What do Medical Towels have to do with math?

Video Link: <https://youtu.be/z9XCuKAGZ2k>

**Video Summary:**

Manufacturers often need to calculate a measure of center to find a value that best represents the amount of production of their manufactured products. This value assists manufacturers in creating a production standard for the materials they are producing. A production standard is a benchmark used for measuring the production of the company. The unit of measurement used in a production standard indicates the normal level of performance for an industrial operation and is expressed as units per hour or units per day. Companies use the Mean Absolute Deviation to assist in calculating an accurate measure of center with upper and lower thresholds. These thresholds allow manufacturers to consider modern production variations. By using MAD to calculate the thresholds, manufacturers offer a method to take the causes of different fluctuations in their hourly or daily production standards into account. This video and lesson show how companies calculate production standards and how they use measures of center and variation to create those standards.

**About TIDI Products-**

TIDI® Products has a history of providing forward-looking solutions to healthcare professionals—solutions that help reduce the risk of contamination and deliver the highest-quality patient care. Each day, caregivers turn to TIDI Products for a supply of user-friendly, compliance-enhancing, and risk-reducing solutions. The TIDI Products portfolio of brands includes TIDIShield®, C-Armor®, Grip-Lok®, Sterile-Z®, Posey® and Zero-Gravity®. To learn more about our company, our history, and our products, please visit www.TIDIProducts.com.

**Common Core Mathematical Content Standards:**

**6.SP.A.3:** Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number

**6.SP.B.5.C:** Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered

**7.SP.B.4:** Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences.

**Common Core Mathematical Practice Standards:**

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with Mathematics.

**Teacher note:** *Please preview the entire video and pre-work solutions in order to anticipate students’ needs, misconceptions and materials unique to your classroom.*

The student work page at the end of the lesson will give students data needed to calculate the MAD and to determine the upper and lower thresholds. The worksheet will also provide a place to jot down ideas and work through answers as they are following along with the video.

**Pre-Activity Discussion**

Question to ask students: How do you think companies in the manufacturing industry use measures of center and variability in the production of products?

Discussion: Manufacturing companies like TIDI Products are faced with determining a value to represent the amount they produce, while also considering the many things that can cause those production numbers to fluctuate. They need to use mathematics to assist them in providing an accurate representative data number that will allow for the many production elements that can occur in a manufacturing plant. They utilize this information to determine an accurate production standard. What types of items in a production line may happen to create these fluctuations in production?

**Part 1**

* Play Video (0:00-1:02), pause at (1:02) to answer the discussion questions.
* Brad is trying to come up with a new production standard for a towel TIDI products produces. He is looking at data of the number of cases of towels produced per hour over the last three months to create this standard. Jeff says he uses the average or mean of all the production runs. Which measure of center would you use to represent the production standard (The number used to represent the production of a product per hour or per day)?
* Have students Think-Pair-Share of which measure of center they would use to represent the production standard. Have students share why they would choose that measure of center. Encourage peers to critique their reasoning by highlighting problems the different measures of center may cause when representing the production standard. Are there factors that may cause the measure of center to not be a good representation of the data? What might cause these gaps and outliers in their production measurements?
* Answers:

Mean: Average may not be an accurate measurement if the production run had problems with the machines, conveyors, automation, raw product, or human error. These all could cause outliers in numbers of cases run and therefore cause the Mean to be skewed when representing the production standard.

Mode: The amount of cases produced most often many do not represent the data because if there is a mechanical error this may cause the Mode to be a lower amount or a higher amount than what is typically represented.

Median: The middle value of cases produced per hour may not represent the data because there are many factors that can slow down or speed up production and if those values are not represented your production standard may not be a accurate number of cases run per hour.

**Part 2**

* Play Video (1:02 – 1:42), pause at (1:42) to answer the discussion questions.
* Have students use the worksheet to use data collected to calculate the Mean Absolute Deviation to determine the variability in the data runs. This will assist in creating a lower and upper threshold to assist in finding a production standard to best represent the production run.
* Thresholds provide a method of eliminating upper and lower outliers of production runs to create a more accurate measure of data. By calculating the MAD, you can calculate these thresholds by adding or subtracting the MAD from the lowest and highest data point. Manufacturers can use the middle data inside the thresholds to then calculate an average. This eliminates outliers outside the thresholds.
* Have students share how they arrived at their answer with a peer and then have several students explain how they calculated their answer. Encourage students to ask, “I wonder…” and “I noticed….” Questions of the reasoning of their peers. Discuss methods and answers as necessary.
* **Answers:**
* MAD = 10.15
* To calculate Thresholds, take lowest data point plus MAD and highest data point less MAD.
* Lower Threshold = 12 + 10.15 = 22.15
* Upper Threshold = 55 – 10.15 = 44.85
* Mean = 33 cases per hour
* Median = 35 cases per hour
* Mode = 42 cases per hour
* See Completed Chart

Completed Chart:

**Extension**

Graph the data points and determine a line of fit. This would assist in creating a visual of the data and visually display the outliers. Draw a vertical line to represent the thresholds that were calculated.

Student Work Page

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Part 1**

Brad is trying to come up with a new production standard for a towel TIDI products produces. He is looking at data of the number of cases of towels produced per hour over the last three months to create this standard. Jeff says he uses the average or mean of all the production runs. Which measure of center would you use to represent the production standard (The number used to represent the production of a product per hour or per day)?

**Part 2:** Calculate the Mean, Median, and Mean Absolute Deviation. 

**Extension**

Graph the data points and determine a line of fit. This would assist in creating a visual of the data and visually display the outliers. Draw a vertical line to represent the thresholds that were calculated.