
ISyE 2028 – Basic Statistical Methods - Fall 2015

Bonus Project: “Big” Data Analytics

Final Report

What is the average amount of time spent on hold in a phone call in 2015?
Abigail Copeland

My research for this project was focused on estimating and finding a confidence interval for the amount of time a person spends on hold with customer service during a phone call. My interest in this topic began this year when I had to call our internet provider twice -and stayed on hold for quite a while- to get the internet running again, and another time when I was put on hold by the bank when my card was stolen. I have read interesting articles about this topic, (including this one from TIME: <http://business.time.com/2013/01/24/you-probably-spent-13-hours-on-hold-last-year/> , <http://www.dialogtech.com/blog/call-management/why-callers-on-hold-hang-up-on-you-an-ifbyphone-benchmarking-analysis-part-one>, and http://www.soundresultsonhold.com/on_hold_stats_studies.html) some claiming that we will spend over 40 days on hold in our lifetime. Using these average hold times, these articles claim that the companies will hire the minimum number of employees so that, given the calls they expect to receive, the people will need to wait the average amount of time on the phone. There are many surveys and averages about the amount of time spent on phone calls that vary greatly, it will be interesting to see how my survey results compare to those reported by other companies and surveys.

My data source came from an anonymous survey of self-reported hold times, and I obtained a sample size of 52 responses. This data is not readily available due to privacy concerns, which is why there is so much variation in the data that does exist, so I reached out to my peers with a survey. After doing some research, I decided to narrow my scope down to a few questions, “How many minutes did you spend on hold (in one phone call this year)?” and “Did you hang up?”

This is a very specific and small sample, as such there are some flaws in the design that could affect the results of the study. I expected to get from 50-100 responses, and I got 52, just over 50. People may have been more likely to respond if they remember a particularly long time they had to wait. It is a fairly biased survey, with most respondents from the Georgia Tech community, and it shows college student’s experience with calling customer service. It was an anonymous, self-reported survey, which also does not guarantee much accuracy. It was a very broad scope, which could limit practical interpretations of the data. One way to improve this would be to expand the scope and duration of the survey, and trying to get more data from an unbiased, representative sample.

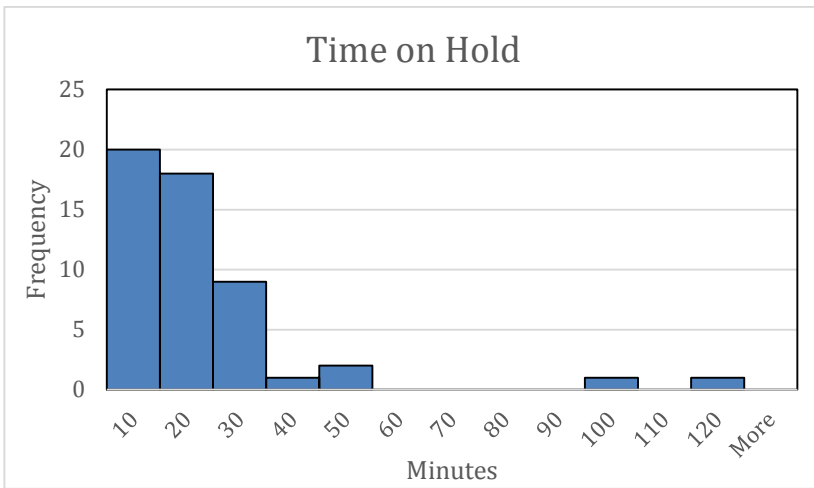
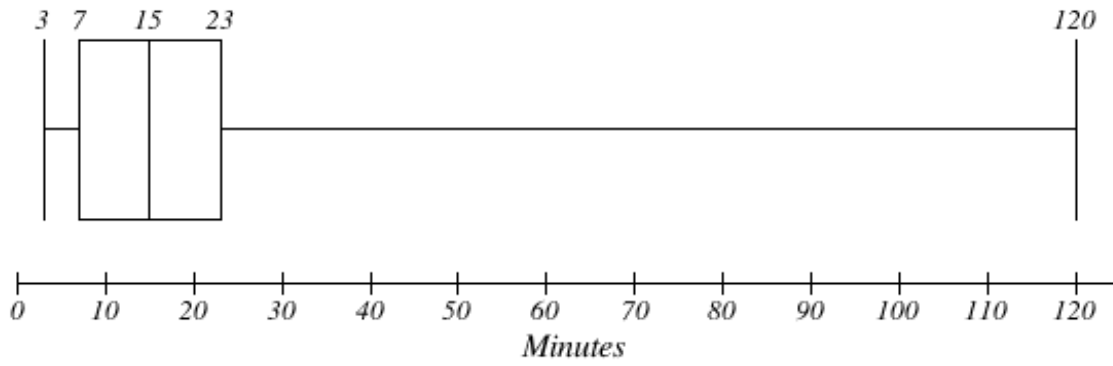
Based on my prior research into this subject, I expected the mean time on hold to be close to or equal to the national average, which is 13 minutes per phone call. The sample mean was 19.5 minutes (and the median is 15 minutes), higher than predicted average, but it is still a reasonable result. There was a very high range of 117, with 2 outliers of times above 100 minutes, with the rest of the data gathered in the 3-30 minute range. The Interquartile Range was quite small, 16 minutes, was as a result of most of the data being very close together. These outliers greatly affected the variance and standard deviation, which were 431.9 and 20.17, respectively.

As a secondary question, I asked about whether or not the people hung up while on hold. There was little correlation between how much time was spent on hold and whether the people hung up, about 40% hung up, with times ranging from 7 to 120 minutes before they hung up.

Graphical and Numeric Summaries

Numerical Summary	
Mean	19.52
Standard Deviation	20.17
Variance	431.9
Range	117
IQR	16
Min	3
Q1	7
Median	15
Q3	23
Max	120

Boxplot: Minutes on hold, per phone call



Confidence Intervals

I developed two-sided Confidence Intervals for the mean with unknown variance using the formula:

$$\mu = [\bar{x} - t_{\alpha/2, n-1}(S/\sqrt{n}), \bar{x} + t_{\alpha/2, n-1}(S/\sqrt{n})] \quad S=20.17, n=52, \bar{x}=19.52$$

$$95\% \text{ Confidence Interval, } \alpha = .05 \quad [13.901, 25.139]$$

$$99\% \text{ Confidence Interval, } \alpha = .01 \quad [12.03, 27.01]$$

Hypothesis Testing

I also conducted a Hypothesis test on the mean using $\mu_0 = 13$ minutes from some of my research.

Parameter of interest: mean, μ

Null and Alternative Hypothesis: $H_0: \mu = 13$
 $H_1: \mu > 13$

Test Statistic: $t_0 = (\bar{x} - \mu)/(S/\sqrt{n}) = 6.52/2.797 = 2.33$
 $S=20.17, n=52, \bar{x}=19.52, \mu_0 = 13$

Rejection region: $t_0 > t_{\alpha, n-1}$.

Computations: When α is set to .05, $t_{\alpha, n-1} \approx t_{.05, 50} = 1.676$
 $t_0 > t_{\alpha, n-1}$? $2.33 > 1.676$,

Conclusion: The Null Hypothesis was rejected.

Works Cited

- Cole, Olivia. "Why Callers On Hold Hang Up on You: An DialogTech Benchmarking Analysis." *DialogTech*. N.p., 31 July 2013. Web. 29 Oct. 2015.
- "Telephone On Hold Statistics." *Sound Results on Hold*. N.p., n.d. Web. 29 Oct. 2015.
- Tuttle, Brad. "You Probably Spent 13 Hours on Hold Last Year | TIME.com." *TIME*. N.p., 14 Jan. 2013. Web. 29 Oct. 2015.