



Science Assessment System Through Course Task

How Sweet It Is

Grade Levels:

9, 10, 11, 12

Phenomena:

Artificial Sweeteners and Obesity

Science & Engineering Practices:

Analyzing and Interpreting Data
Asking Questions and Defining Problems

Crosscutting Concepts:

Cause and Effect

Designed and revised by Kentucky Department of Education staff
in collaboration with teachers from Kentucky schools and districts.



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Preparing to implement Through Course Tasks in the Classroom

What is a TCT?

- TCTs are 3-dimensional tasks specifically designed to get evidence of student competency in two dimensions, Science and Engineering Processes (SEPs) and Crosscutting Concepts (CCC), untethered from Performance Expectations (PEs)/standards. Tasks are sense-making experiences.
- Tasks are to be used formatively. The goal is for both students and teachers to understand areas of strength and improvement for the SEP(s) and CCC assessed within the task.

How do I facilitate a Through Course Task (TCT)?

- TCT facilitation is a collaborative process in which teacher teams calibrate understanding of the expectations of the task and refine strategies to be used during task facilitation.

Before the task:

1. Complete the TCT as a learner – compare understanding of task through the lens of success criteria (identified in the task) in order to understand expectations.
Success criteria include:
 - What is this task designed to get evidence of?
 - What is the task asking the students to do?
 - What might a student response look like?
2. Identify the phenomenon within the task. Consult resources to assure teacher teams have a deep understanding of associated science concepts.
3. Collaborate to generate, review and refine feedback questions during facilitation.
4. Identify potential “trouble spots” and plan for possible misconceptions.

During the task:

5. Collect defensible evidence of each student’s competencies in 3-dimensional sense-making for the task.
6. Ask appropriate feedback questions to support student access and engagement with the task in order to elicit accurate evidence of student capacities.

After the task:

7. Reflect on the task as a collaborative team.
8. Review student work samples to identify areas of strength and areas of need.
9. Determine/plan next steps to move 3-D sense making forward through the strengthening of the use of SEPs and CCCs.

Using the materials included in this packet:

- **Task Annotation:** The task annotation is a teacher guide for using the task in the classroom. Additionally, the annotation gives insight into the thinking of developers and the task overall.

- Each task has science and engineering practices, disciplinary core ideas, and crosscutting concepts designated with both color and text style:
 - **Science and Engineering Practices**
 - *Disciplinary Core Ideas*
 - Crosscutting Concepts
- **Student Task:** The materials to be used by students to complete the TCT.

How Sweet it Is Task Annotation

After analyzing and interpreting data *about BMI, obesity and various types of sweetener consumption*, **develop questions to clarify an argument** that proposes a cause and effect relationship *between obesity and artificial sweetener consumption*.

Phenomenon within the task:

Are artificial sweeteners and weight gain linked? Since the 1960s, the use of artificial sweeteners (AS) consumed has increased, as has human obesity rates. Studies have been conducted to determine if there is a cause and effect relationship between these two statistics. Sometimes the citing of scientific studies by the media does not accurately present the research and can lead to misinterpretation or over interpretation. Conjecture may be presented as fact and can lead to much confusion across public sectors. Students may be reluctant to question other’s interpretation of data, especially if reported in the media. This task provides students the opportunity to analyze an argument and the data that is intended to support the argument, and then question conclusions drawn from the data.

How the phenomenon relates to DCI, if applicable:

The task builds upon MS LS1.B—Growth and Development of Organisms (Genetic factors as well as local conditions affect the growth of plants and animals.

All organisms have genetic potential for their growth and development. Environmental factors, however, can also affect growth and development. In this task students are exploring the external factor of artificial sweeteners on the growth of humans.

What information/data will students use within this task?

Students are provided with eight different graphs that show relationships between different variables including artificial sweetener usage, obesity rates and health risks. Students must understand how to read and interpret graphs and data charts, including any explanatory information included with these graphs. Students should be able to differentiate between causation and correlation and have experiences distinguishing between the two.

Additionally, students are provided an argument developed by a group of hypothetical students that definitively claims that there is a causal relationship between artificial sweetener consumption and human obesity, and cites much of the data that's presented in this task. Students are asked to study this argument, identifying the claim, evidence and reasoning of the argument.

Ideas for setting up the task with students:

Students should have experience using various types of data sets throughout year so that they are able to analyze data effectively. You may wish to start with infographics in media and discuss what they mean, progressing through to higher level and on in to SCIENTIFIC data. In this way they will have more confidence when processing complex graphics.

Students need to be comfortable looking at data sets that are in an unfamiliar format. Sometimes data sets contain multiple pieces of information that are not related. Teachers may wish to show <http://twentytwowords.com/funny-graphs-show-correlation-between-completely-unrelated-stats-9-pictures/> and discuss causation vs correlation.

This task is designed to get evidence of students' ability to analyze and interpret data so that they may be able to ask relevant questions to clarify a given argument. Students who are struggling with data interpretation may need some prompting, such as:

- a) Make sure you read the notes associated with the graph.
- b) Look for relationship/data patterns.
- c) Read the variables closely.

Intent of the Task for Assessment:

The main intent of this task is to get evidence of a student's ability to ask questions to critique an argument, or ask questions that might provide additional evidence to support or refute the claim of the argument. However, in order to get accurate evidence of a student's ability to develop these questions, it is first important to ensure that the student meaningfully engages with the task and can successfully process all of the information in the task.

Thus, students are first asked to analyze all of the data presented to them; students are prompted to consider evidence of correlation vs. causation, combining variables, etc., in order to stimulate their thinking and engage with the data. They are asked to record their analysis in any form that helps them make sense of the information. Students are then asked to analyze the argument presented by the hypothetical students, by identifying the claim, evidence and scientific reasoning and document their analysis. These first two parts of the task provide evidence of both a student's ability to make sense of several data presentations, as well as

analyze an argument and use their analysis of the data to support their analysis. These first two parts of the task provide evidence that a student has engaged with the context, and how effectively the student has processed the information provided.

Part 3 of the task asks them to develop the questions to critique, and possibly lead to either strengthening or refuting the claim made by the argument. Students must explain why their questions would be useful to refining or refuting the argument. Evidence from parts 1 and 2 will help both teacher and student understand where struggles may lie in developing good critique questions of the argument.

List components of the task / resources used with the task. Everything needed for the task is provided in the task.

Success Criteria

Evidence of Learning Desired based on Progression from Appendices

Analyzing and Interpreting Data

- Distinguish between causal and correlational relationships in data (6-8)

Ask Questions and Defining Problems

- Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set.

Cause and Effect

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

Success Criteria

Student develops a question that is relevant to the argument as stated and explains how the answer will provide evidence of causation rather than correlation or be useful to having a deeper understanding of the relationship claimed (AS causes obesity).

Possible Student Responses

Possible Student questions include:

- As the consumption of artificial sweeteners increased, obesity and risk for type 2 diabetes increases. Are AS the main cause for obesity?
- Why did obesity rates continue to increase if sugar intake decreased?
- How does the body react to AS for the BMI of a person's body to increase?
- If someone consumed only sugar sweetened beverages, would their BMI still rise?
- Why didn't people who drank 22 or more AS beverages a week have a much greater increase in BMI than people who didn't drink any AS beverages?
- What else could cause high school obesity and are sugary beverages the only cause?

Other information teacher teams might find useful when preparing to use this task in the TCT process:

Students should have a basic understanding of metabolism. Many students do not understand the complexity of metabolism and the feedback mechanisms that are involved, which makes actual measurements difficult. Many students are unaware that drinks with artificial sweeteners have little or no calories. This fact is important to note as students connect calories consumed with changes in weight. A teacher should be aware of how content understanding is affecting student interpretation and scaffold appropriately. The intent is to get evidence of good questioning skills, and not measure content understanding.

Extensions and/or other uses after the task is implemented:

After students have identified their probing questions, these could be shared with the class, who could then take on the task of identifying further data in order to strengthen the argument. Other extensions include:

- Conduct further research on the effects of artificial sweeteners on the human body.
- Conduct further research on other contributing factors for obesity.
- Rewrite argument based upon further data.
- The following article might be a helpful follow up reading/discussion piece: <https://www.popsci.com/artificial-sweeteners-vs-sugar>

Through Course Task – How Sweet It Is

A number of studies have been conducted in the last ten years to determine if weight gain occurs as a result of eating or drinking foods with artificial sweeteners (AS) such as aspartame found in NutraSweet and saccharin found in many products such as Sweet N Low. Artificially sweetened foods have fewer calories than those sweetened with natural sugar. For example, a regular 16-ounce bottle of Coca-Cola has 184 calories; whereas, Coke Zero has zero calories (no calories).

Body Mass Index (BMI) is used to determine whether a person is of normal weight. Higher BMIs mean that people have a greater tendency to have health issues such as heart disease and the onset of Type 2 diabetes. Normal BMI is between 18.5 –24.9; overweight is 25.0—29.9; obese is 30 and above BMI.

Adult BMI Chart																	
BMI	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Height	Weight in Pounds																
4'10"	91	96	100	105	110	115	119	124	129	134	138	143	148	153	158	162	167
4'11"	94	99	104	109	114	119	124	128	133	138	143	148	153	158	163	168	173
5'	97	102	107	112	118	123	128	133	138	143	148	153	158	163	168	174	179
5'1"	100	106	111	116	122	127	132	137	143	148	153	158	164	169	174	180	185
5'2"	104	109	115	120	126	131	136	142	147	153	158	164	169	175	180	186	191
5'3"	107	113	118	124	130	135	141	146	152	158	163	169	175	180	186	191	197
5'4"	110	116	122	128	134	140	145	151	157	163	169	174	180	186	192	197	204
5'5"	114	120	123	132	138	144	150	156	162	168	174	180	186	192	198	204	210
5'6"	118	124	130	136	142	148	155	161	167	173	179	186	192	198	204	210	216
5'7"	121	127	134	140	146	153	159	166	172	178	185	191	198	204	211	217	223
5'8"	125	131	138	144	151	158	164	171	177	184	190	197	203	210	216	223	230
5'9"	128	135	142	149	155	162	169	176	182	189	196	203	209	216	223	230	236
5'10"	132	139	146	153	160	167	174	181	188	195	202	209	216	222	229	236	243
5'11"	136	143	150	157	165	172	179	186	193	200	208	215	222	229	236	243	250
6'	140	147	154	162	169	177	184	191	199	206	213	221	228	235	242	250	258
6'1"	144	151	159	166	174	182	189	197	204	212	219	227	235	242	250	257	265
6'2"	148	155	163	171	179	186	194	202	210	218	225	233	241	249	256	264	272
6'3"	152	160	168	176	184	192	200	208	216	224	232	240	248	256	264	272	279
	Healthy Weight						Overweight					Obese					

The following are data sets showing relationships between artificial/natural sugar and its effect on the human body. Having processed the given data sets, a team of students developed an argument to support their claim **“the consumption of artificial sugar is the cause of obesity.”** Your task is to analyze the data sets as well as the team’s argument.

Part 1: Process the data

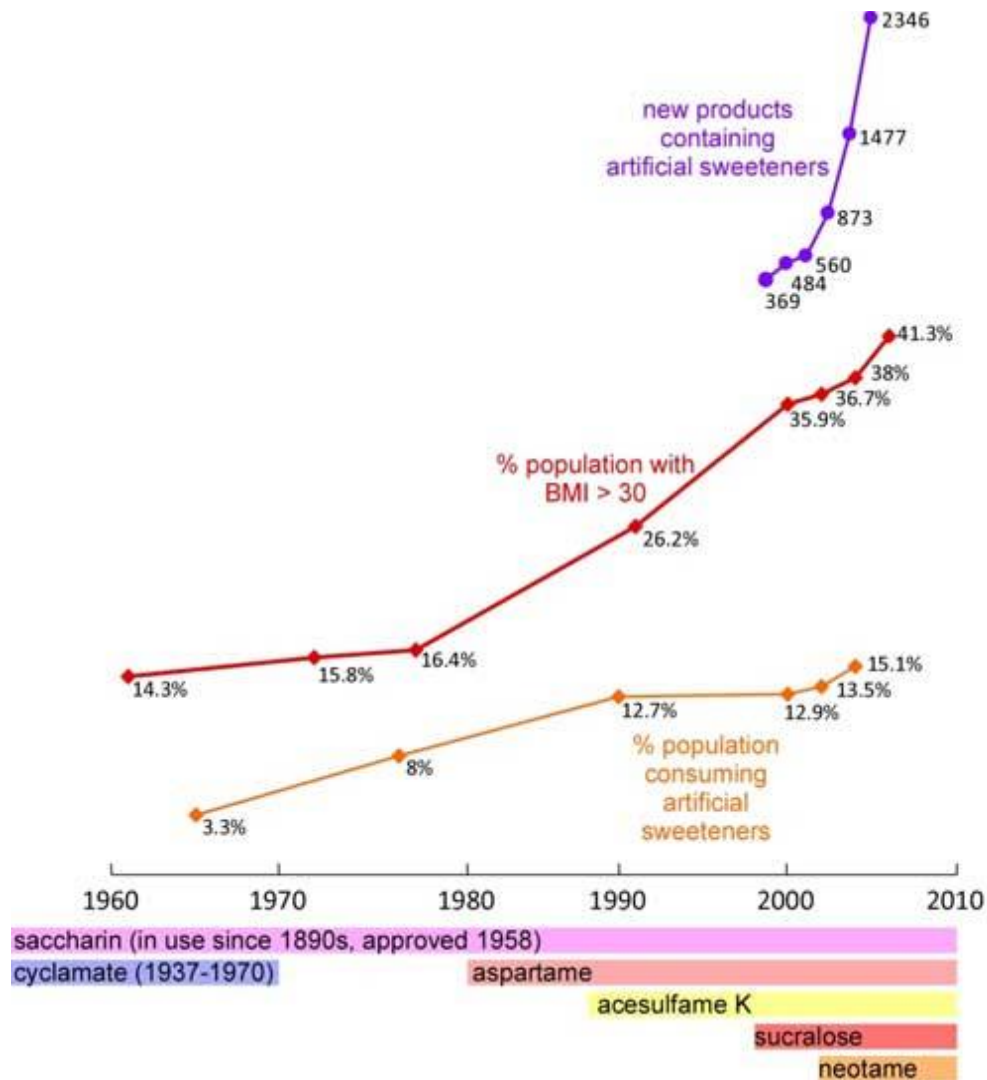
Carefully analyze the given data sets being mindful of the accompanying text for some of the graphs. Describe what each of the graphs represents and record any patterns or relationships you observe in the data. Use an organizational tool such as a table or T-chart to gather this information.

Questions to consider as you analyze the data sets:

- Is there clear evidence of causal relationships or is it just correlational?
- Consider if/how each graph provides any information about a relationship between AS and obesity.
- If you combine the information from two or more of the graphs, can you learn anything more?

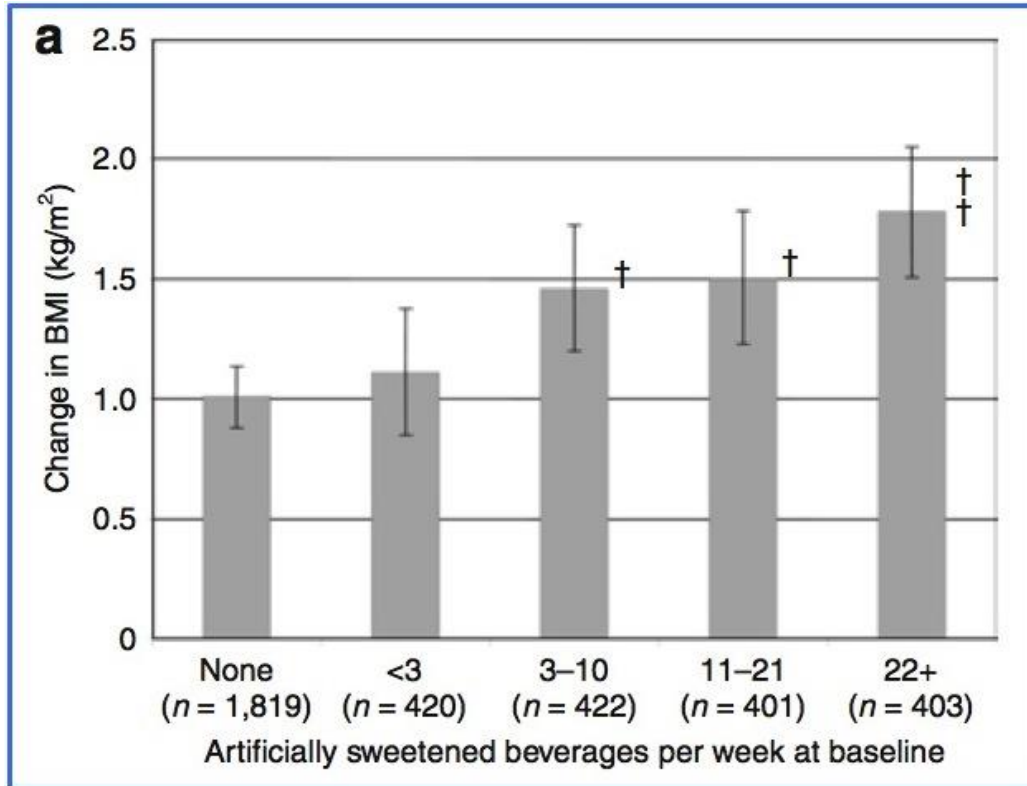
Make notes about the data on this page. Organize your thoughts in any way that helps you make sense of the information.

Data Chart 1



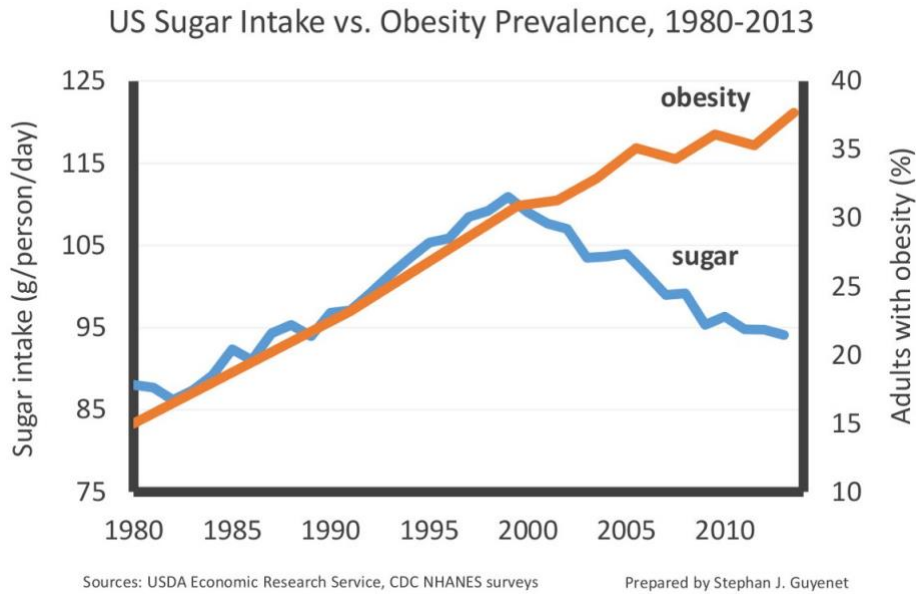
Timeline of artificial sweetener use and obesity trends in the United States. Red line: changes in the percentage of the population who are obese (BMI >30) from 1961 to 2006. Source: National Health and Nutrition Examination Survey. Orange line: changes in the percentage of the population who are regular artificial sweetener users from 1965 to 2004. Source: National Household Survey. Purple line: changes in the number of new artificial sweetener containing food products introduced to the American market from 1999 to 2004. Source: Mintel Market Analysis. Bars below the time axis indicates the type and availability of artificial sweeteners in the United States over time. Source: Kroger et al.

Data Chart 2 --



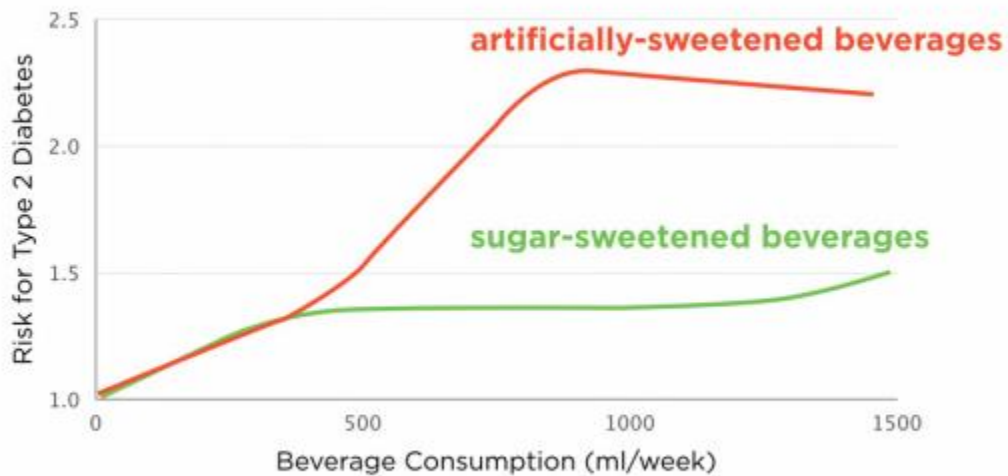
Note about this graph: 1,819 participants in a long-term study in San Antonio, Texas had a change increase of 1-point BMI in a 7-8 year study who didn't drink AS beverages at all. 420 in the study that had less than 3 artificially sweetened drinks PER WEEK increased by 1.2 approximately—See graph. 422 who averaged 3-10 drinks increased BMI by almost 1.5 points. Those who drank 11-21 increased 1.5 on BMI and those who drank 22 or more AS drinks a week raised their BMIs by around 1.75 points. This study started with a total of 1767 participants (830 men and 937 women); 1245 were Mexican American and 522 were Non-Hispanic White.

Data Chart 3



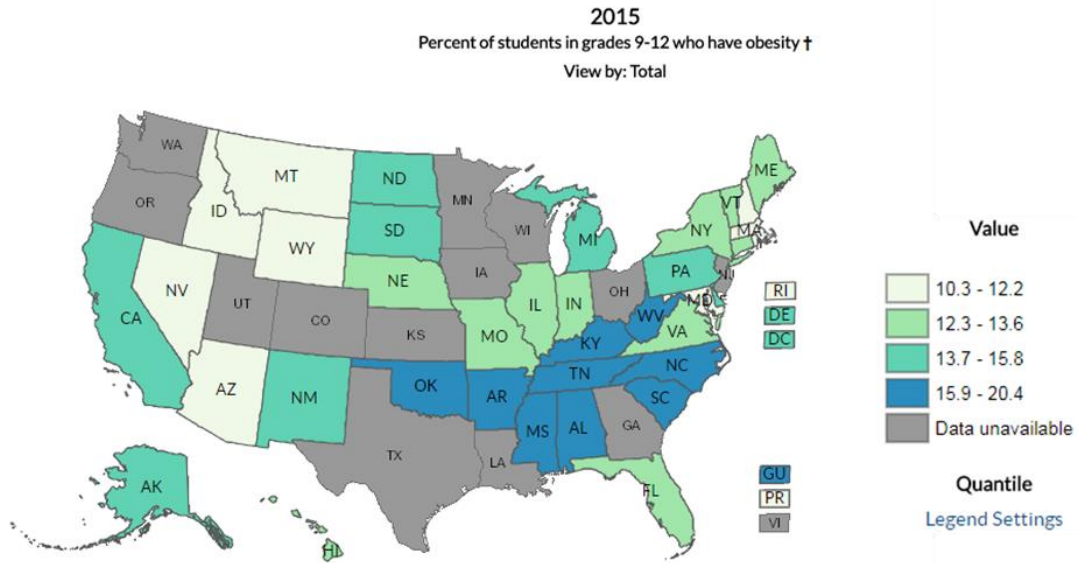
<https://www.cato-unbound.org/2017/01/11/stephan-guyenet/americans-eat-too-much-cake-government-isnt-blame>

Data Chart 4



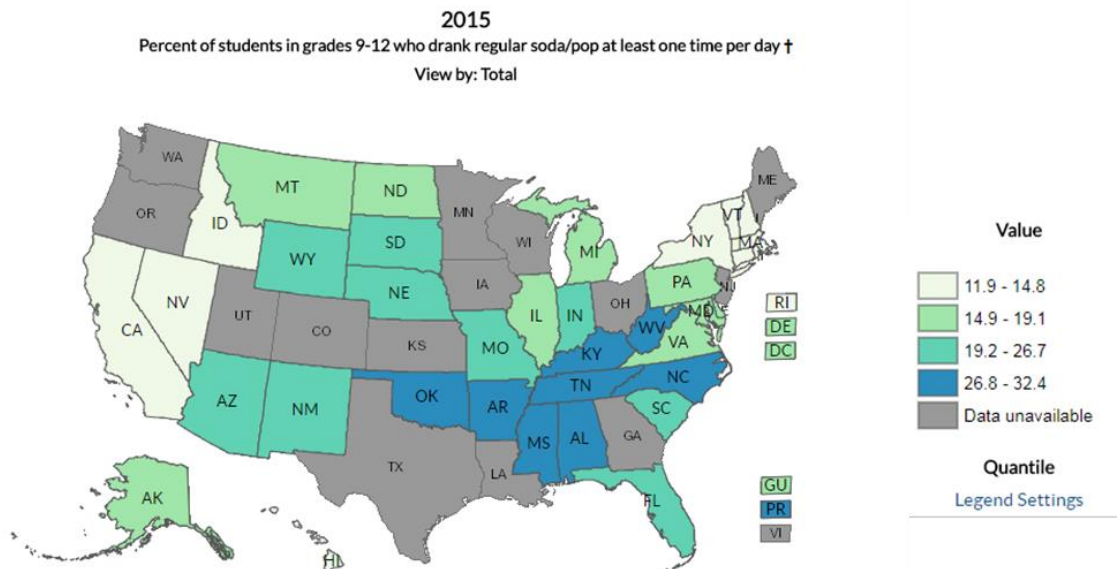
Adapted from the American Journal of Clinical Nutrition: 2013;97:517-523

Data Chart 5



Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion, Division of Nutrition, Physical Activity, and Obesity. Data, Trend and Maps [online]. [accessed Apr 04, 2018].
URL: <https://www.cdc.gov/nccdphp/dnpao/data-trends-maps/index.html>.

Data Chart 6



Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion, Division of Nutrition, Physical Activity, and Obesity. Data, Trend and Maps [online]. [accessed Apr 04, 2018].
URL: <https://www.cdc.gov/nccdphp/dnpao/data-trends-maps/index.html>.

Part 1: Analyze Students' Claim

A team of students studied the data above and developed the following argument. Read the argument carefully to identify the **claim**, the **evidence** used to support the claim and the **reasoning** that provides a rationale for the use of specific evidence.

The consumption of artificial sugar is the cause of obesity. Since the 1960s, more artificial sweeteners are being used in food products. During that same time period, the percentage of people with a BMI of over 30, which is considered obese, has increased from 14% to 41%. During an 8-year-study, people who drank 22 or more artificially sweetened beverages per week had a 1.75-point increase in their BMI. People who drink artificially sweetened beverages have nearly a 2.5 greater chance for developing Type 2 diabetes than those who do not. Type 2 diabetes is caused by obesity. In 2015, the CDC reports that many states that have a high percentage of high school students drinking sugary drinks also had a high rate of obesity. Obesity rates and sugar intake increased simultaneously from 1980 to 2000, but obesity rates continued to increase while sugar intake decreased by 15 g/day. This shows that artificial sweeteners are the cause since people like sweet foods.

As you analyze this argument, consider the following:

- What patterns in the data did the students use as evidence to support their claim?
- Was a strong rationale provided to support the use of specific data as evidence?
- Does the argument support a causal or correlative relationship?

Part 3: Having analyzed the data sets as well as the students' argument, what further questions do you have that would better clarify the argument?

Develop three questions that, if answered, would bring clarity to the argument the students produced. The goal is to get evidence to strengthen the argument as presented or to refute the argument. Explain how the answer to each question will either strengthen or refute the argument.