

Impact of behavioral design strategies on patrons' food choices in a US Army hospital cafeteria

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*(Study completed as a post-doctoral fellow for
Division of Nutrition, Physical Activity, and Obesity, CDC)*



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National Center for Chronic Disease Prevention and Health Promotion
Division of Nutrition, Physical Activity, and Obesity



Background

- > 60% of active-duty military overweight or obese
- ¼ of new applicants medically disqualified due to excessive weight
- Obesity prevalence considered a security threat to readiness
- \$3.3 billion per year spent in attributable health care costs among active duty personnel and military families

Background

- Go for Green[®] (G4G) is a joint-service performance-nutrition initiative that improves the food environment where Military Service Members live and work.
- G4G uses behavioral design (e.g., color-coding, choice architecture, branding) and menu reformulation to improve food choices.
- <https://www.hprc-online.org/nutrition/go-green>

Background

- What is behavioral design?
- Dual process theory and behavioral economics (e.g., Type 1/hot/fast/impulsive vs. Type 2/cold/slow/deliberate)
- The utilization of behavioral design is similar to food marketing environments, which use 4P's (price, promotion, placement, product) to capitalize on individuals making Type 1 decisions

Background

- Can public health practitioners use similar approaches to create environments in which individuals make *healthier* choices?
- Behavioral design or ‘nudges’ target automatic, heuristic decision-making by altering environmental cues, to *improve food choice* while maintaining the *freedom to choose* (i.e., without restricting choice).

Background

Aim

- We determined the effect of implementing G4G's behavioral design strategies on food purchases in a dining facility (DFAC).
- No changes to recipes were made.

Study Overview

- Quasi-experimental design - one group, repeated measures
- Collected Point-of-Sales (POS) data for 45 weeks

Stage 1	Stage 2	Stage 3	Stage 4
Formative research and development of intervention strategies	Baseline data collection	Intervention implementation	Post-intervention data collection and feasibility study
October 2016 – April 2017	April – August 2017	August – December 2017	January – March 2018
<ul style="list-style-type: none"> • Intervention development meetings with DFAC dietitians • BD strategy selection • Menu board, color-coded labels, and signage development • Implementation Manual of Procedures (MOP) development 	<ul style="list-style-type: none"> • Re-coding of 200+ foods • Food service staff training • Environmental scans (n=3) • Point-of-sale data collection (18 weeks) 	<ul style="list-style-type: none"> • Implementation of 11 behavioral design strategies with correction and reinforcement by cafeteria management • Environmental scans (n=6) • Point-of-sale data collection (18 weeks) 	<ul style="list-style-type: none"> • Intervention strategies no longer reinforced or corrected by cafeteria management • In-depth interviews with food service managers and staff • Environmental scans (n=2) • Point-of-sale data collection (9 weeks)

Setting



- Eisenhower Army Medical Center (EAMC), Ft. Gordon, GA
- 99 bed hospital with 3000-5000 employees

Setting



- 60 DFAC staff
- Average 32.4K in sales per month
- Civilians & active military

Intervention Overview

- 10 no- or low-cost environmental changes
- Developed by CDC & DFAC dietitians
- Implemented by DFAC staff for 18 weeks
- Evaluated by CDC

BD Strategies

1. Menu Board Redesign
2. Featured 'Performance' Plate of the Day
3. Salad Bar Redesign
4. Hot Station Redesign
5. Short Order Bar Redesign
6. Multiple Fruit Displays
7. Chip Display
8. Healthier Drink Fountains
9. Refrigerated Vending Placement
10. Communications Messaging

Color Coding of Foods

GREEN, YELLOW, & RED FOOD CODES			
PROCESSING	LEAST-PROCESSED	SOME PROCESSING	MOST-PROCESSED FOODS
NUTRIENTS	WHOLE FOODS, NUTRIENT PACKED	SOME HEALTHFUL NUTRIENTS	LOWEST-QUALITY INGREDIENTS
FIBER	HIGH IN FIBER	LOWER IN FIBER	MINIMAL FIBER
SUGAR	LOW IN ADDED SUGAR	ADDED SUGAR OR ARTIFICIAL SWEETNERS	ADDED SUGAR OR ARTIFICIAL SWEETNERS
FAT	HEALTHY FATS	POOR-QUALITY FATS	EXCESS FATS AND/OR TRANS FAT FRIED FOODS

Brown Rice

✓

Choose Frequently

White Rice

Choose Occasionally

New England Clam Chowder

Choose Sparingly

Attempt #1:

- Recode 200+ recipes using G4G algorithm

Attempt #2:

- 4 Dietitians
- Consensus on appropriate code for each item

Menu Board Redesign

LUNCH

Fried Chicken - \$3.60
Savory Baked Chicken – \$2.30
Baked Salmon- \$3.45

Sides - \$0.65 each
Steamed Rice
Herbed Potatoes
Baked Beans
Mixed Vegetables
Sautéed Cabbage
Sautéed Cabbage w/Bacon

Chicken and Gumbo - \$2.00

Cornbread – \$0.40
Assorted Desserts - \$1.40
Cookies - \$1.55

Ike's Café Lunch Menu

Entrées

- Baked Salmon – 3.45
salmon filet baked to perfection in herb sauce
- Fried Chicken – 3.60
- Savory Baked Chicken – 2.30

Soups

- Chicken Gumbo – 2.00

Salad Bar

Assortment of field greens, fresh vegetables, and proteins with your choice of dressing – 0.40/lb



Sides

- Sautéed Cabbage
- Mixed Vegetables
- Baked Beans
- Steamed Rice
- Potatoes and Herbs
- Sautéed Cabbage w/ Bacon

-- 0.65 each --

- Cornbread - 0.40

Desserts

- Pies or Cakes – 1.40
- Pudding Cups – 0.38
- Fruit Cups – 0.75
- Fresh Fruit – 0.45



Performance Plate

Plate of the day sign



TRY TODAY'S "FIT N' FRESH" LUNCH SPECIAL

Lean protein + fiber-rich starch + vegetable + fruit

Baked Salmon Filet

Served with tender oven roasted potatoes, sautéed cabbage, and your choice of fresh fruit

Only 5.40



TRY TODAY'S "FIT N' FRESH" LUNCH SPECIAL

Lean protein + whole grain/starch + 2 vegetables

Grilled Chicken Breast

Served with brown rice, steamed broccoli, and stir-fried vegetables

Only 3.80



Salad Bar Redesign

Green ----- > Yellow ----- > Red



Salad Bar Sign

Salad Bar Items

Choose Frequently

Mixed Salad Greens
Cucumbers
Tomatoes
Bell Peppers
Carrots
Celery
Radishes

Red Onion
Broccoli
Peas
Snow Peas
Kidney Beans
Garbanzo Beans
Mushrooms
Raisins



Choose Occasionally

Chopped Eggs
Tuna
Green Olives
Black Olives
Jalapenos
Sunflower Seeds
Croutons

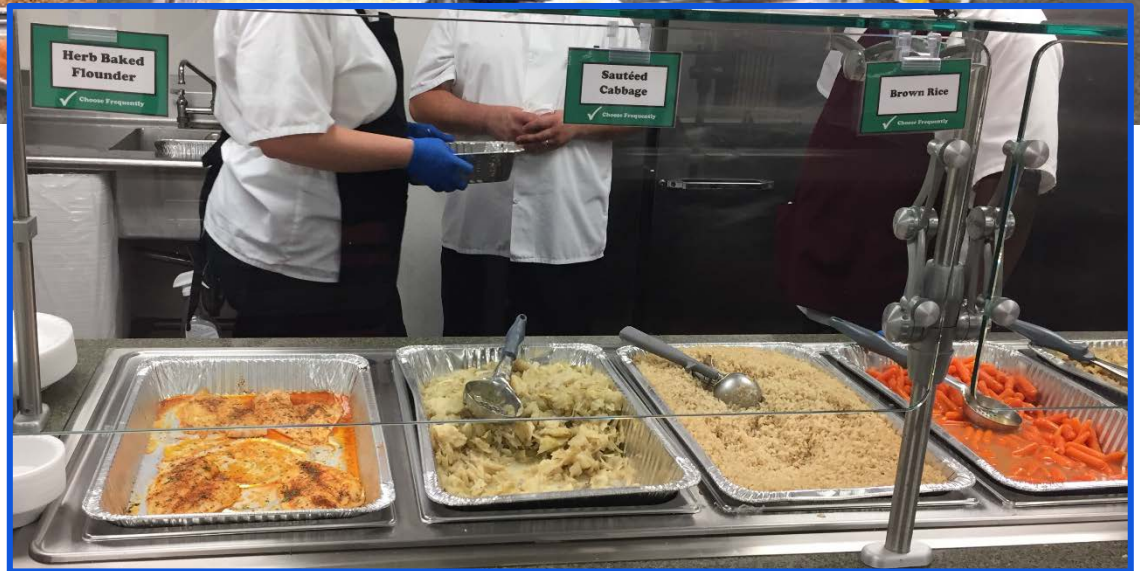
Choose Sparingly

Cheddar Cheese
Bacon Bits
Chow Mein Noodles
Macaroni Salad
Pasta Salad
Potato Salad
Coleslaw

Hot Food Line



White Rice Choose Occasionally	Brown Rice ✓ Choose Frequently
New England Clam Chowder Choose Sparingly	Sautéed Asparagus ✓ Choose Frequently



Background & Aims

Study Overview & Intervention

Measures

Findings

Discussion

Communications Messaging

EAT OUTSIDE THE BOX

EAT WELL · PERFORM WELL

Go for Green® makes it easy for you to identify and choose foods that enhance your performance.

GO FOR GREEN

Green: High-performance fuel
Yellow: Moderate-performance fuel
Red: Low-performance fuel

VEGETABLES ARE NOT THE ENEMY

EAT WELL · PERFORM WELL

Go for Green® makes it easy for you to identify and choose foods that enhance your performance.

GO FOR GREEN

Green: High-performance fuel
Yellow: Moderate-performance fuel
Red: Low-performance fuel

BUILD A BETTER SALAD

EAT WELL · PERFORM WELL

Go for Green® makes it easy for you to identify and choose foods that enhance your performance.

GO FOR GREEN

Green: High-performance fuel
Yellow: Moderate-performance fuel
Red: Low-performance fuel

Vending Redesign & Fruit Baskets



Beverages

Choose Frequently

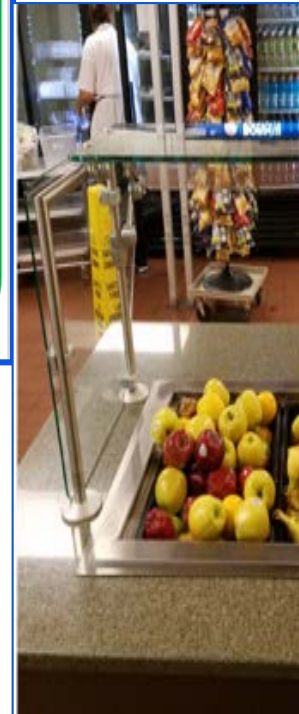
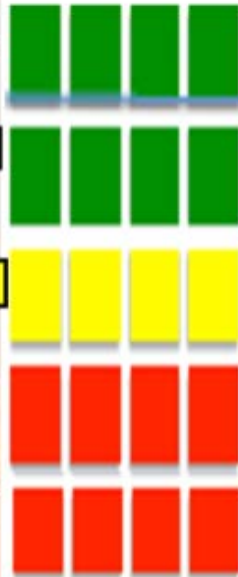
Water (Fountain)	0.10
Fruit-infused sparkling water	0.65
Bottled water	1.00
Hot tea	0.15
Coffee	1.00 1.40

Choose Occasionally

Ice	0.85
Storage	1.00
Bottled diet drinks	1.00
Crystal Light (packet)	0.20

Choose Sparingly

Mountain Soda	0.65
Bottled soda (regular)	1.00



Measures

Point of Sales Reports from MICROS

Apr 17, 2017
to Feb 23, 2018

Consolidated SYS Menu Item Sales Summary

Subtotal By Family Group

Fort Gordon - Augusta, GA

Holmes, H

Period From : 05/01/2017 To : 05/06/2017

Printed on 6/5/2017 - 1:45 PM

	Sales Qty	% of Ttl	Net Sales	% of Ttl
105001 Pork, Chop Grill	36	26.67%	48.60	19.80%
105005 Pork, Rosemary RstL	16	11.85%	19.20	7.82%
105008 Ham, Honey Glazd	83	61.48%	177.62	72.37%
Total Pork	135	0.45%	245.42	1.21%
106003 Baked Salmon	156	29.66%	404.04	29.85%
106004 Baked Tilapia	3	0.57%	3.51	0.26%
106005 Baked Tilapia Parm	21	3.99%	34.65	2.56%
106007 Herb Baked Flounder	35	6.65%	82.95	6.13%
106008 Shrimp Cajun Creol	41	7.79%	101.68	7.51%
106011 Herb Flounder	59	11.22%	139.83	10.33%
106012 Lemon Flounder	23	4.37%	49.22	3.64%
106016 Fried Flounder	188	35.74%	537.68	39.72%
Total Seafood	526	1.77%	1,353.56	6.69%
107001 Lasagna	213	41.36%	472.86	52.48%
107002 Veggie Lasagna	65	12.62%	85.80	9.52%
107003 Spaghetti Meat Sc	188	36.50%	297.04	32.96%
107004 Spagh w/Mar SC	48	9.32%	43.20	4.79%
107005 Veggie Spagh	1	0.19%	2.18	0.24%
Total Pasta	515	1.73%	901.08	4.45%
109001 Hamburger	87	11.24%	189.66	15.21%
109002 Cheeseburger	132	17.05%	327.36	26.26%
109003 Veggie Burger	29	3.75%	63.22	5.07%
109007 Chicken Sandwich	127	16.41%	205.74	16.50%
109008 Hot Dog	106	13.70%	103.88	8.33%
109009 Chicken Dog	159	20.54%	155.82	12.50%
109010 Chili Cheese Dog	19	2.45%	30.02	2.41%

Data Analysis

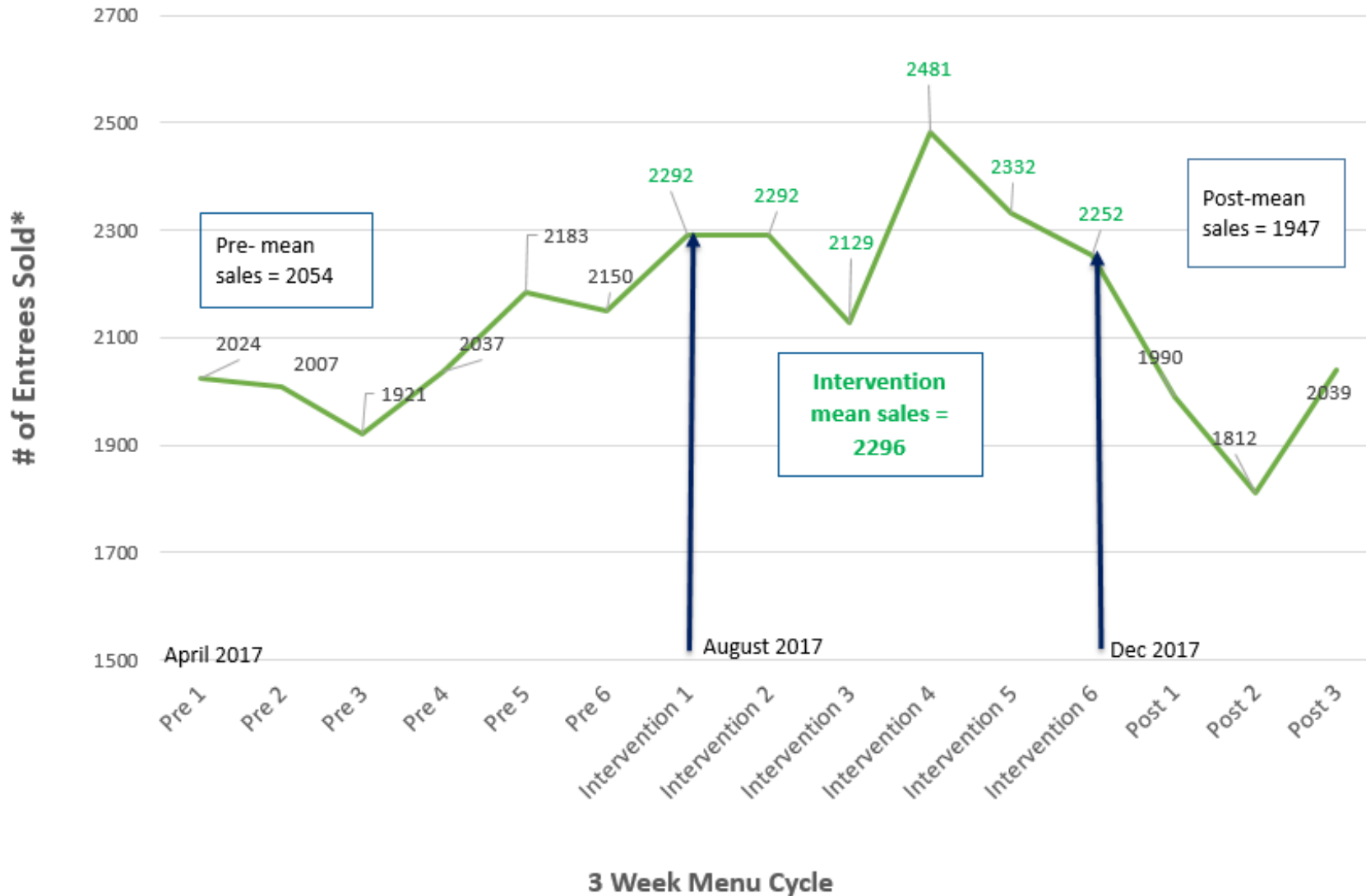
Volume sales trends of coded foods

Hot Entrees	Green, Yellow, Red
Hot Vegetables	Green
Hot starches	Green, Yellow, Red
Whole Fruit, Fruit Cups	Green
Pies, Cakes, Brownies	Red
To-go Salads	Green
French Fries	Red

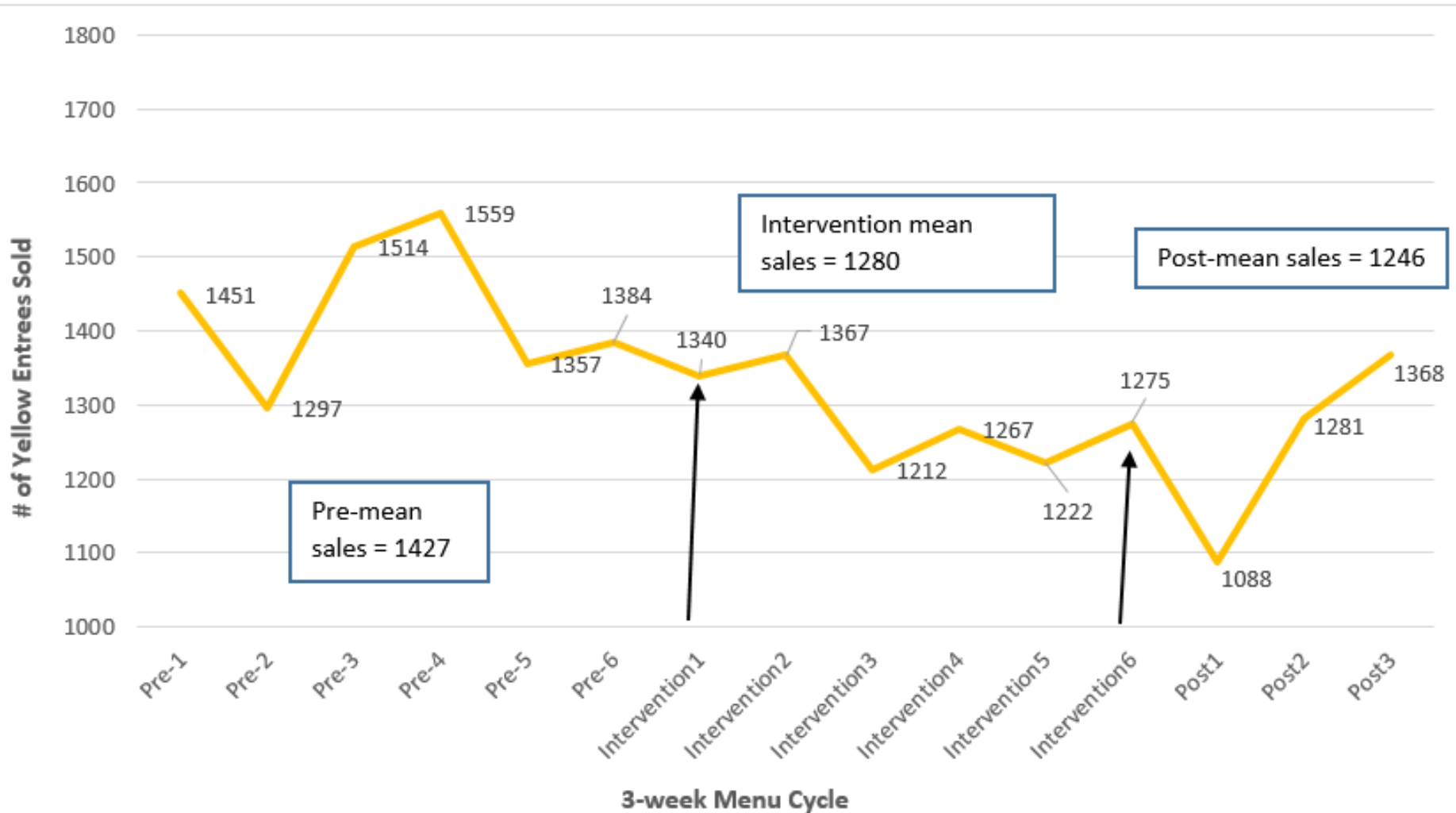
*Standardized by total sales volume to control for differences in overall sales over the study period

Sales trends of 15 time-points (1 time-point = 1 menu cycle/3-weeks)

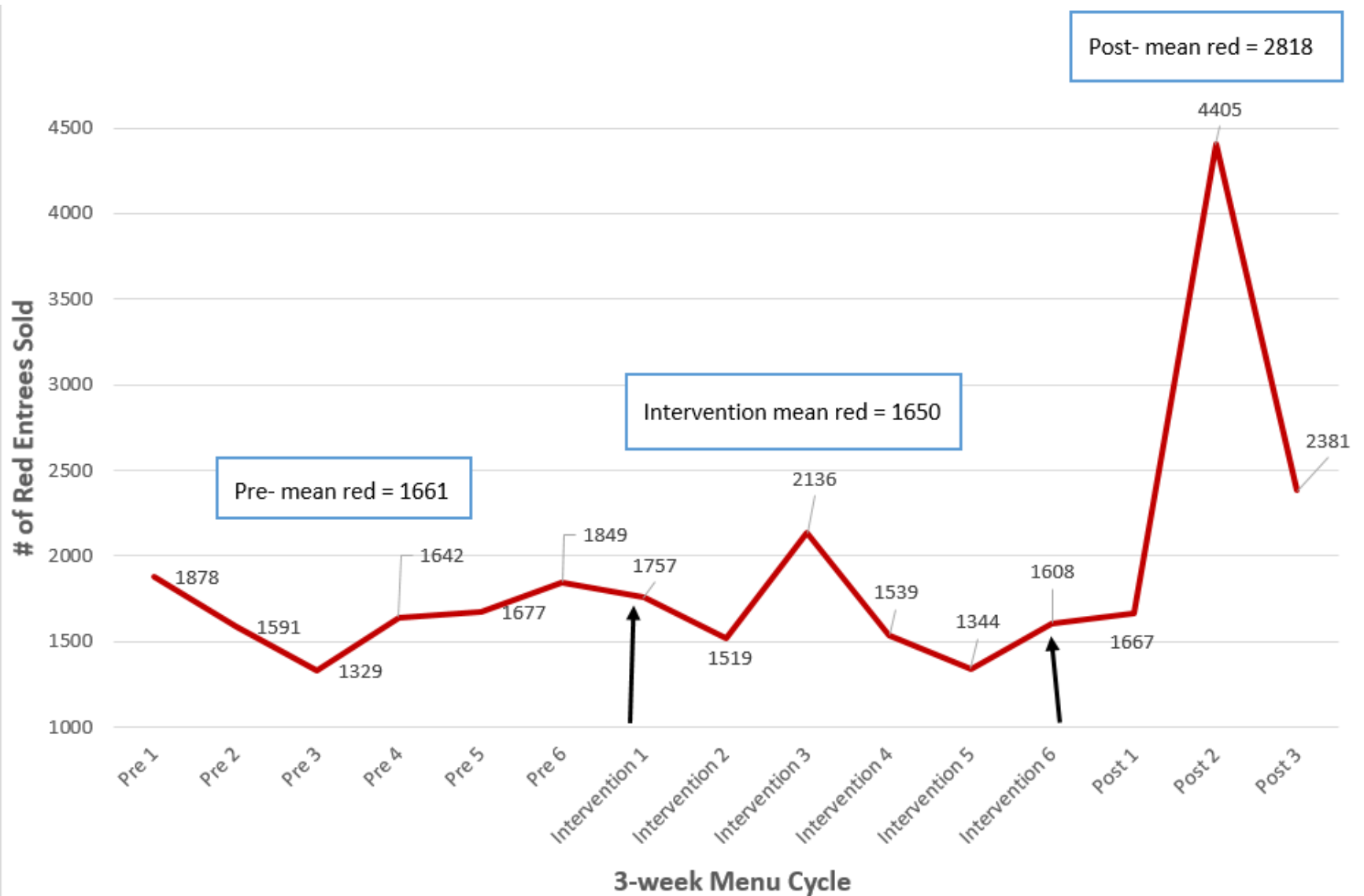
Green Entrée Sales



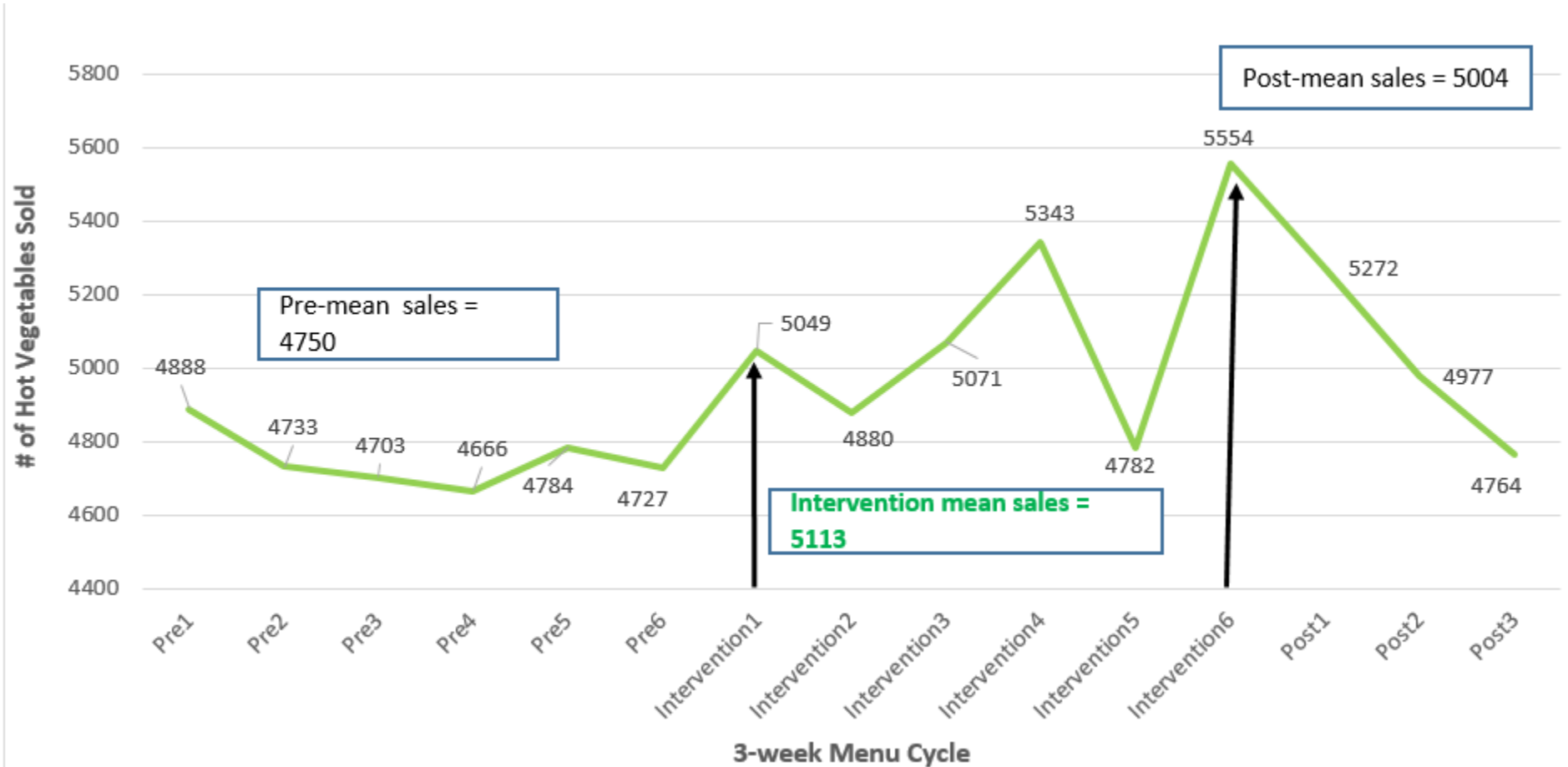
Yellow Entrée Sales



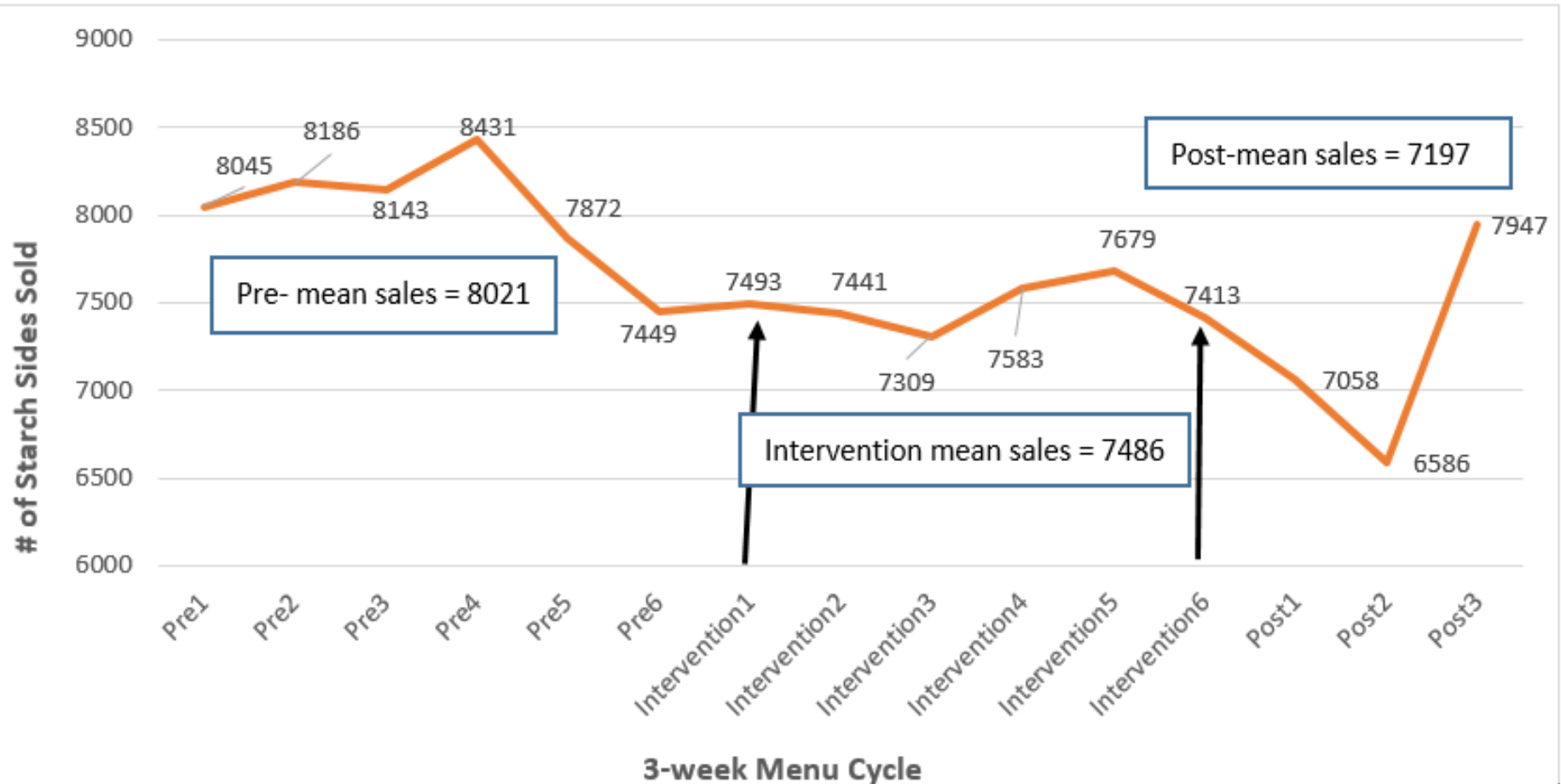
Red Entrée Sales



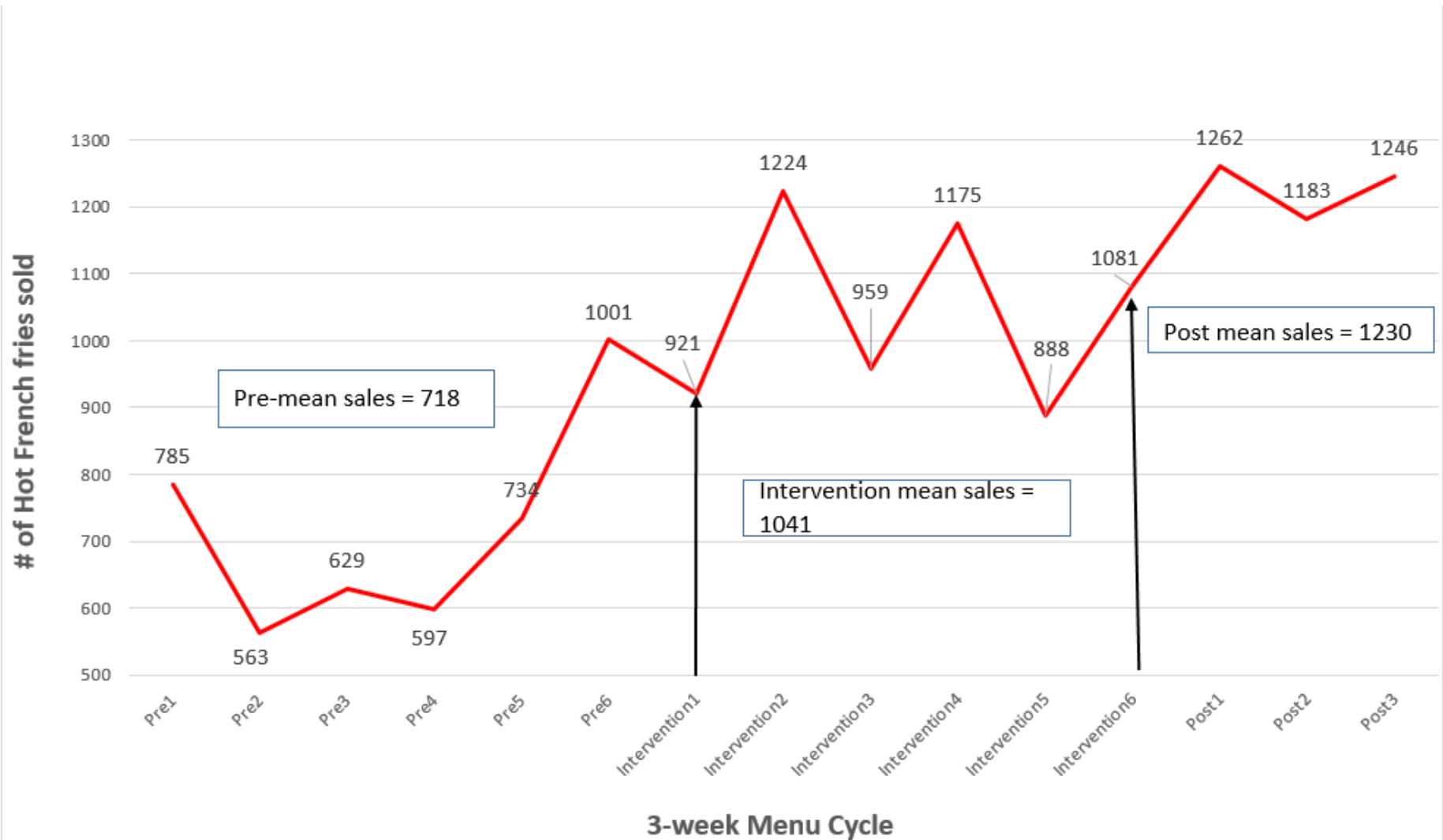
Hot Vegetable Sales



Hot Starch Sales



French Fry Sales



Background & Aims

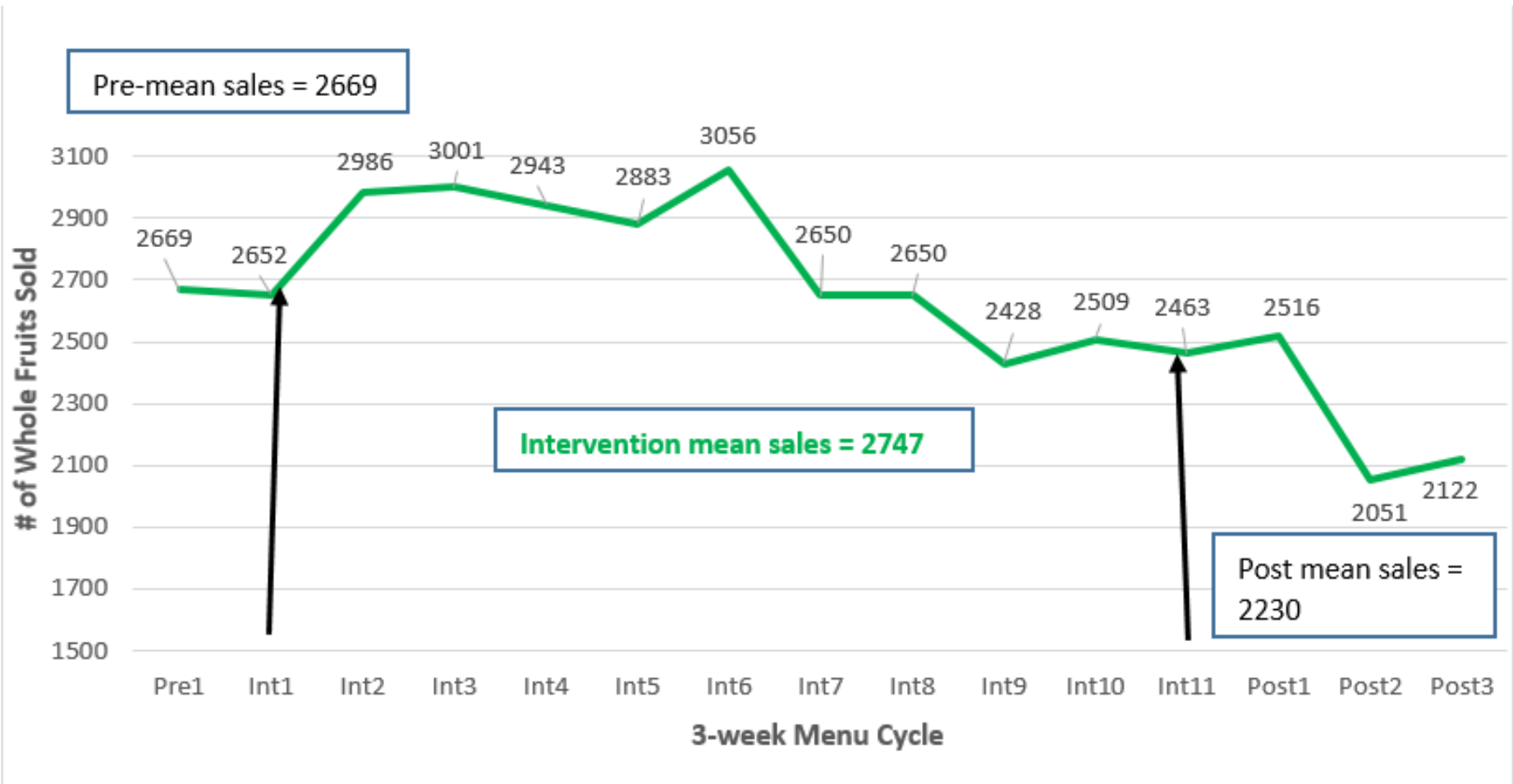
Study Overview & Intervention

Measures

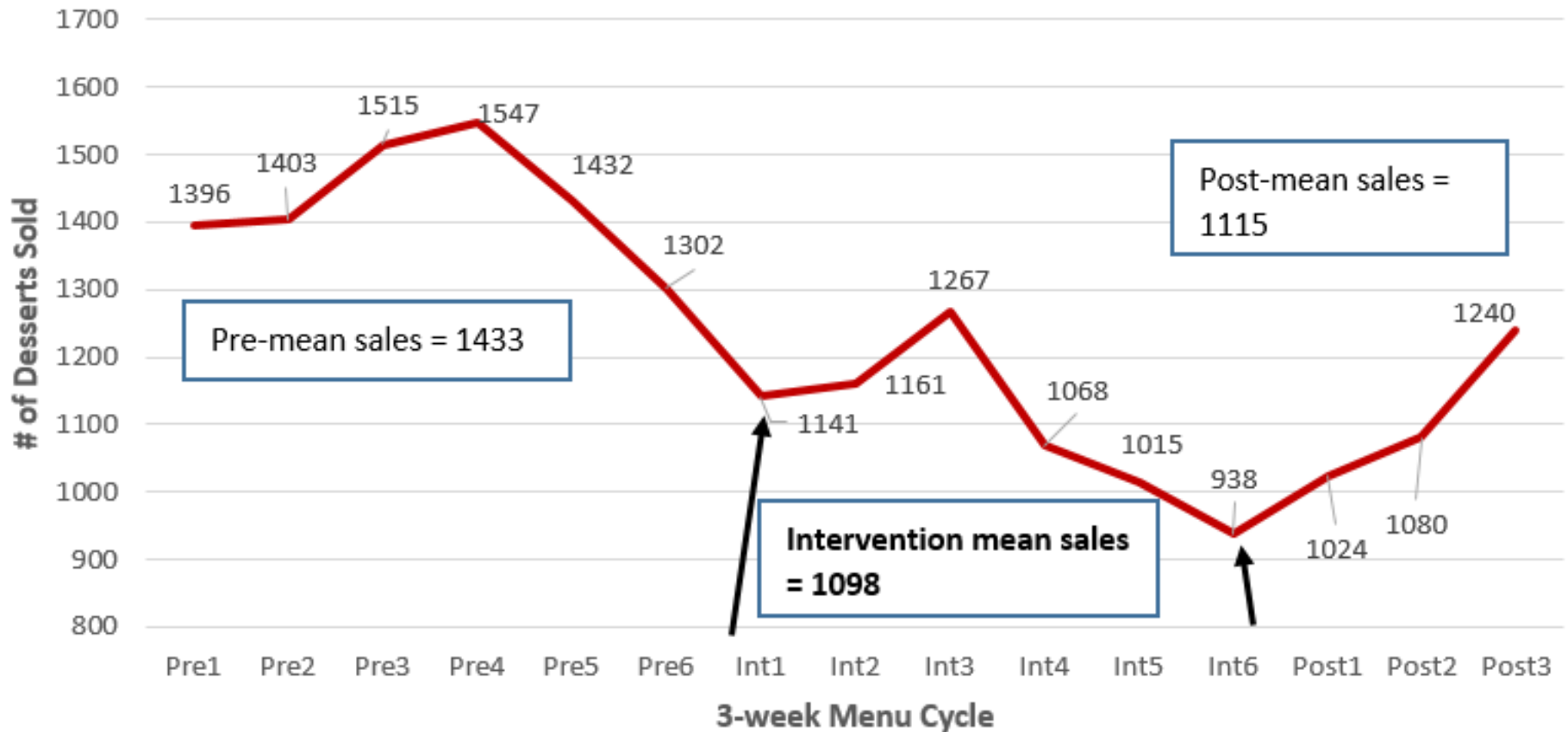
Findings

Discussion

Whole Fruit Sales



Cakes, Cookies, and Pie Sales



Data Analyses

Adjusted models

- 1) **T-test comparison:** Compared mean weekly sales of each food outcome (adjusted for total weekly sales of all foods) between the pre-intervention period and the intervention period.
- 2) **Log-linear regression model:** Adjusted for total weekly sales volume, menu cycle week, season of the year, time trend, and special holiday meals

$\ln(\text{Weekly Green Entree Sales})$

$$= \beta_0 + \beta_1 \text{Intervention} + \beta_2 \text{PostIntervention} + \beta_3 t + \beta_3 \text{MenuCycle2} + \beta_4 \text{MenuCycle3} + \beta_5 \text{AprilToOctober} + \beta_6 \text{SpecialMeal} + \beta_7 \ln(\text{TotalSales})$$

Table 1. Mean adjusted weekly unit sales (#) of selected foods during baseline, and intervention, and multivariable adjusted percent (%) change from baseline to intervention period

Food Item	Baseline Mean Unit Sales per Week*	Intervention Mean Unit Sales per Week*	Unadjusted p-value ^a	Intervention % change ± SE**	Adjusted p-value**
	Mean ± SD	Mean ± SD			
Green-coded Entree	684.0 ± 196.7	764.3±190.5	0.2	6.3±6.9	0.366
Yellow-coded Entree	473.8 ± 292.8	429.8±293.9	0.7	-10.1±15.0	0.508
Red-coded Entree	551.7 ± 132.5	548.1±183.9	0.9	-4.0±18.3	0.828
Desserts	487.8 ± 42.9	367.0±50.4	<0.001	-20.2±8.4	0.022
Whole Fruit	853.1±88.3	920.7±93.9	0.18	18.1±8.0	0.031
French Fries	239.3±63.6	344.8±72.0	<0.001	22.7±14.1	0.117
Hot Vegetables	1586.0±77.7	1702.8±142.3	0.005	7.4±3.6	0.046
Hot Starches	2668.7±181.8	2497.6±188.6	0.009	-5.0±5.0	0.326
Hamburgers/Hotdogs	302.0±23.4	368.8±53.1	<0.001	4.5±7.6	0.555
Veggie/Turkey Burgers	25.4±6.4	36.7±6.7	<0.001	15.8±12.5	0.244
Background & Grilled Chicken	Study Overview & Intervention	Measures	Findings	Discussion	
	267.3±29.2	310.9±65.6	0.02	10.1±9.0	0.272

Summary of Results



- BD strategies (e.g., placing hot vegetables at grill station) was effective to increase sales of vegetables
- BD strategies (e.g., prominent placement of fruit, less prominent placement of desserts) were effective to reduce sales of cookies, cakes, and pies, and increase sales of fresh fruit.
- Green-, yellow-, and red-entree sales did not significantly change.



Intervention

- Food waste (e.g., unanticipated changes to decrease food waste)
- Not enough leadership buy-in to sustain at follow-up

Data Collection

- Point-of-sale system
- Burdensome for dietitians
- Sales \neq Consumption

Interpretation

- No control group, cannot eliminate all confounders (e.g., unexpected/unknown changes in food service operations)



Intervention

- Implemented by food service staff as a part of normal job duties (feasible for long-term)
- High fidelity
- Relatively 'Low-cost'

Data Collection

- Sales data (not a recall)
- Collected sales at multiple time points (time series)

Discussion & Next Steps



- Low-cost BD strategies were effective to change some food purchasing behaviors among hospital cafeteria patrons.
- Changes were relatively small and warrant adjunct strategies (e.g., pricing, recipe reformulations) to improve dietary quality or health outcomes over time.
- Buy-in from food service staff is essential for sustainability.
- Unintended consequences (e.g., food waste, substitution effects) of BD strategies should be anticipated to prevent an overall caloric increase and/or revenue loss.
- Study should be replicated with a control group, and with adjunct strategies (e.g., factorial design).

Acknowledgements



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Questions?



I'd love to answer any of your questions!

And feel free to contact me:

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