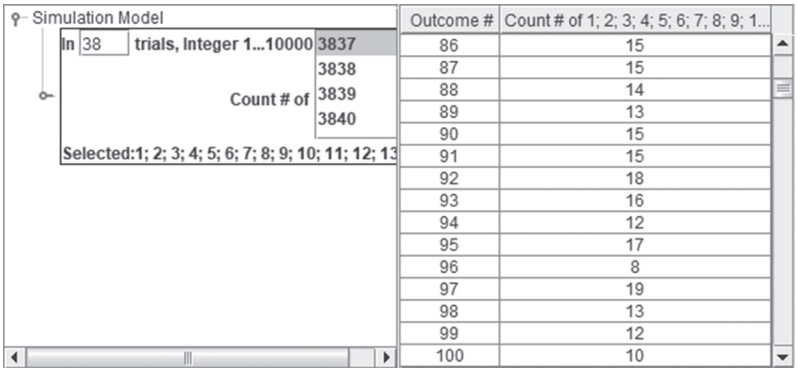
Lesson 2, Option 2: Confidence Interval Simulation

- Have students create a simulation to experiment with how much variation would be expected for a proportion of 4,606 deaths out of 12,000 total deaths.
- Have students look back at the Sampling and Proportion worksheet to determine how many actual deaths were sampled in the study (38). This is the number that each student will sample from a population of 12,000.
- Provide resources or a resource for students to use to simulate the sampling procedure. You may
  - + use technology to randomly assign deaths to the first 4,606 of 12,000 numbers, then randomly sample 38 numbers (deaths) to determine if a selected number is less than or equal to 4,606, labeled as a death related to the hurricane or if the selected number is greater than 4,606, labeled an unrelated death.
  - + use a bag of peas or beans and color code the peas according to the proportion.
  - + use NCTM's Core Math Tools to create a simulation and count the number of deaths related to the hurricane. Using this tool, different samples of 38 each can be created to create a distribution that is easy to relate back to a percent of confidence in the proportion of $\frac{4,604}{12,000}$.
- Given the large population and the small sample from it, sampling with or without replacement is not important. However, teachers may reduce the number of peas, cards, or other random generation needed by ensuring the proportion of $\frac{4,604}{12,000}$ is approximately true with a smaller population and sampling with replacement. Using Core Math Tools, this can be done up to a count of 10,000. The following is a simulation using this tool with a count of $\frac{4604}{12,000} \times 10{,}000 = 3837$ with replacement.



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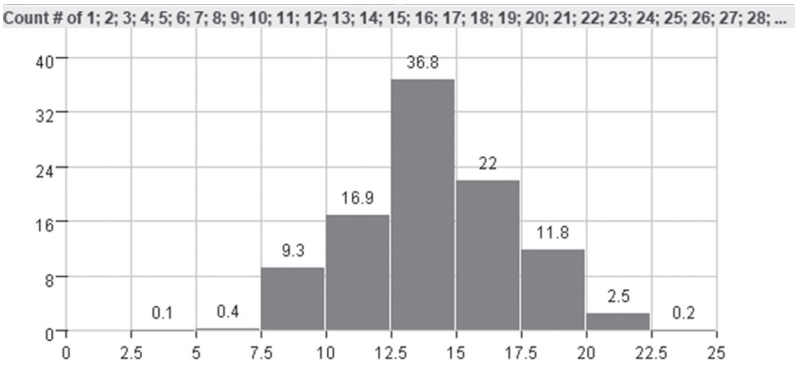

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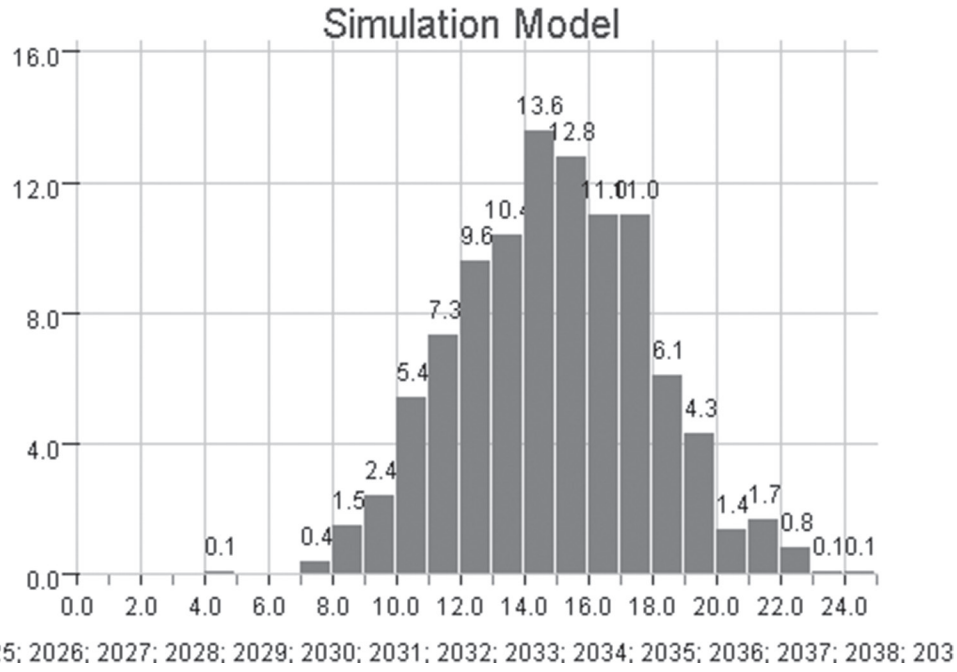
- Have students create a distribution from their samples of 38. The following is a possible distribution from sampling:



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- Ensure students change or create a bin width (size 1) that allows them to disaggregate the count of deaths that were potentially related to the hurricane.
- Using the distribution, students should approximate a confidence interval that includes 95 percent, 90 percent, or other amounts using symmetry. In the above graphic, students would approximate that $\frac{8.5}{38}$ up to $\frac{21}{38}$ deaths contain 95 percent of the sampling distribution and were related to the hurricane.
- Have students relate their proportions back to the actual death toll approximation in the news and the research study. Students should find the proportional amount by $\frac{8}{38} \times 12{,}000 = 2526$ for the lower bound and $\frac{21}{38} \times 12{,}000 = 6632$ for the upper bound.
- Have each group calculate a 95 percent, 90 percent, and 80 percent confidence interval and share how they calculated them.
- Make a table at the board for each group to input their similar confidence interval calculations.
- Facilitate a discussion around why each confidence interval was slightly different based on the simulation.