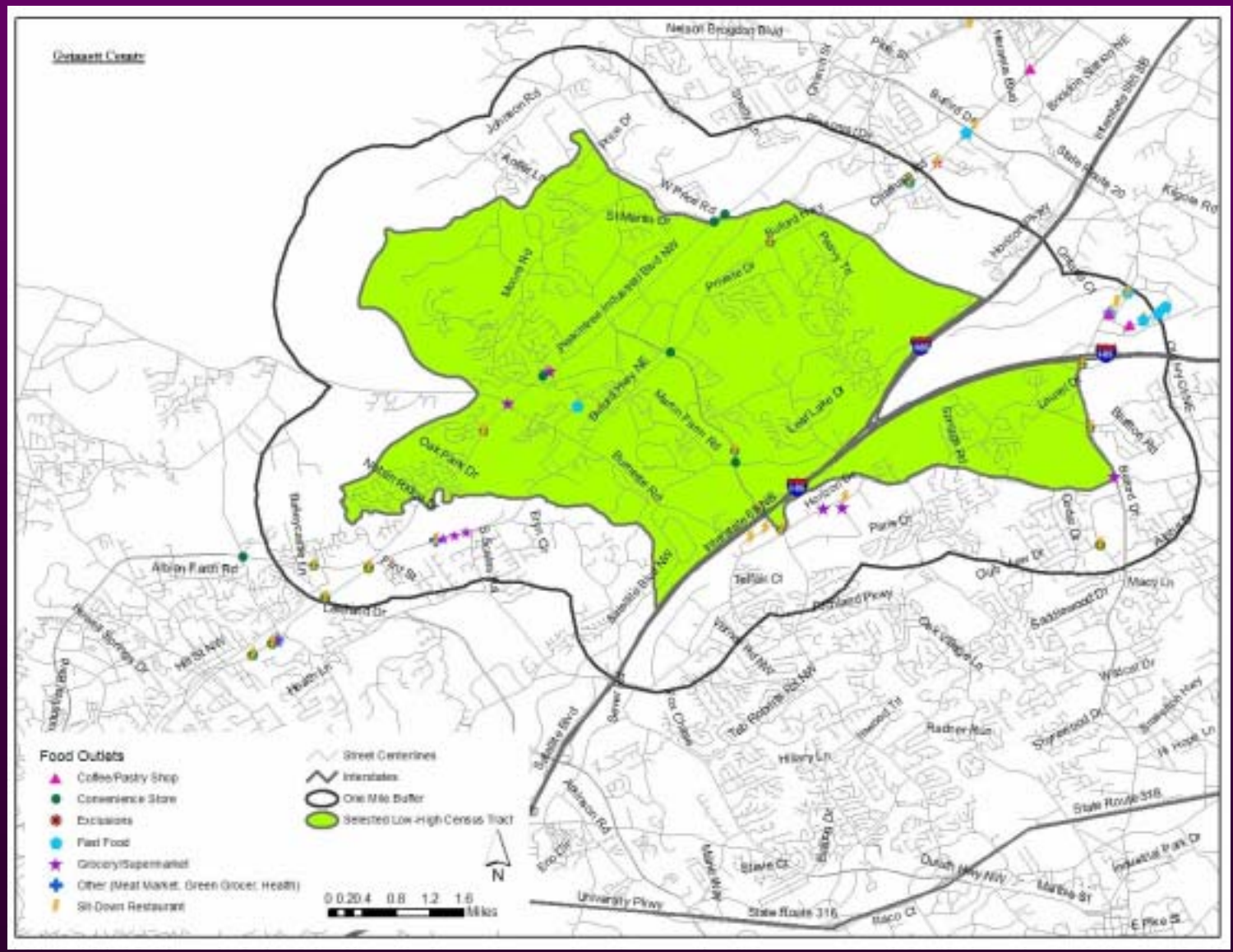
301 restaurants

- 129 SDR’s in High-Walk, High-Income Area
- Sample of 40
- 216 restaurants assessed



High Income/ High-Walkability

High Income/Low-Walkability

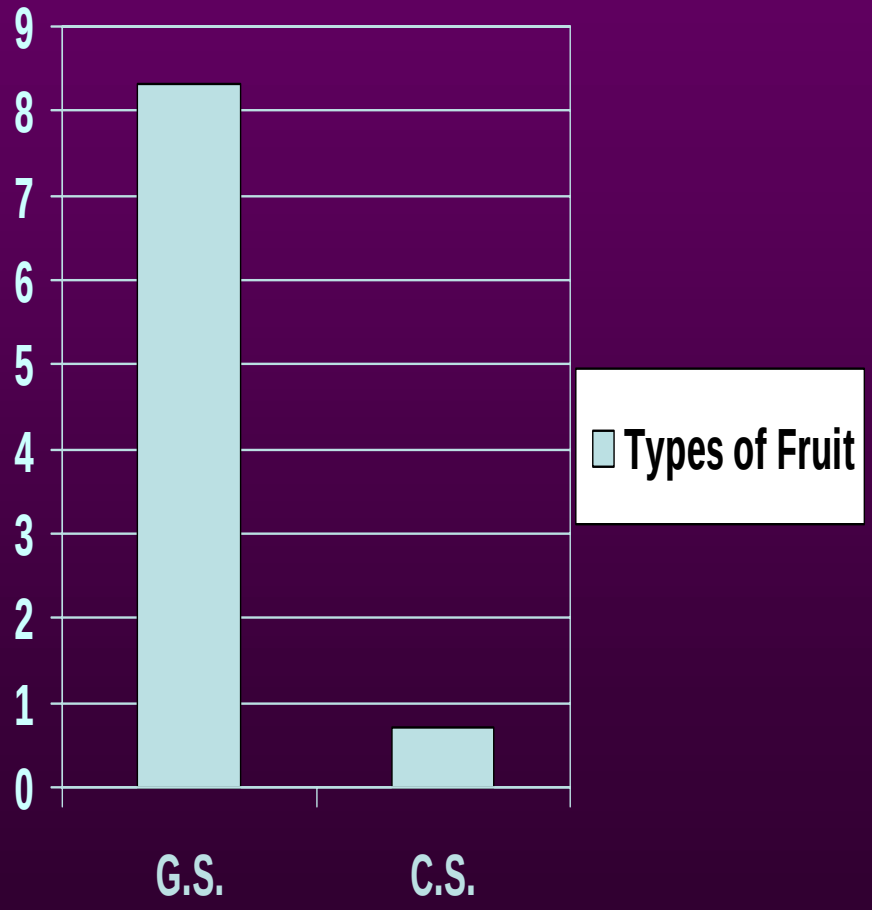


Inter-Rater Reliability of NEMS Store Observations

Variable/Indicator	Inter-Rater Reliability (2 raters, same day)	
	% agreement	*Kappa/V* [a]
Fruit – availability (10 types)	97 to 100%	.93 to 1.00
Fruit – quality (10 types)	87 to 95%	.75 to .95
Vegetables – availability (10 types)	97 to 100%	.94 to 1.00
Vegetables – quality (10 types)	87 to 97%	.83 to .95
Baked chips	95%	.89
Hot dogs (regular vs. fat-free)	100%	1.00

a Cramer's V statistic used when Kappa could not be computed due to asymmetric rater response dimensions

Grocery Stores vs. Convenience Stores: Availability of Fruit & Vegetables



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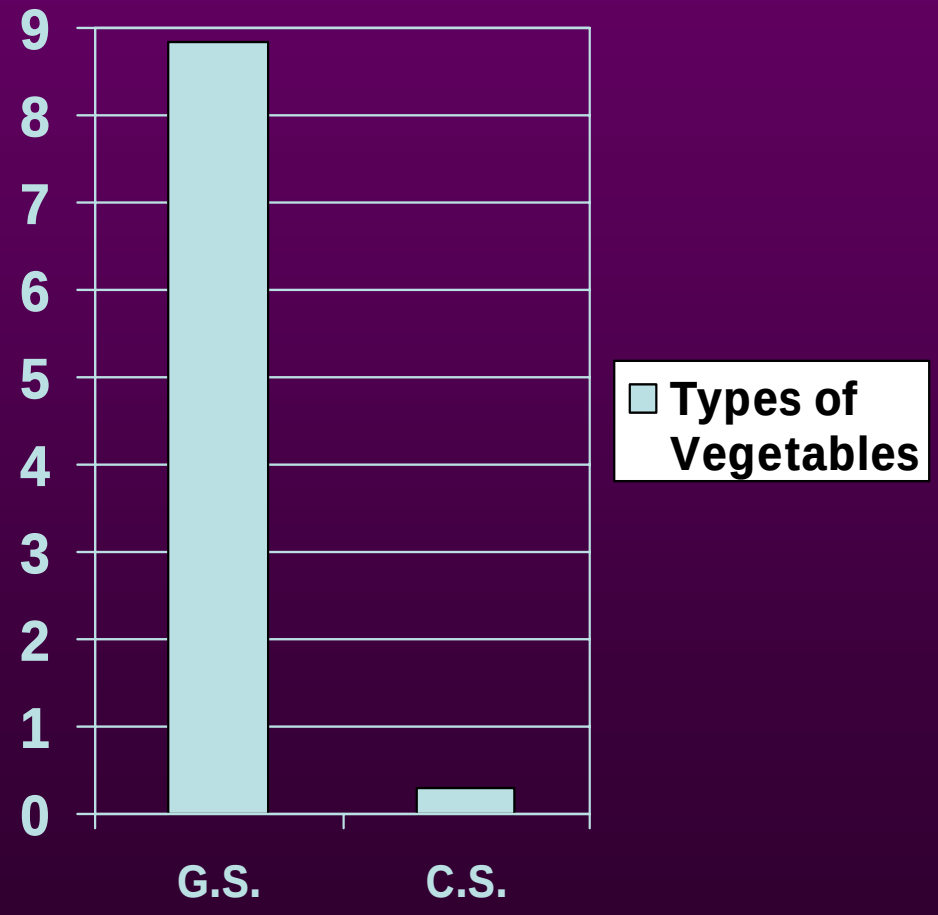

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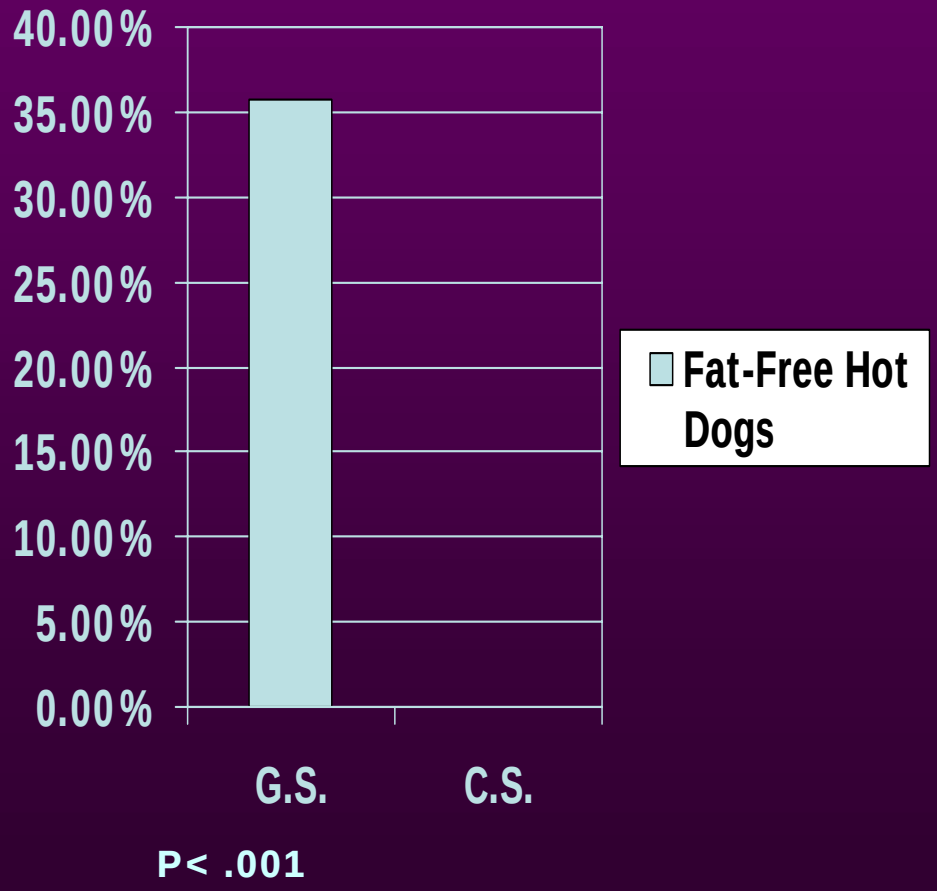
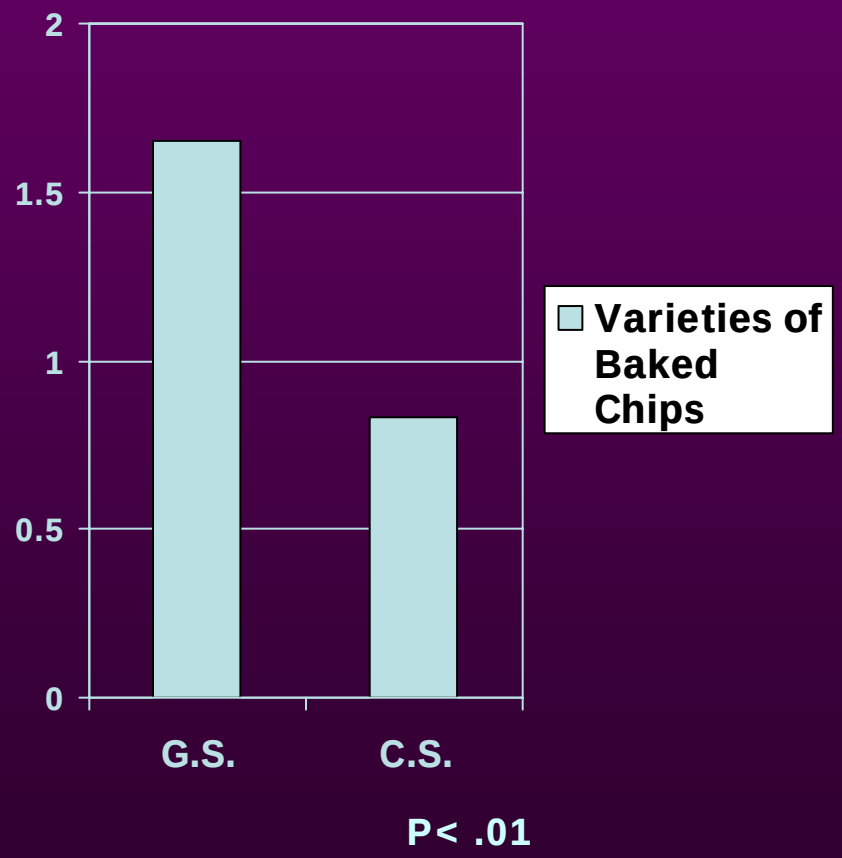
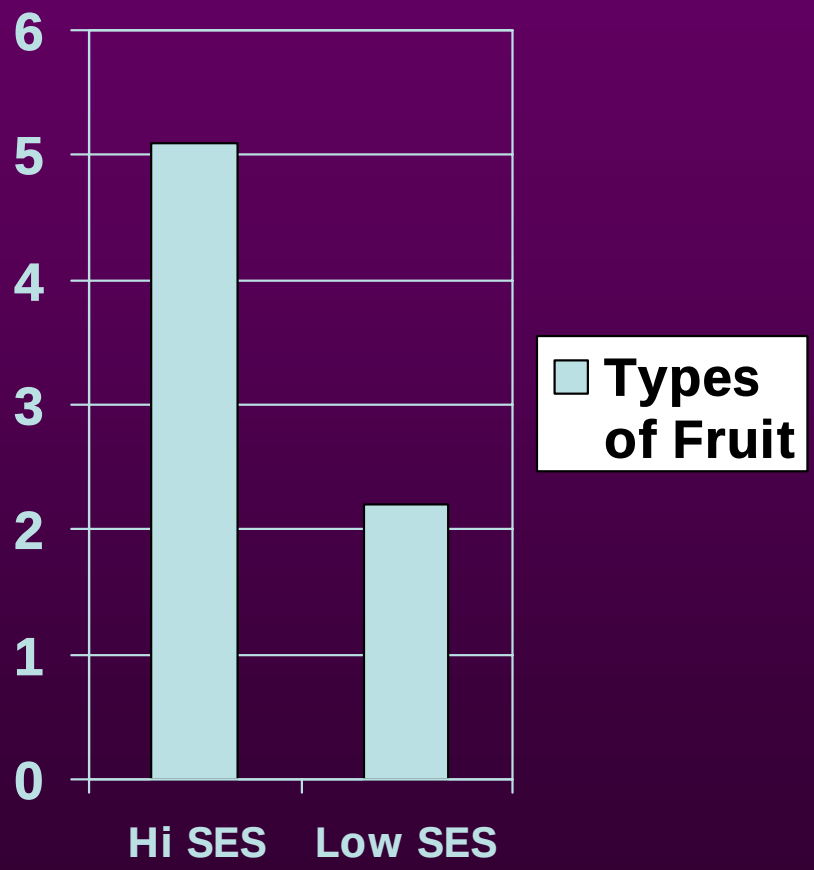
Grocery Stores vs. Convenience Stores: Availability of Fat-Free Hot Dogs & Baked Chips





High- vs. Low-Income Neighborhoods: Availability of Fruits & Vegetables



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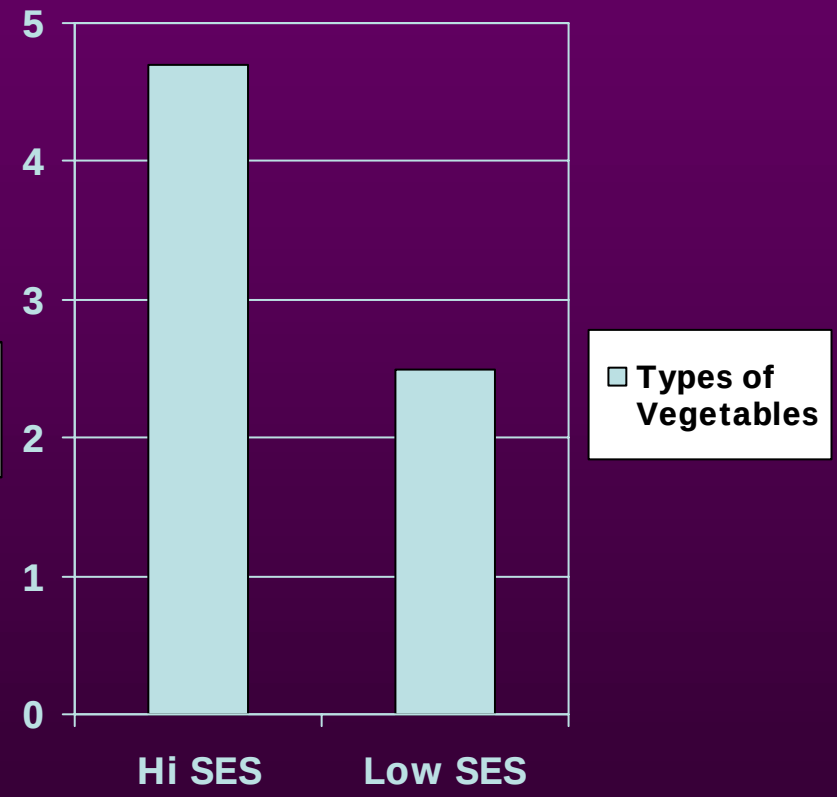

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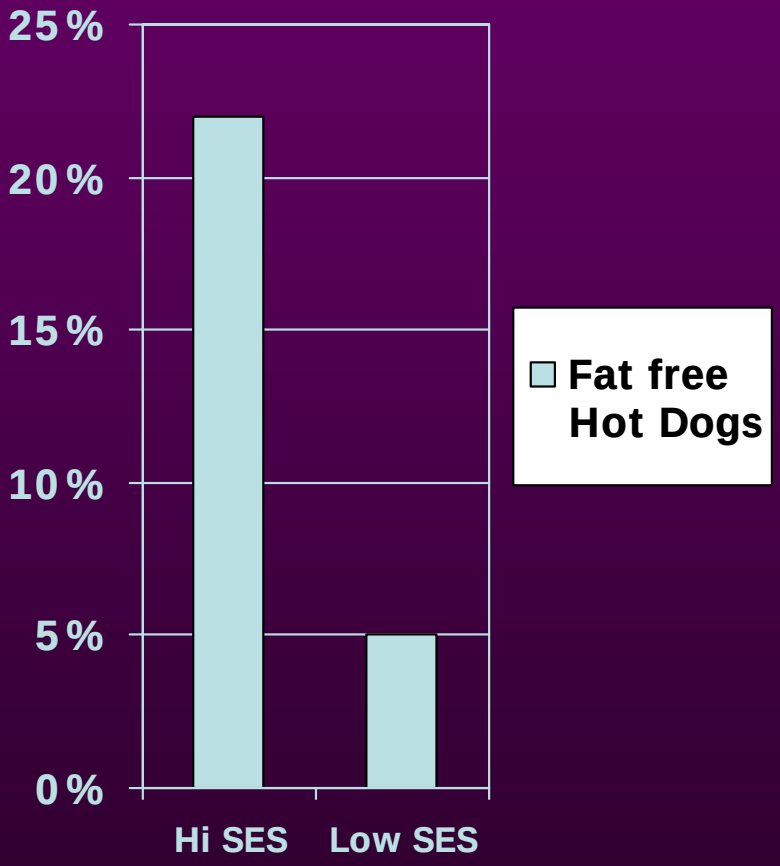
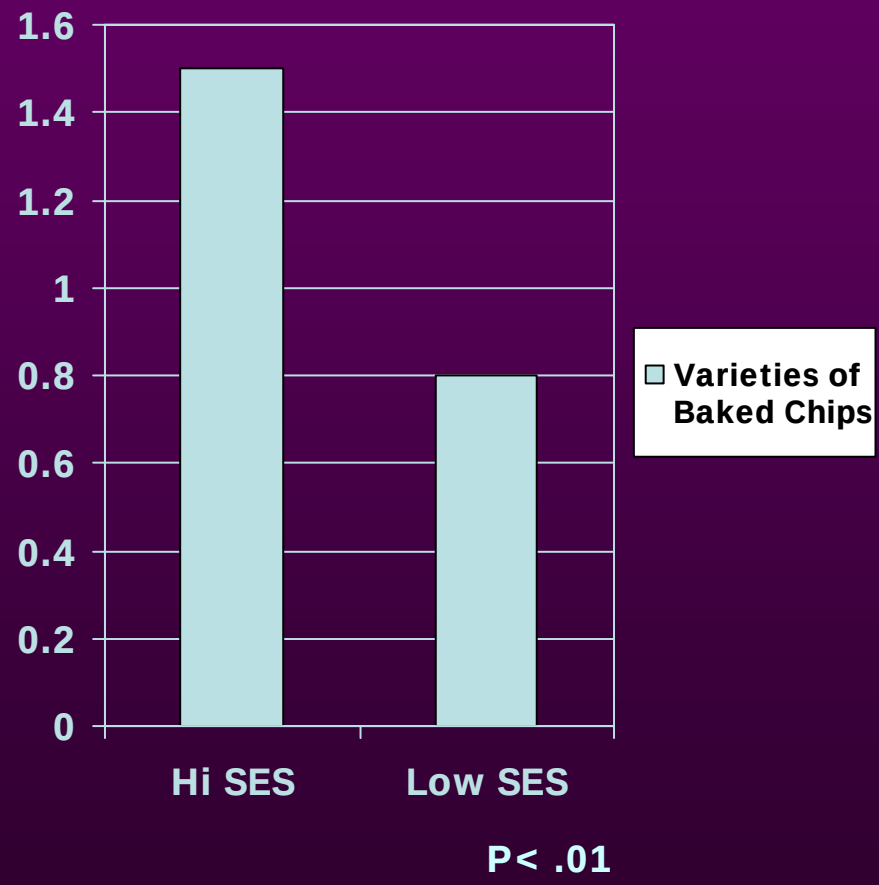
High- vs. Low-Income Neighborhoods: Availability
Fat-Free Hot Dogs & Baked Chips



n.s., trend



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Shelf Space

Skim Milk vs. Full-Fat Milk:

39.6% skim milk
Higher in GS
& High SES
areas

Cost Comparisons

Fruits

Bananas:

.47/.62 = 76 % GS/CS (p<.001)

Milk

.99 = ratio skim/full fat (NS)

Cost Comparisons

Hot Dogs

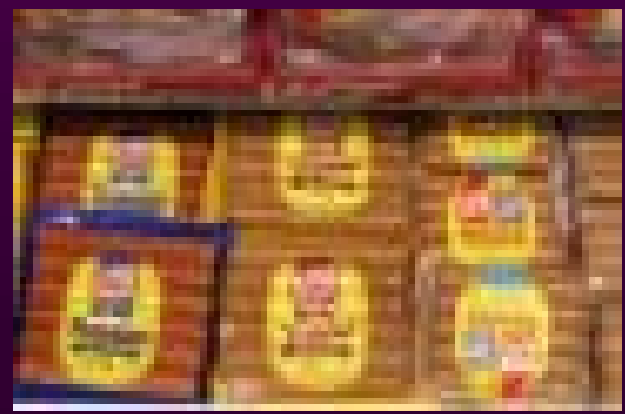
115% of regular for lean franks

Ground Beef

155% of regular for lean meat

Chips

131% of regular for lo-fat



Restaurant Findings

Inter-Rater Reliability (% agreement):

- **Recording sources – 100%**
- **Healthy choices shown? 86%**
- **Total entrees? 78%**
- **# Healthy entrees? 87%**

Time for Completing Measures

Convenience stores: 10-18 min

Grocery Stores: 30-66 min

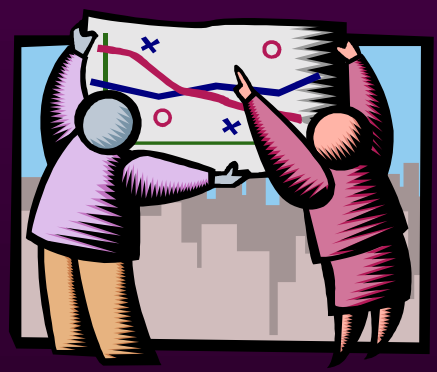
Restaurant site visits: average 11.5 minutes (9-35)

Menu reviews: avg 35 min

Limitations

Other venues where food is sold not included

May have left out some important variables



What we do & do not know

- Environmental vs. individual/social determinants?
- Distribution of unhealthy environments (SES,etc.)
- How much environmental change is needed?

Training Package planned…

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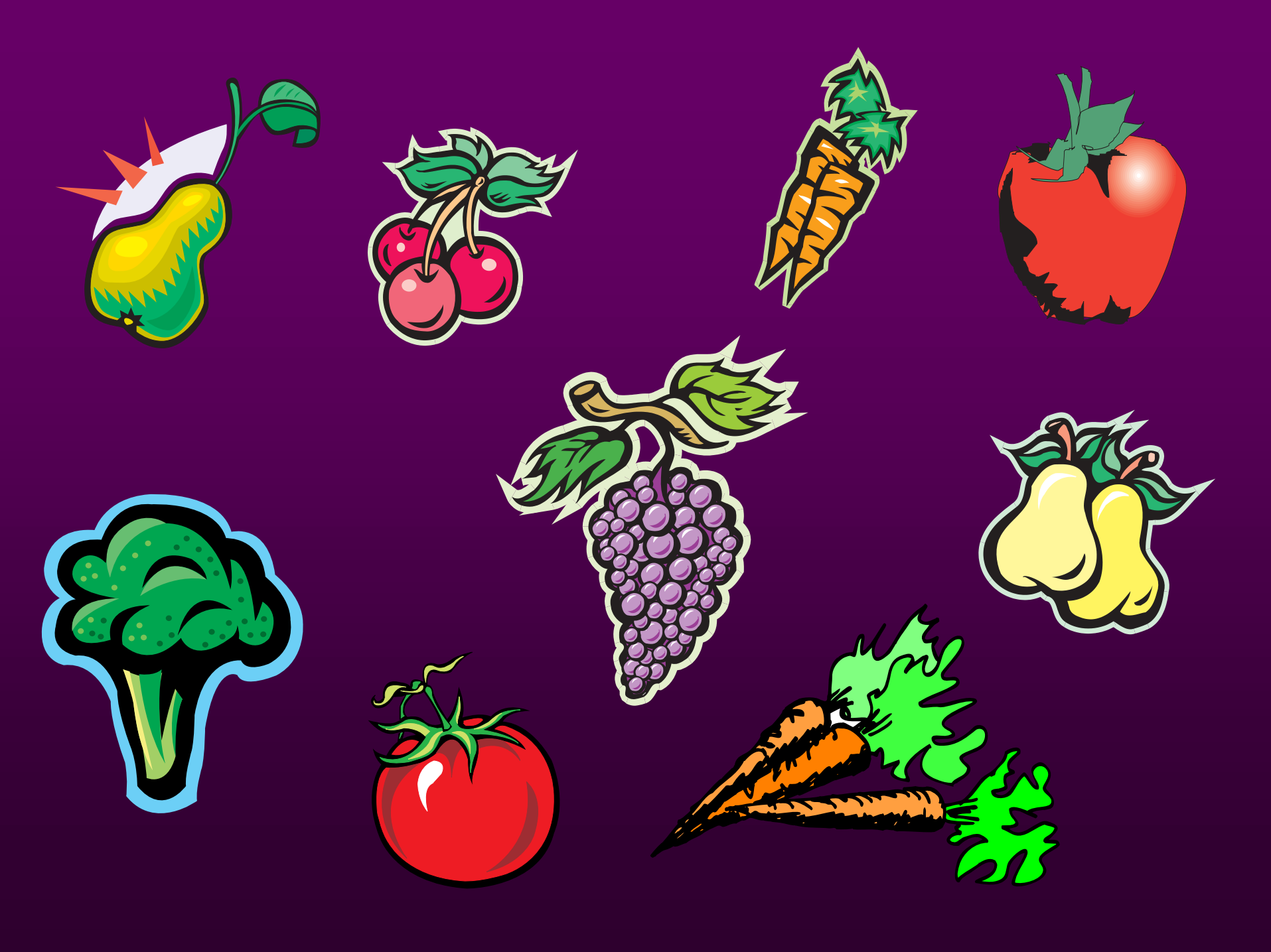
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