Learning Not to Waste
The Power of Attentiveness & Avoiding Mixed Messages

Brian E. Roe, Van Buren Professor

Session: Public Awareness & Public Programs
Promoting Food Waste Reduction Initiatives

Des Moines
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Introduction

• **One-third of all edible food is wasted [1]**
  - In developed countries, ~ 40% of waste occurs at the retail and consumer level
  - Food waste at the consumer level in industrialized countries (222 million ton) is almost as high as the total net food production in sub-Saharan Africa

• **Awareness is moderate, and perhaps increasing**
  - “In the last 12 months, have you read, seen or heard anything about the amount of food that is wasted or about ways to reduce the amount of food that is wasted?”
    - July 2015 sample of U.S. Consumers – 53% said ‘yes’ [2]
    - “In the past year, have you seen or heard anything in the news, social media, or elsewhere about the issue of food that is thrown out or otherwise not eaten by humans? (Sometimes referred to as ‘wasted food’).”
    - April 2014 sample of U.S. Consumers - 42% said ‘yes’ [3]
Scope for Awareness & Promotion Programs?

Can we reduce food waste through awareness formation and messaging?

- Awareness is above 50% but far from universal
- What information levers can be altered?
- What is the evidence such programs prompt behavioral change?

Review Several Types of Studies

- Messages encouraging food waste reduction in all you care to eat food service settings
- Elimination of date labels on milk packages
- Self monitoring of food intake patterns

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Direct Appeals to Consumers

- 6 weeks collection during spring 2011 of solid food waste during lunch + dinner at a single all you care to eat facility (trays used)
  - Ave lunch patrons: 412
  - Ave dinner patrons: 381
  - 19,046 meals served during study
- 296 students had waste tracked for the entire study
  - Baseline collection: 2 weeks
  - Message #1: next 2 weeks
  - Message #2: following 2 weeks

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On average each resident wastes 2.25 oz. of food each meal. This amounts to more than 22 pounds per person per semester.

This complex disposes of more than 45 pounds of edible food each meal on trays. That is enough food to prepare more than 30 meals.
Kansas State - Messages to Reduce Waste

- 6 weeks collection during spring 2011 of food waste during lunch and dinner at a single all you care to eat facility that uses trays
  - Ave lunch patrons: 412
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- 296 students allowed waste to be tracked across the entire study
  - Baseline collection: 2 weeks
  - Message #1: next 2 weeks
  - Message #2: following 2 weeks

<table>
<thead>
<tr>
<th>Study Period</th>
<th>Edible Plate Waste (lbs)</th>
<th>% Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>0.138</td>
<td>--</td>
</tr>
<tr>
<td>Message #1</td>
<td>0.117</td>
<td>15.4*</td>
</tr>
<tr>
<td>Message #2</td>
<td>0.120</td>
<td>13.6*</td>
</tr>
</tbody>
</table>

*statistically significant reduction from baseline

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KSU Messages

- 1\textsuperscript{st} message decreased waste significantly
- 2\textsuperscript{nd} more detailed message had no additional effect
- No way to know if the pattern of waste reduction due to
  - The quality or content of the messages
  - Anyone open to change responded to the 1\textsuperscript{st} message
  - Merely a seasonal effect as there was no ‘control’ location

---

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Figure 1. The prompt-type message intervention poster used to encourage food waste behavior change in a university dining facility.

Figure 2. The feedback-based message intervention poster used to encourage food waste behavior change in a university dining facility.
U. Illinois Study [5]

Fall 2016 study 2 facilities

- Both all-you-care-to-eat, station-based locations (grill, pizza, pasta, deli, others)
- 1.5 miles apart - furthest apart of their 6 facilities
- One received the messages
- One served as the control location

Intervention implemented mid-semester via signs and napkin holder messages

<table>
<thead>
<tr>
<th></th>
<th>Treatment</th>
<th>Control</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lbs/student/meal</td>
<td>0.195</td>
<td>0.157</td>
<td></td>
</tr>
<tr>
<td>Lunches/wk</td>
<td>14,875</td>
<td>4,060</td>
<td></td>
</tr>
<tr>
<td>wk/acad yr</td>
<td>32</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>lbs/acad yr</td>
<td>92,820</td>
<td>20,397</td>
<td></td>
</tr>
<tr>
<td>Tons/acad yr</td>
<td>&gt;46</td>
<td>&gt;10</td>
<td></td>
</tr>
</tbody>
</table>

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U. Ill. Intervention Signs

1. In the United States, 40% of all food goes uneaten. That's more than 20 pounds per person each month.

2. U.S. food production uses:
   - 10% of our total energy budget
   - 50% of our land
   - 80% of our freshwater

3. When food is wasted, so are these resources.

4. Uneaten food represents a loss of $165 billion each year.

5. 40% of food in the U.S. goes uneaten. Yet, despite the amount of food wasted, 1 in 7 Americans are food insecure.
Food waste is a global problem.

Dining works hard to reduce waste.
You can too.

**How Dining Reduces Waste**

90% of dining waste is diverted from landfills through reducing, recycling, & repurposing.

Overproduction waste is donated to those in need in the community through the ZERO PERCENT program.

Post-consumer waste is broken down into AEROBIC DIGESTERS, which converts food waste to gray water.

100% of coffee grounds recycled are used by local farmers and gardeners.

100% of Dining oil is recycled.

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U. Illinois Study - Results

No statistically significant reduction in waste produced:

<table>
<thead>
<tr>
<th>Treatment*</th>
<th>Control*</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.195</td>
<td>0.157</td>
<td>Pre Education (baseline)</td>
</tr>
<tr>
<td>0.187</td>
<td>0.153</td>
<td>Post Education</td>
</tr>
</tbody>
</table>

*Lbs/student/meal

Why no significant improvement? At least 2 possible explanations:
- Messages emphasizing Dining’s efforts to reduce impact of food waste (e.g., donations and digester) let students ‘off the hook’ with respect to their own effort and actions
- More time and broader education effort directed at students required

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Ohio State Lab Meal Study [6]

- Recruited local residents and student to complete a face-to-face survey
  - 40% of participants were OSU students
- A free meal offered as compensation for participation
  - Sub sandwich segments, apple slices, chips, drinks
- Food selection and plate waste measured surreptitiously
- Between-subjects design
  - Participants in different sessions received different information provided before food selection and consumption

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Research Method-Experiment Design

1. Receive Welcome Sheet
2. Receive Information Card
3. Return Information Card and Answer Quiz about the Information Card
4. Order Food
5. Eat Food
6. Return Uneaten Food to Staff
7. Answer Demographic and Food Waste Attitudinal Questions
8. Receive Debrief Form and Exit

- Intervention 1 - Food Waste Destination: Landfill / Compost
- Intervention 2 - Information Card: Food Waste / Financial Literacy
- Food Order Data is Collected
- Food Waste Data is Collected
Research Method-Experiment Design

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Food Order Data is Collected

Food Waste Data is Collected

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Food Waste Data is Collected

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Research Method-Experiment Design

Receive Welcome Sheet

Receive Information Card

Return Information Card and Answer Quiz about the Information Card

Order Food

Eat Food

Return Uneaten Food to Staff

Answer Demographic and Food Waste Attitudinal Questions

Receive Debrief Form and Exit

Intervention 1 - Food Waste Destination: Landfill / Compost

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Food Order Data is Collected

Food Waste Data is Collected

Qi & Roe, February 3, 2017

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# Experiment Design

## Where Uneaten Food Goes

<table>
<thead>
<tr>
<th>Where Uneaten Food Goes</th>
<th>Information Card Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landfill</td>
<td>Food Waste Impacts: N=57, 4 sessions</td>
</tr>
<tr>
<td>Compost</td>
<td>Food Waste Impacts: N=85, 4 sessions</td>
</tr>
</tbody>
</table>

## 2x2 Experimental Design

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Policy Implication

Grams of Solid Food Discarded

<table>
<thead>
<tr>
<th>No FW Info, No Compost</th>
<th>Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td>40.8</td>
<td></td>
</tr>
</tbody>
</table>

Qi & Roe, February 3, 2017

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Policy Implication

Grams of Solid Food Discarded

Added Policy
Promote Reduction of Food Waste to Consumers

Result
Large, significant decrease in wasted food

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*p=0.000***
Policy Implication

Added 2 Policies
1. Promote Reduction of Food Waste to Consumers
2. Tell consumers about your composting efforts

Result
1. Some improvement over baseline
2. Backsliding compared to only encouraging reduction

Grams of Solid Waste Discarded

<table>
<thead>
<tr>
<th>Condition</th>
<th>Waste Discarded</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No FW Info, No Compost</td>
<td>40.8</td>
<td></td>
</tr>
<tr>
<td>FW Info, No Compost</td>
<td>9.2</td>
<td>**0.011</td>
</tr>
<tr>
<td>FW Info, Compost</td>
<td>29.3</td>
<td></td>
</tr>
</tbody>
</table>

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Our Thoughts in Food Service Settings

Avoid mixed messages to maximize reduction of food waste:

• Emphasize potential consumer actions
• Silence about food service ongoing efforts
Date Labels
What Do Date Labels Teach Consumers?

Broad-Lieb et al./NRDC [7] discussion of date labels
- “…poorly understood and surprisingly under-regulated… their meanings and timeframes are generally not defined in law…”
- “…dearth of rigorous policy analyses of how these labels affect consumers’ choices surrounding purchasing and discarding food products…”
- “…if milk is “handled properly,” it will still be safe to consume even after the expiration date passes…”

ReFED [8] rates standardizing food date labels as being one of the most promising avenues for reducing food waste.
Ohio State Milk Date Labeling Study [9]

88 regular milk drinkers smelled 2 ‘flights’ of ½ gal. containers

- Each flight featured 4 containers with whole milk
- One container each: 15, 25, 30 and 40 days post bottling
- All containers had been continuously stored at 4⁰ C
- All containers opened 2 days prior & had 1/3 of milk removed
- One flight had a ‘sell-by’ date printed on each label that was 18 days post bottling
  - 3 days prior, 7 days past, 12 days past and 22 days past date
- The other flight had no date label
- Order of flights and order of presentation within flights randomized
- Asked if they would keep/discard milk if it was in their own fridge
- Smelled inside of forearm between samples to re-orient smell
Intention to Discard Milk After Examining Bottle & Sniffing

Sell by Date
18 days

% Intended Discard

With Date Label
- 15 days
- 25 days
- 30 days
- 40 days
**Intention to Discard Milk After Examining Bottle & Sniffing**

Sell by Date 18 days

<table>
<thead>
<tr>
<th>Intended Discard Date Label:</th>
<th>48.9%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Date Label:</td>
<td>38.1%</td>
</tr>
<tr>
<td>Ratio:</td>
<td>1.28</td>
</tr>
</tbody>
</table>

% Intended Discard

- **With Date Label**
  - 15 days
  - 25 days
  - 30 days
  - 40 days

- **No Date Label**
  - 15 days
  - 25 days
  - 30 days
  - 40 days
Intention to Discard Milk After Examining Bottle & Sniffing

Intended Discard

Post-date samples
With Date: 64.0%
No Date: 45.8%
Ratio: 1.40

In-date samples
With Date: 33.0%
No Date: 52.3%
Ratio: 0.63

% Intended Discard

Sell by Date 18 days

With Date Label
No Date Label

15 days  25 days  30 days  40 days
Remove Date Labels from Milk?

- Intriguing potential, but problematic
  - Yes, could reduce discards of post-date milk
  - But, could also increase discards of in-date milk
- Consumer likely still wants label guidance
  - Need to help consumers trust their senses for items that lack food safety concerns
  - Currently we are testing ‘smart’ labels that display accumulated temperature abuse
Self-monitoring & Plate Waste
Pennington Biomedical Food Intake Monitoring Study [10]

50 adults used the SmartInake® app to track food intake

- All caloric intake over 6 days in every day life (free-living conditions)
- The Remote Food Photography Method (RFPM) estimated quantities, calories, macronutrients and micronutrients of
  - Food selection
  - Plate waste
  - Food intake (Food selection – plate waste)
- Validated that energy (calorie) intake as measured by RFPM was within 3.7% of actual intake [10]
  - RFPM doesn’t rely upon participants to estimate portion size
  - Error doesn’t vary with weight or BMI
  - SmartIntake/RFPM did not induce undereating by participants
Our Method: Remote Food Photography Method (RFPM)

The Remote Food Photography Method (RFPM) ® uses ecological momentary assessment (EMA) methods to improve data quality & minimize missing data. The Food Photography Application stores & manages images sent from participants.
Remote Food Photography Method (RFPM)

Screen shots of the RFPM being used as part of the SmartIntake smart phone app to capture pre-meal (bottom left) and post-meal (bottom right) images.
Remote Food Photography Method (RFPM)

Screen shots of the RFPM being used to capture pre-meal (bottom left) and post-meal (bottom right) images.

Plate Waste
Plate Waste Fraction by # of Days in Field Trial
Implications

No instructions focused on food waste

• Yet plate waste declined with app use
• Even indirect efforts that make waste salient to consumers may induce reduction behavior
  • Will this translate to other household food waste sources?
• Currently working with Pennington to develop a more comprehensive app that also measures
  • Prep waste and purges of stored food
  • Amount, nutrient content and destination of waste
  • Food acquisition source and cost
Take Home Messages

Consumers can potentially learn to waste less

- Avoid mixed messages and focus on consumer action to reduce waste
- Reforming date labels for milk will require additional innovation and educational effort but could help consumers discard less milk
- Apps or other interventions that increase attention to food handling and intake decisions may help draw attention to plate waste and lead to reductions
Pennington Biomedical Research Center
Corby K. Martin, John W. Apolzan,
H. Raymond Allen

Ohio State University
Danyi Qi, Dennis Heldman
David Phinney, Chris Simons

References
Questions?

Remote Food Photography Method (RFPM)