In volleyball, timeouts are often called by teams when they are losing a set. By analyzing NCAA Division 3 Liberty League Conference Volleyball data from the 2013-2022 seasons, we can examine the impact of calling a timeout on winning a set. This data contains 2781 sets in which a time out was called.

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1. Suppose you are interested in finding out the chance of winning a set if your team was losing before the final timeout of the set.
2. Identify the information you would need from a set to address this question. (These would represent the observations and variables you would need from a data set.)

*We would need to know which team called the last timeout and whether or not they won.*

1. Based on the sample described in the first paragraph, identify a population from which this sample could be considered representative.

*Answers may vary. A feasible answer would be that the teams in the Liberty League could be representative of all Division 3 Volleyball teams. It could possibly be extended to all NCAA indoor volleyball.*

1. Suppose that you are interested in the percentage of times a team wins if they call the final timeout in a set (from the 2781 sets we have data on). Would this quantity be a statistic or parameter? Explain.

*This is a statistic because it is calculated from a sample of data (2013-2022 seasons).*

1. What is a possible parameter that we can learn about based on your answers to b) and c)?

*The proportion of all volleyball sets in NCAA Division 3 where the team that calls the last timeout wins the set. This is a parameter because it represents the characteristic of the entire population of D-3 volleyball sets.*

1. In 222 out of 2781 sets, the team calling the final timeout ended up winning. Given this data, what is our estimate of the team winning a set after they call the last timeout of the match?

*About 8% chance that the team that calls the final timeout wins a set*

1. If we were to take another sample of 2781 sets in which a timeout was called (e.g., perhaps by looking at a different conference), would we necessarily get the same estimate? Briefly explain.

*No, since each sample may vary due to different teams, situations, and strategies during matches. However, with a sufficiently large and random sample, we expect our estimate to be close to the true parameter*.

1. Now, construct a 95% confidence interval for the proportion of team that win a set after calling the final timeout.

*Depending on the method used, answers may slightly vary. The interval below was calculated using the Normal Approximation (without Continuity Correction) via Minitab.*

|  |  |  |  |
| --- | --- | --- | --- |
| **N** | **Event** | **Sample p** | **95% CI for p** |
| 2781 | 222 | 0.079827 | (0.069754, 0.089900) |

1. Provide an interpretation for the resulting interval. Be sure to provide context that someone familiar with volleyball, but not statistics could understand.

*Based on 95% confidence and a sample of 2781 sets, the team calling the final time out of the set only has about a 7.0% to 9.0% chance of winning.*

**Discussion Questions**

1. Brainstorm some ideas as to why the chance of winning after calling the last timeout is so low.

*Answers will vary. Some ideas include*

* *Not much time left to catch up*
* *The weaker team is likely losing anyway*
* *Coaches know they will lose, but are calling timeouts because they feel they should make every attempt to win*
* *Even though the chances of winning are low, calling a timeout may allow for a higher chance of winning the game than if no timeout were called*
* *Teams may be able to better plan and score after a timeout is called, or may gain some momentum for the next set*

1. When looking at only the first timeout of the set, we see that the team that called the (first) timeout has a substantially higher chance of winning the game than they would have after the last timeout. More specifically, the team that called the first time out won 532 of the 2781 sets. (This results in a 95% confidence interval of approximately (0.177, 0.206).) Why do you think that calling the first timeout in a game has a higher chance of winning?

*Calling an earlier timeout allows teams to have more time to make back the points they lost, so it makes sense that the chances of winning would increase if you call timeouts earlier in the game rather than later.*

1. Brainstorm several other research questions related to the impact of timeouts in volleyball that one might be able to address with point-by-point volleyball data.

*Answers will vary. Some thoughts for possible discussion include*

* *What is the chance that the team scores the point after a timeout?*
* *Is there an optimal time to call a timeout?*
* *Does the general strength of the time impact the likelihood that the timeout results in a favorable outcome?*
* *Does the impact of a timeout change based on the level of play? (e.g., NCAA Division 1 vs 2 v s3?)*

*Most of these research questions would require students to completely reanalyze the play-by-play data. Answering them is beyond the scope of this activity.*