

M113: Modeling with Probability

Post-Badge Task

Reflecting on Badge Learning

Now that you have learned more about modeling with probability, respond to the questions that follow. These are the same questions you responded to before the start of this badge.

The Task

A company is considering launching a new snack product—high-protein, gluten-free chips. The company conducted a market survey to understand how likely different demographic groups are to purchase this product. The survey asked 500 participants about their preferences for snack types and whether they were interested in trying this new product, which is marketed as both gluten-free and high in protein. Three different age groups were surveyed—teens aged 13-19, adults aged 20-40, and adults aged 41 and older.

The company would like to estimate the potential market share for this new product based on the survey results and use the data to help make marketing decisions.

QUESTION 1 Of the three different age groups, which do you believe may be the most interested in high-protein, gluten-free chips? Why?



Answers will vary. Possible student response:

I believe that the adults aged 20-40 will be the most interested in a high-protein, gluten-free chip because this group is typically more health-conscious than teens and older adults. I also feel like specialty items like this cost more, and adults usually have more money to be able to afford specialty items.

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Below is a two-way frequency table that summarizes the data collected from the survey:

	Interested	Not Interested	Total
Teens (Aged 13-19)	82	18	100
Adults (Aged 20-40)	115	85	200
Older Adults (Aged 41+)	43	157	200
Total	240	260	500

QUESTION 2 Based on the survey data, would you recommend targeting teens, adults, or older adults for the initial launch of the gluten-free chips? Justify your recommendation.



Answers may vary. Possible student response:

$P(\text{Interested} \mid \text{Teens}) = 82/100 = 82\%$

$P(\text{Interested} \mid \text{Adults}) = 115/200 = 57.5\%$

$P(\text{Interested} \mid \text{Older Adults}) = 43/200 = 21.5\%$

I would recommend targeting teens the most for the initial launch of the gluten-free chips because they are the most interested group in the product. I would then recommend targeting adults second, and older adults last.

QUESTION 3 Are the categories “age group” and “interest” independent or dependent? How do you know?



Answers may vary. Possible student response:

Using my result from Question 2, we see that the level of interest in the gluten-free chips changes depending on the age group since the percentages I calculated are different for each group. Therefore, “age group” and “interest” are dependent.

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QUESTION 4 Using the two-way frequency table from the survey, calculate the probability that a randomly selected person from the survey is:

- A teen and interested in the product.
- An older adult (41+) or not interested in the product.

What do these probabilities suggest about preferences of the product or how the company should market the product?



Answers may vary. Possible student response:

$$P(\text{Teen and Interested}) = 82/500 = 16.4\%$$

This probability suggests that those interested within their most interested age group make up about 16% of their sample. This indicates what percentage of people the company should market the most for.

$$P(\text{Older Adult or Not Interested}) = 200/500 + 260/500 - 157/500 = 303/500 = 60.6\%$$

This probability suggests that more than half of those surveyed are an older adult or not interested in the product. Since the older adult group was our least interested group, this helps the company see that they can focus their efforts on marketing the product to close to 40% of people.

QUESTION 5 Imagine that the company finds that 6% of all individuals surveyed are gluten-intolerant. If 10% of the surveyed individuals who are interested in the new chip are gluten-intolerant, what percentage of the non-interested individuals are gluten-intolerant? What do these probabilities suggest about how the company should market the product?



Answers may vary. Possible student response:

$$P(\text{Interested}) = 240/500 = 48\%$$

$$P(\text{Not Interested}) = 1 - 0.48 = 52\%$$

$$P(\text{interested}) \cdot P(\text{gluten-intolerant} \mid \text{interested}) + P(\text{not interested}) \cdot P(\text{gluten-intolerant} \mid \text{not interested}) = P(\text{gluten-intolerant})$$

$$(0.48)(0.1) + (0.52)x = 0.06$$

$$x = 0.023 = 2.3\%$$

Approximately 2.3% of non-interested individuals are gluten-intolerant.

These probabilities suggest that generally more gluten-intolerant people are interested in the product more than not, so the company can focus efforts on marketing towards gluten-intolerant people.

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QUESTION 6 What else did you learn that was not reflected in Questions 1-5?



Answers will vary. Possible student responses:

- I can design a simulation to generate frequencies for the age groups and interest levels, then I can use this simulation to decide if the survey data is consistent with the simulation results.
- If I have information about how the survey data was collected, I could make an inference about the population if I know that they survey participants were chosen at random.

QUESTION 7 Compare your answers to these questions now to your answers from the earlier attempt. What do you notice about your progress?



Answers will vary. Look for students to explain what they know now compared to what they knew when responding to the pre-test.