

***FROM FOOD SAMPLING LOCATIONS TO PEDAGOGY:
EXPLORING GEOGRAPHIC DIETARY VARIATIONS AND
GAMIFIED LEARNING IN HEALTH ECONOMICS***

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About Me

B.S. Milling Science and Management

M.S. Agricultural Economics

Southeastern Mills, Rome Georgia

Economics Instructor

Healthcare Economics Instructor



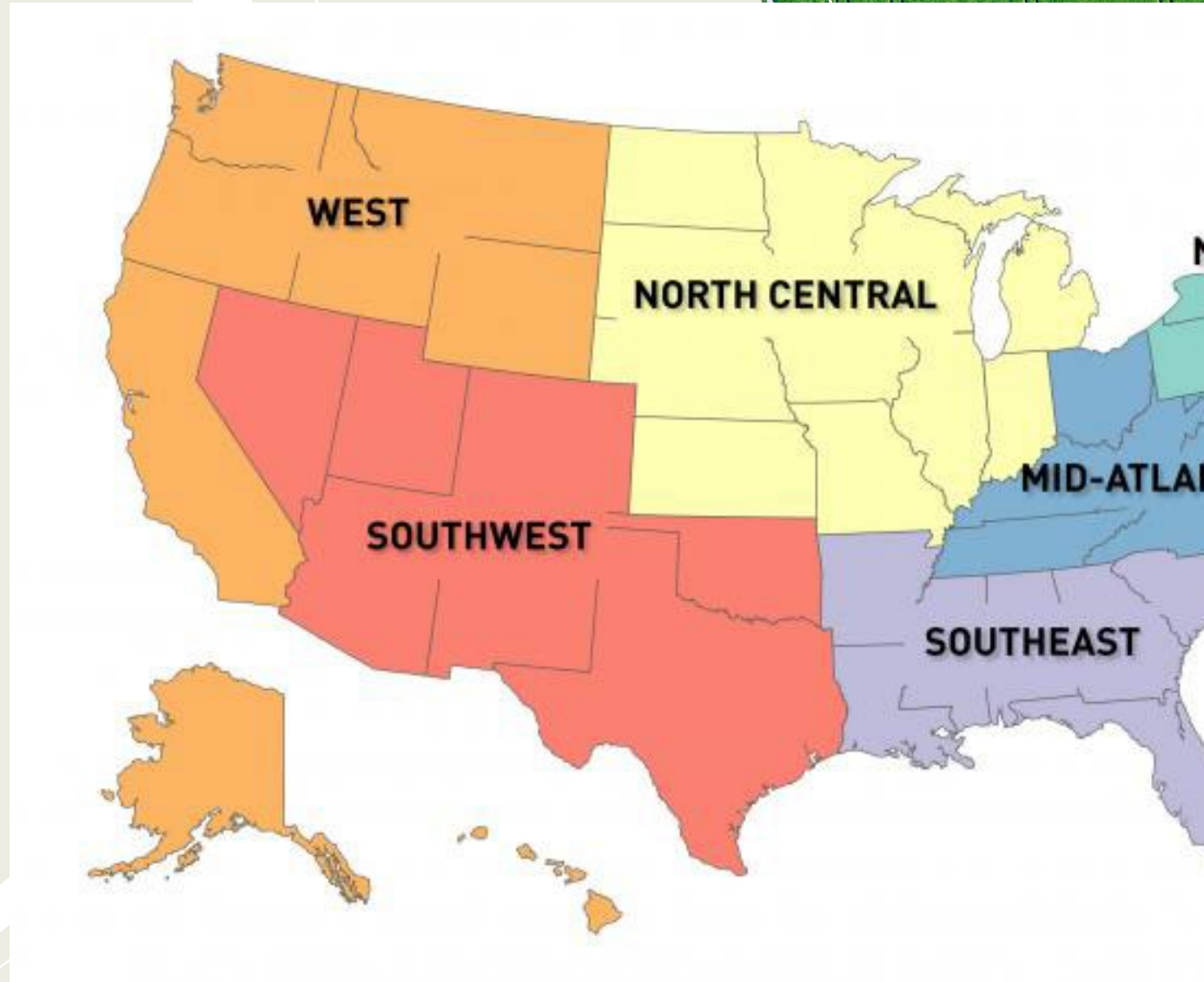
Project Overview

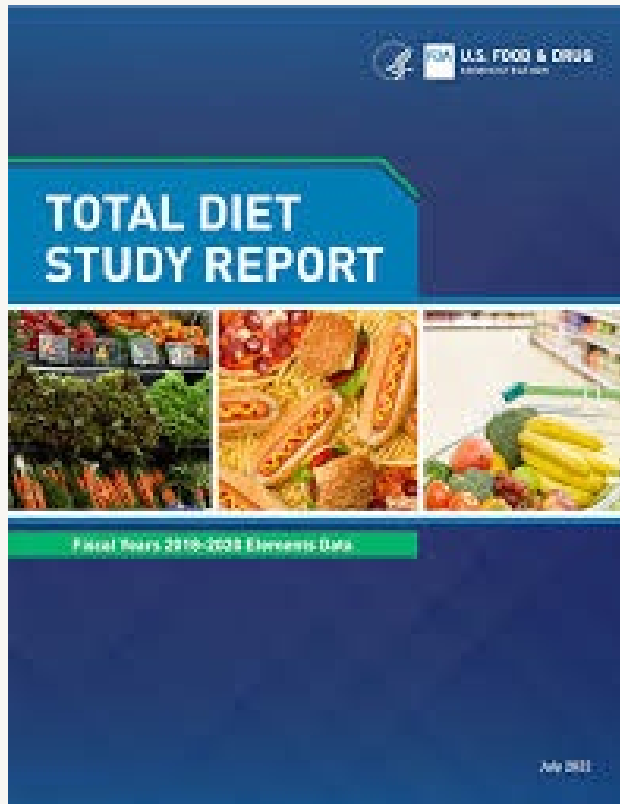
- Location: FDA, Lenexa, Kansas
- I worked with the Total Diet Study (TDS) program.
- Assigned Mentor: Terry Councell, microbiology and chemistry



About the TDS

The TDS collects retail food samples from all fifty states to ensure each geographic area is adequately represented.



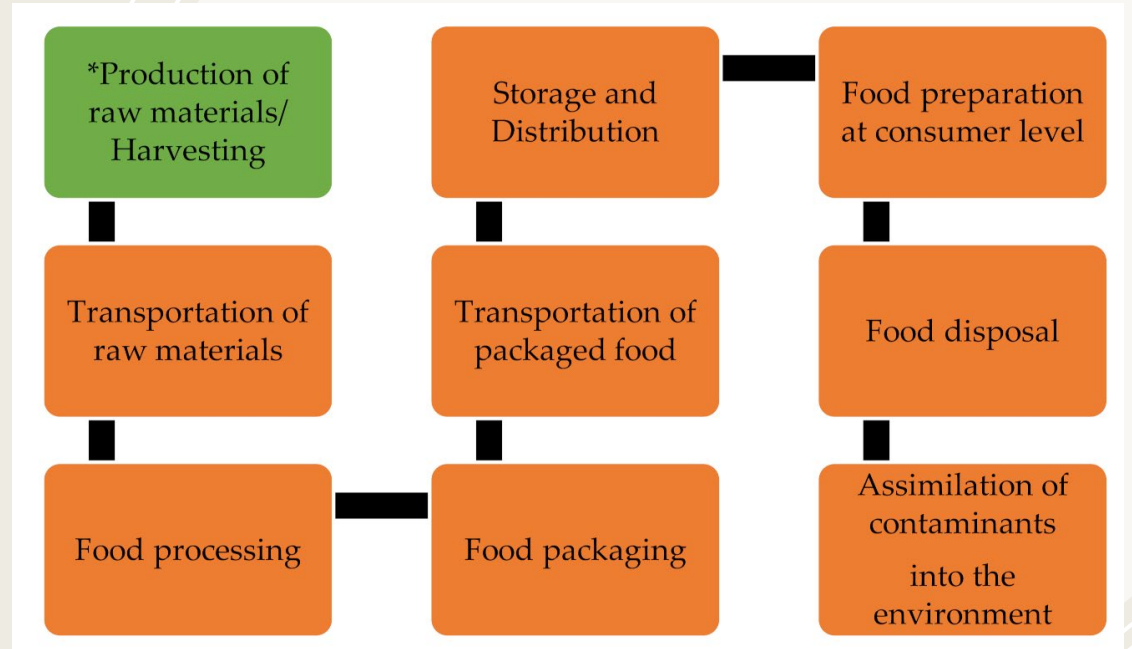


Literature Review

- The Total Diet Study program began in 1961, measuring pesticides, metals, and other contaminants in food.
- The data collected in the TDS can be used by dietitians to determine the nutrients that people are consuming through their diet.

Literature Review

- The TDS data collected can be used to track trends in contaminant levels over short and long periods of time.





products	Action Level	20 ppb	CPG 570.37
	Action Level	20 ppb	CPG 570.37
	Action Level	0.03 ppm	CPG 570.37
	Action Level	0.03 ppm	CPG 570.37
	Action Level	0.05 ppm	CPG 570.37
	Action Level	0.03 ppm	CPG 570.37
	Action Level	0.02 ppm	CPG 570.37
	Action Level	0.05 ppm	CPG 570.37
	Action Level	0.1 ppm	CPG 570.37
	Action Level	0.03 ppm	CPG 570.37
	Action Level	0.03 ppm	CPG 570.37
	Action Level	0.1 ppm	CPG 570.37

Literature Review

- While the TDS is only utilized in the USA, the methodology utilized by the FDA has been harmonized allowing comparison with the data from other countries.
- Foods and beverages tested are routinely updated to include changing dietary trends and preferences.

Literature Review

- The FDA has worked in recent years to streamline testing, and the most recent TDS Report includes testing on over 300 foods and beverages for contaminants and 25 elements with a focus on nutrients that are often low in residents' diets, such as iron and iodine.



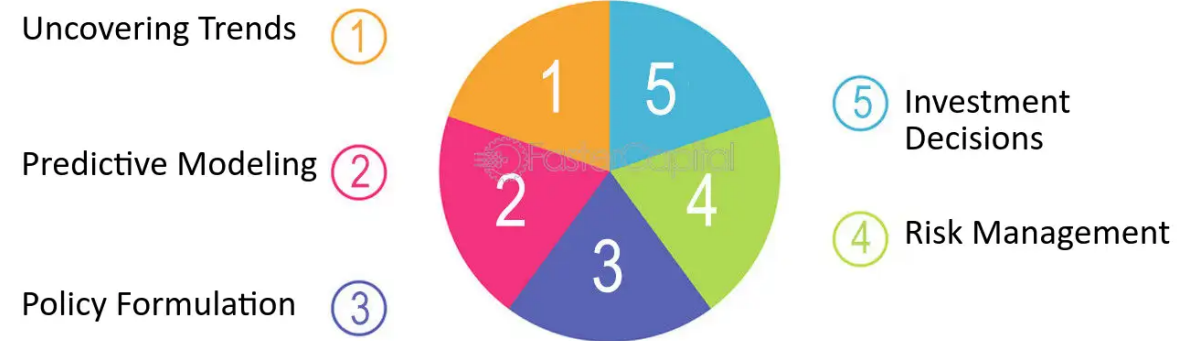
Literature Review

- The FDA aims to reduce food testing locations in future years from three locations per region to only one location per region.
- This aim created the opportunity for data analysis!

Literature Review

- Quantitative classes such as statistics, economics, and finance require students to actively engaged with data to solve problems and interpret data.

The Power of Economic Data Analytics



Literature Review

- One possible strategy to improve outcomes in online quantitative courses is the use of gamification in the classroom (Lampropoulos and Sidiropoulos, 2024).
- Gamification is the use of game elements in a context that is not related to games, such as in educational settings.



Summary of Portfolio Products

Portfolio Product		Description
1	ANOVA Analysis Results – 3 Cities	Determine if sampling results from three cities were significantly different using ANOVA data analysis technique.
2	ANOVA Analysis Results – Outliers	Determine if outlier samples were significantly different using ANOVA data analysis technique.
3	Percentage of Samples < LOD Results	Provide data visualizations for various food samples, showcasing the percentage of samples whose concentrations were below the limit of detection.
4	TDS Presentation	Present data analysis findings to the TDS team and provide insights on the differences between regional and national production of retail food offerings.
5	CMA Game-Based Assignment	Create a game-based assignment for a healthcare economics course. The assignment was set in a fictitious hospital, and administrators must decide how to minimize costs due to rising operational costs using Cost Minimization Analysis.

Product 1

- 109 food and beverage products
- 27 analytes

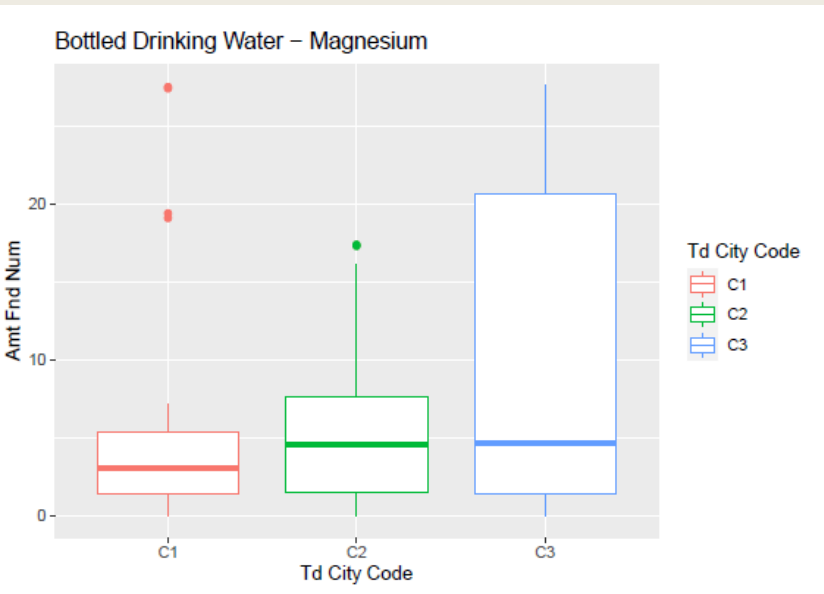
Examples of some of the foods tested include cereal, syrup, soup, pretzels, peanuts, chips, and gravy.

Examples of some of the beverages tested included water, juice, and wine.



Product 1 – ANOVA

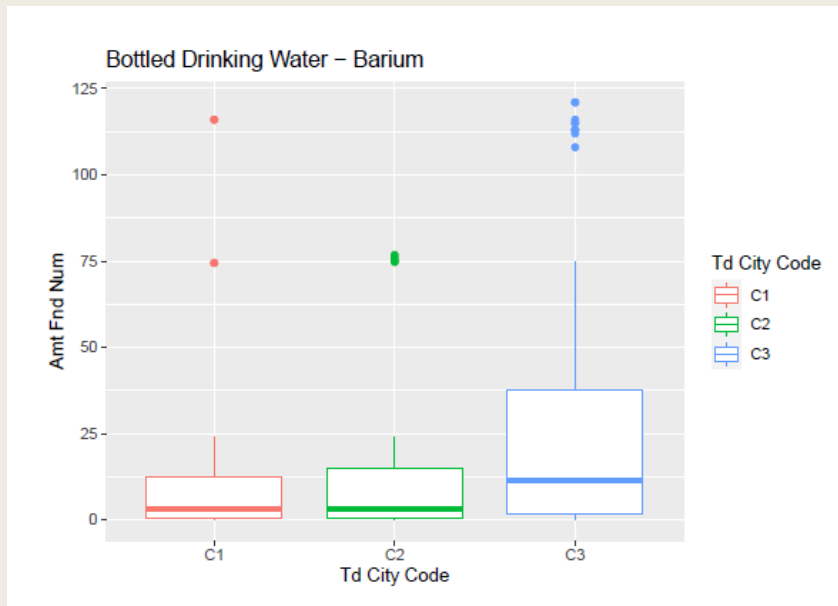
Magnesium - Bottled Drinking Water (mineral/spring)
not carbonated or flavored.



```
## Tukey multiple comparisons of means
## 95% family-wise confidence level
##
## Fit: aov(formula = Amt ~ City, data = bottwatmagnesium)
##
## $City
##          diff          lwr          upr          p adj
## C2-C1 0.492913 -3.0808870 4.066713 0.9427989
## C3-C1 5.007277  1.3493765 8.665178 0.0042267
## C3-C2 4.514364  0.8564634 8.172265 0.0112265
```

Product 1 – ANOVA

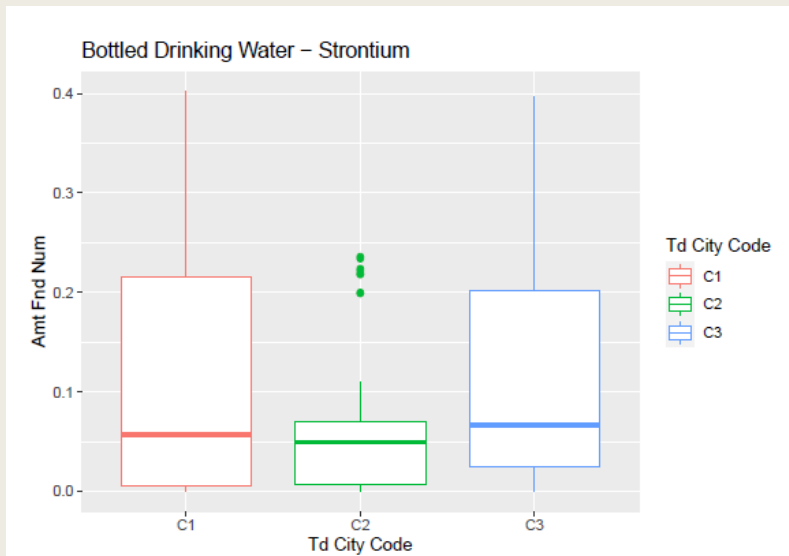
Barium - Bottled Drinking Water (mineral/spring) not carbonated or flavored.



```
## Tukey multiple comparisons of means
## 95% family-wise confidence level
##
## Fit: aov(formula = Amt ~ City, data = bottwatbarium)
##
## $City
##          diff          lwr          upr          p adj
## C2-C1 -0.51760 -15.761827 14.72663 0.9964423
## C3-C1 19.41239  4.010186 34.81459 0.0092917
## C3-C2 19.92999  4.527786 35.33219 0.0073015
```

Product 1 – ANOVA

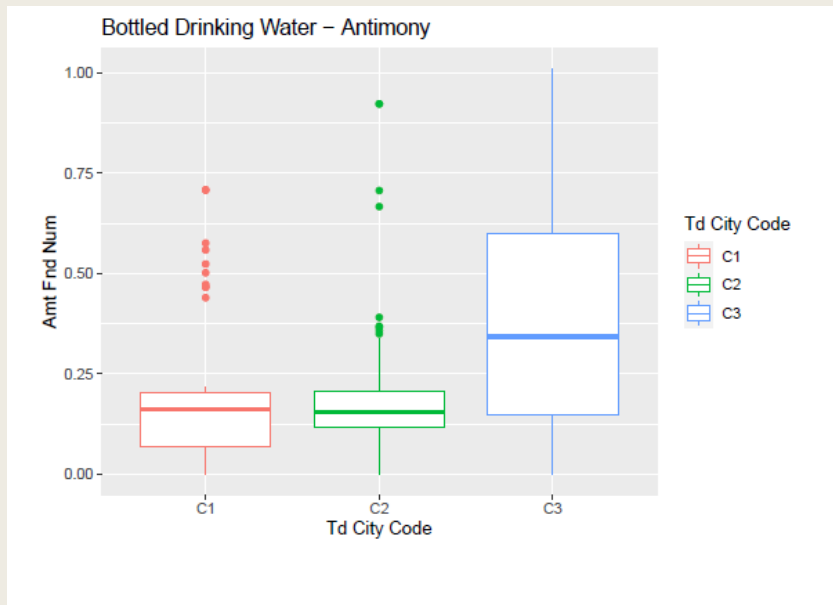
Strontium - Bottled Drinking Water (mineral/spring)
not carbonated or flavored.



```
## Tukey multiple comparisons of means
## 95% family-wise confidence level
##
## Fit: aov(formula = Amt ~ City, data = bottwatstrontium)
##
## $City
##           diff           lwr           upr          p adj
## C2-C1 -0.03215652 -0.08591971 0.02160667 0.3347308
## C3-C1 0.02565543 -0.02871527 0.08002614 0.5044387
## C3-C2 0.05781196 0.00344125 0.11218266 0.0342822
```


Product 1 – ANOVA

Antimony - Bottled Drinking Water (mineral/spring)
not carbonated or flavored.



```
## Tukey multiple comparisons of means
## 95% family-wise confidence level
## Fit: aov(formula = Amt ~ City, data = bottwatantimony)
## $City
##           diff           lwr           upr           p adj
## C2-C1 0.0056600 -0.10033512 0.1116551 0.9912241
## C3-C1 0.1631142 0.05602062 0.2702077 0.0012321
## C3-C2 0.1574542 0.05036062 0.2645477 0.0018957
```

Product 2 – ANOVA – Outlier data

FY	Smpl Trckng Num	Bskt Num	Cfsan Prdct Desc CodeText	Anlys Type Code	Mthd Code	Facts Analyte Codes Grp1 Fnd.Desc Text	Amt Fnd Num	Amt Unit Code	Lookup Abrvtn Desc	Td City Code
2019	108924501		Bottled drinking water (mineral/spring), not carbonated or flavored	Q	ICPMS	ANTIMONY	0.074U	ug/kg	C2	
2019	108924501		Bottled drinking water (mineral/spring), not carbonated or flavored	Q	ICPMS	ANTIMONY	0.081U	ug/kg	C2	
2019	108924501		Bottled drinking water (mineral/spring), not carbonated or flavored	Q	ICPMS	ANTIMONY	0.44U	ug/kg	C1	
2019	108924501		Bottled drinking water (mineral/spring), not carbonated or flavored	Q	ICPMS	ANTIMONY	0.473U	ug/kg	C1	
2019	108924501		Bottled drinking water (mineral/spring), not carbonated or flavored	Q	ICPMS	ANTIMONY	0.594U	ug/kg	C3	
2019	108924501		Bottled drinking water (mineral/spring), not carbonated or flavored	Q	ICPMS	ANTIMONY	0.602U	ug/kg	C3	

Product 2 – ANOVA – Outlier data

FY	Smpl Trckng Num	Bskt Num Code	Cfsan Prdct Desc Text	Anlys Type Code	Mthd Code	Facts Codes Fnd.Desc	Analyte Grp1 Text	Amt Fnd Num	Amt Unit Code	Lookup Abrvtn Desc	Td City Code
2019	108924501		Bottled drinking water (mineral/spring), not carbonated or flavoredQ		ICPMS	ARSENIC		0U		ug/kg	C2
2019	108924501		Bottled drinking water (mineral/spring), not carbonated or flavoredQ		ICPMS	ARSENIC		0U		ug/kg	C2
2019	108924501		Bottled drinking water (mineral/spring), not carbonated or flavoredQ		ICPMS	ARSENIC		0U		ug/kg	C3
2019	108924501		Bottled drinking water (mineral/spring), not carbonated or flavoredQ		ICPMS	ARSENIC		0U		ug/kg	C3
2019	108924501		Bottled drinking water (mineral/spring), not carbonated or flavoredQ		ICPMS	ARSENIC		1.77U		ug/kg	C1
2019	108924501		Bottled drinking water (mineral/spring), not carbonated or flavoredQ		ICPMS	ARSENIC		1.77U		ug/kg	C1

Product 3 – LOD

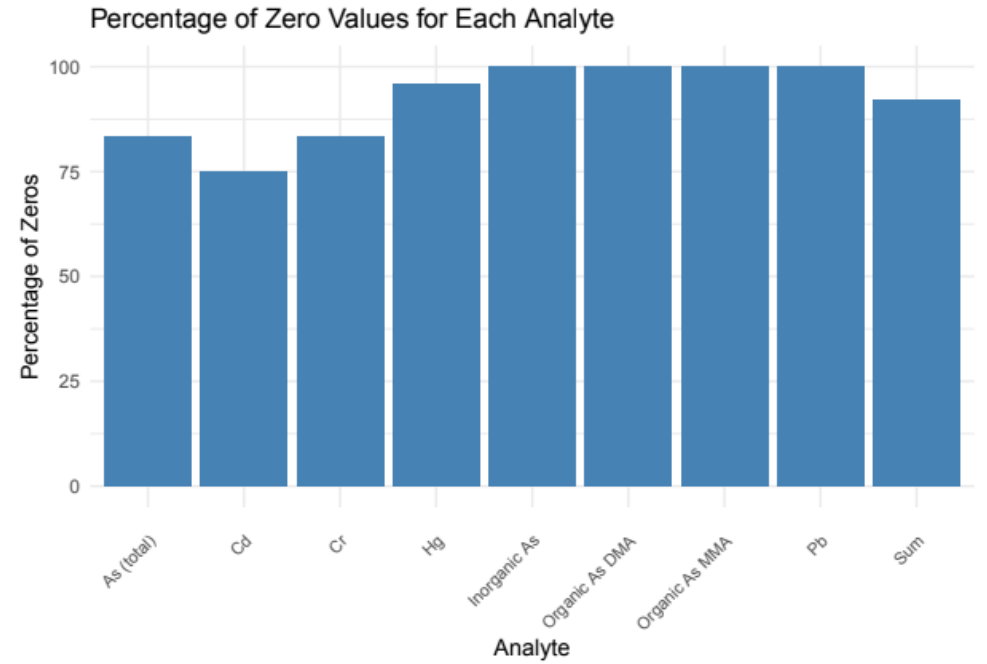


Table 2: Apple Avocado Blueberry Pear Table of Analytes and Percentage of Zero Values

Analyte	Total	ND	Percentage_Zeros
As (total)	18	12	66.66667
Cd	18	8	44.44444
Hg	18	18	100.00000
Pb	18	11	61.11111
Inorganic As	18	18	100.00000
Organic As MMA	18	18	100.00000
Organic As DMA	18	18	100.00000
Cr	18	18	100.00000
Sum	144	121	84.02778

Product 3 – LOD

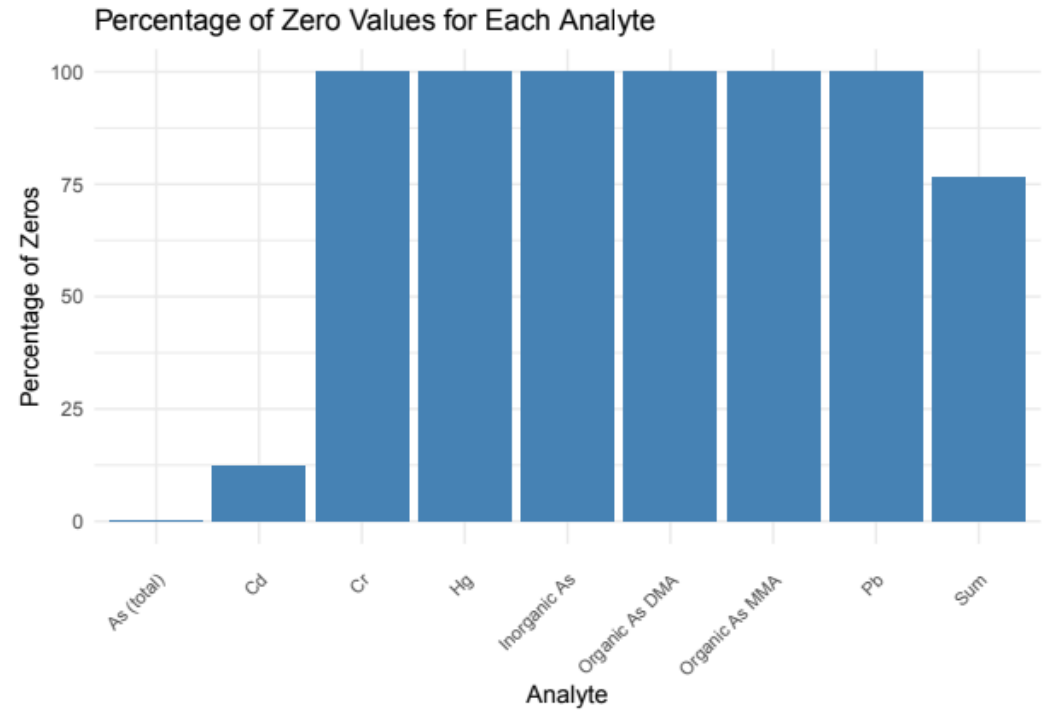
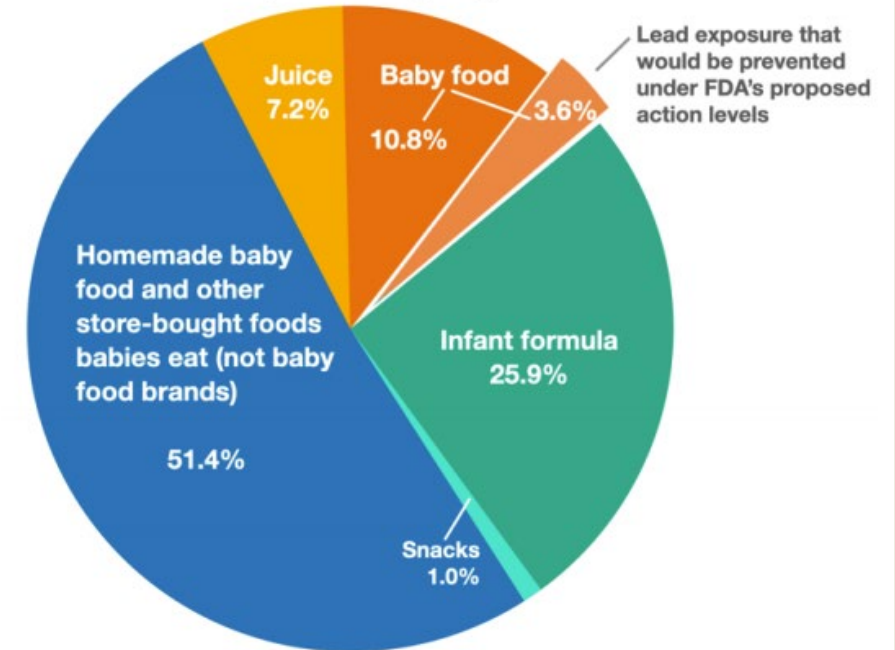


Table 4: Apple Avocado Spinach Table of Analytes and Percentage of Zero Values

Analyte	Total	ND	Percentage_Zeros
As (total)	20	6	30.0
Cd	20	9	45.0
Hg	20	19	95.0
Pb	20	8	40.0
Inorganic As	20	20	100.0
Organic As MMA	20	20	100.0
Organic As DMA	20	20	100.0
Cr	20	14	70.0
Sum	160	116	72.5

Product 3 – LOD

FDA's proposed action levels for lead contamination in baby food would reduce exposures by only 3.6%



Lead exposure from foods consumed by babies and young children (ages 0-2 years)

Total percentage of exposures by food group

Source: Abt Associates dietary lead exposure analysis, attached.

Product 4 – Presentation

Which food/beverages are produced regionally?
What ingredients have the most contaminants/pesticide residues?



Product 5

– Escape Room

ESCAPE ROOM STYLE LEARNING



Wow, we have another fun escape room to solve this week.

In this assignment, we will complete a cost-minimization analysis and enter codes to gain access to a number of rooms. Once you have correctly entered the codes, escape will be granted.

Remember, a journey of a thousand miles begins with one single clue. Please keep track of your time when you enter the room and redo the assignment a second time once you finish to see if you can improve your time. Consider sharing your time with me once you finish. Are you ready? Click the lock below to get started with your first question. You will need to select "View Accuracy" after you submit the answer to your question to get the link to the next room.



Product 5

– Escape Room

WE MUST SPEND LESS THIS FISCAL YEAR

Operational costs are out of control. Let's decide how to reduce spending at Fort Scott Medical Center. You will be assigned to the Primary Care group to evaluate whether telehealth vs. in-person follow-ups for chronic disease reduce costs while maintaining patient outcomes.

Fort Scott Medical Center is in a crisis. This nonprofit hospital is located in rural Fort Scott, Kansas. It serves a population of 20,000 in a four county area. The hospital has 25 beds as well as an outpatient network. The hospital has a specialty in cardiology and offers emergency services. Fort Scott Medical Center is a Critical Access Hospital and receives benefits including cost-based reimbursement for Medicare services. The Critical Access benefits help the hospital to remain operational. There are few alternative healthcare providers in this four county area. In the past 24 months, the Fort Scott Medical Center has experienced a rise in operational costs. The costs have increased in monthly utilities, pharmaceutical costs, compliance costs, technology improvement requirements, and labor shortages that lead to an increase in overtime pay and the use of traveling and contract nurses and doctors.

The goal of this escape room is to participate with your group to evaluate whether telehealth vs. in-person follow-ups are more appropriate for the Fort Scott Medical Center given the financial situation of the hospital. You will assume that clinical processes and outcomes will be equivalent in both modes of treatment. You will identify and quantify direct and indirect costs of both in-person and telehealth appointments and recommend the lower-cost option by utilizing cost minimization framework. After you finish the escape room, your team will present your findings with clear justifications and cost calculations in Excel to the board of directors.

To get to the next room, answer the question in the lock. You will need to select "View Accuracy" after you submit the answer to your question to get the link to the next room.



Product 5

– Escape Room

COST-MINIMIZATION ANALYSIS



Cost minimization analysis can be used to determine which project should be selected by comparing direct and indirect costs - choosing the least expensive option that will maintain the same level of health outcome. In healthcare situations, cost minimization can be used for a variety of applications. Some example applications include comparing generic and name brand drugs and determining whether to offer services in-house or to have the services outsourced. This type of analysis is only appropriate when you know that the health outcomes are the same.

You work at Fort Scott Medical Center, in the Chronic Care Department. You and your team will assess whether to shift follow-up appointments to the Chronic Care team from in-person appointments or telehealth appointments. Research has shown that in many facilities, chronic care management by telehealth yields equivalent health outcomes vs. in-person appointments. Your objective is to identify the lower-cost option at Fort Scott Medical Center by using Cost-Minimization Analysis. Chronic care follow-ups are a high volume visit at the hospital. You will create your own Excel spreadsheet and Row 1 of the spreadsheet will include the titles of each cost. Row 1 will list the costs for Telehealth and Row 2 will list the costs for In-person visits.

Here are the costs to consider.

Telehealth

Telehealth does not have a facility cost, but does require Internet and access to the hospital's Zoom for Healthcare account which costs \$15 per session. Scheduling/administrative costs are estimated to be \$10 a visit. There would not be a need for travel reimbursement and the Physician cost per visit is limited at \$40.

In-person appointments

The in-person appointments incur at \$90 Physician cost per visit and the travel reimbursement to Fort Scott is \$35 a visit. The facility costs include \$80 per visit and cover the building and equipment costs. There is also a cost of \$25 for scheduling and administrative costs.



Product 5 – Escape Room

CONGRATULATIONS

"It is the act of solving puzzles that makes games fun." -Raph Koster, Game Designer.

You selected the correct chronic care follow-up appointment type! Congratulations on escaping the rooms. Continue on to learn more about how to complete the Board of Directors Recommendation Presentation with your team.

Your team of five will now work together to recommend Follow-Up Appointments to the Board of Directors in an effort to cut operational costs. The slide presentation will be 8 slides in length with multimedia. You can feel free to add information that is not mentioned in the scenario, but would be common in smaller rural hospitals.

Slide one will be a title page slide with the title: Follow-Up Appointments. Below the title, include each team member's name in the Chronic Care Department. Include the date.

Slide two will include a background detailing the financial situation at the hospital. Explain the number of appointments that your facility has each month and detail the goal of your escape room.

Slide three will provide background on what cost-minimization is and how it can be used in a hospital setting. Please use external resources in this slide to reinforce what you learned in this escape room.

Slide four will include the data and calculations for Telehealth appointments. You will explain the data in the multimedia presentation.

Slide five will include the data and calculations for In-person appointments. You will explain the data in the multimedia presentation.

Slide six will compare the costs between the two types of appointments.

Slide seven will include your team's recommendation.

Slide eight will include information on the next steps to carry out this program. The change might suggest a pilot program to start with, or perhaps mention the need to monitor satisfaction using surveys.

Reflections

- The projects provided a valuable opportunity to learn about different areas of public health including food safety and healthcare economics. Both projects emphasized the use of data to solve real-world public health challenges.



Future Direction of TDS

- Collect additional data.
- Partner with industry to learn which food products are produced regionally vs. nationally.
- Conduct data analysis on regional foods and beverages in 3 cities and national foods and beverages in 1 city.

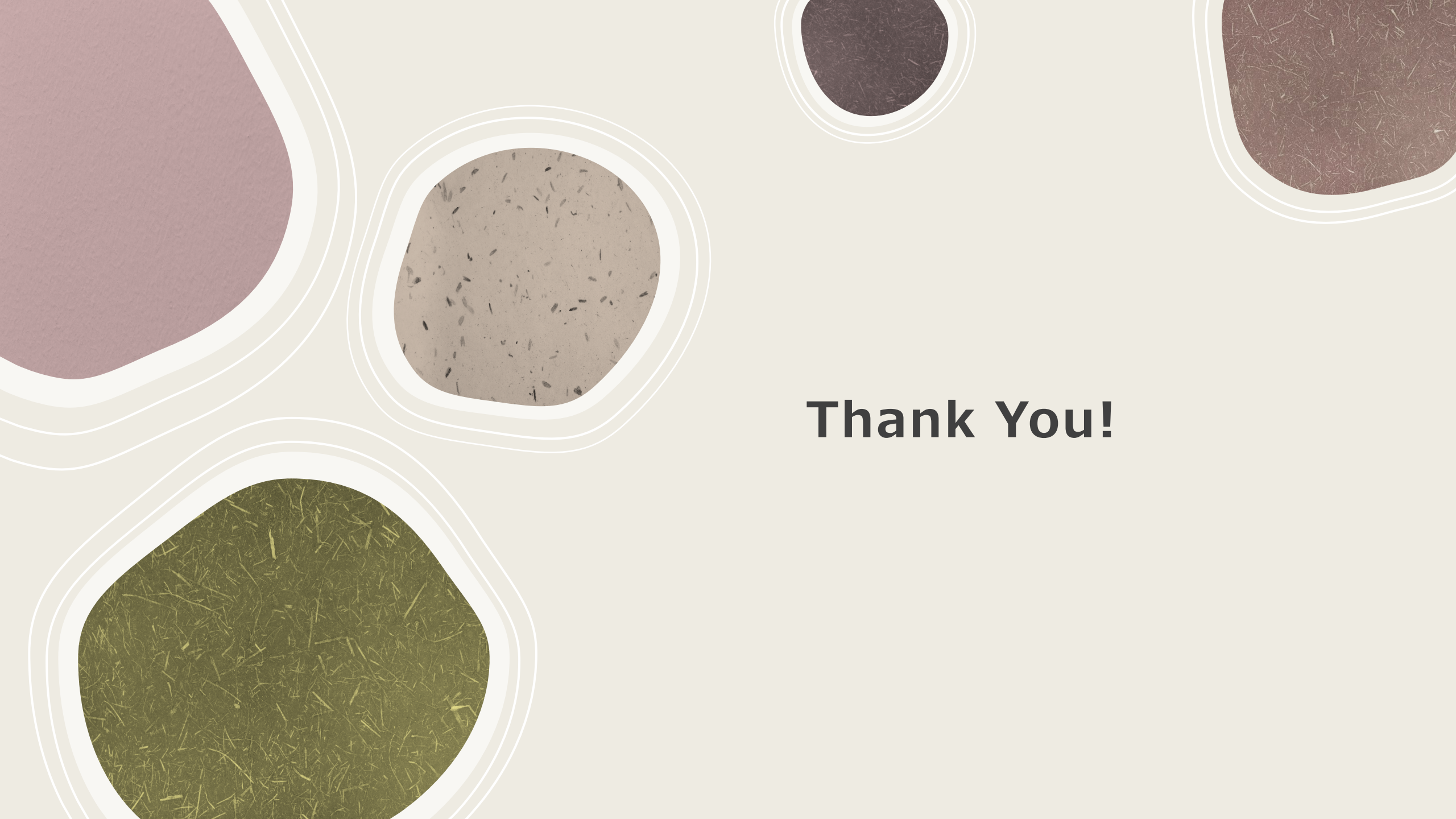


MPH Foundational Competencies

Number and Competency		Description
3	Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate.	TDS Data was analyzed to determine whether there is a statistical difference between samples. Utilized ANOVA.
4	Interpret results of data analysis for public health research, policy or practice.	Examine the results of the data analysis and make recommendations for future sampling protocols.
10	Explain basic principles and tools of budget and resource management.	Findings can help reduce costs by decreasing unnecessary retesting. Creating the game-based learning assignment helps explain how resources are managed in a fictitious hospital setting.
14	Advocate for political, social or economic policies and programs that will improve health in diverse populations.	The TDS project work advocates for equitable food safety policies that protect communities disproportionately affected by foodborne contaminants. Explain CMA results to show how project implementation will reduce costs at a medical facility.
19	Communicate audience-appropriate public health content, both in writing and through oral presentation.	Present content to TDS team in an interactive format with data visualizations.

MPH Emphasis Competencies

Number and Competency		Description
1	Food safety and biosecurity	Evaluate food samples from three different cities to determine whether food safety issues exist. This competency helps determine whether food safety strategies should be location based.
2	Threats to the food system	Analyze contaminant levels in foods and beverages using an outlier data set to look for potential threats to the food supply.
3	Food safety laws and regulations	Differentiate between the FDA and other food safety regulating bodies to ensure food and beverage integrity.
4	Food safety policy and the global food system	Presented data results to FDA/TDS team and provided recommendations for future sample collection throughout the USA.
5	Multidisciplinary leadership	Developed an online escape room for healthcare leaders that facilitated teamwork and application of cost minimization analysis.

The background is a light beige color. It features several organic, rounded shapes with white outlines. These shapes contain different textures: a large purple one on the top left, a brown one with small dark specks in the center, a dark brown one at the top right, a green one with fine fibers at the bottom left, and a brown one with fine fibers at the top right.

Thank You!