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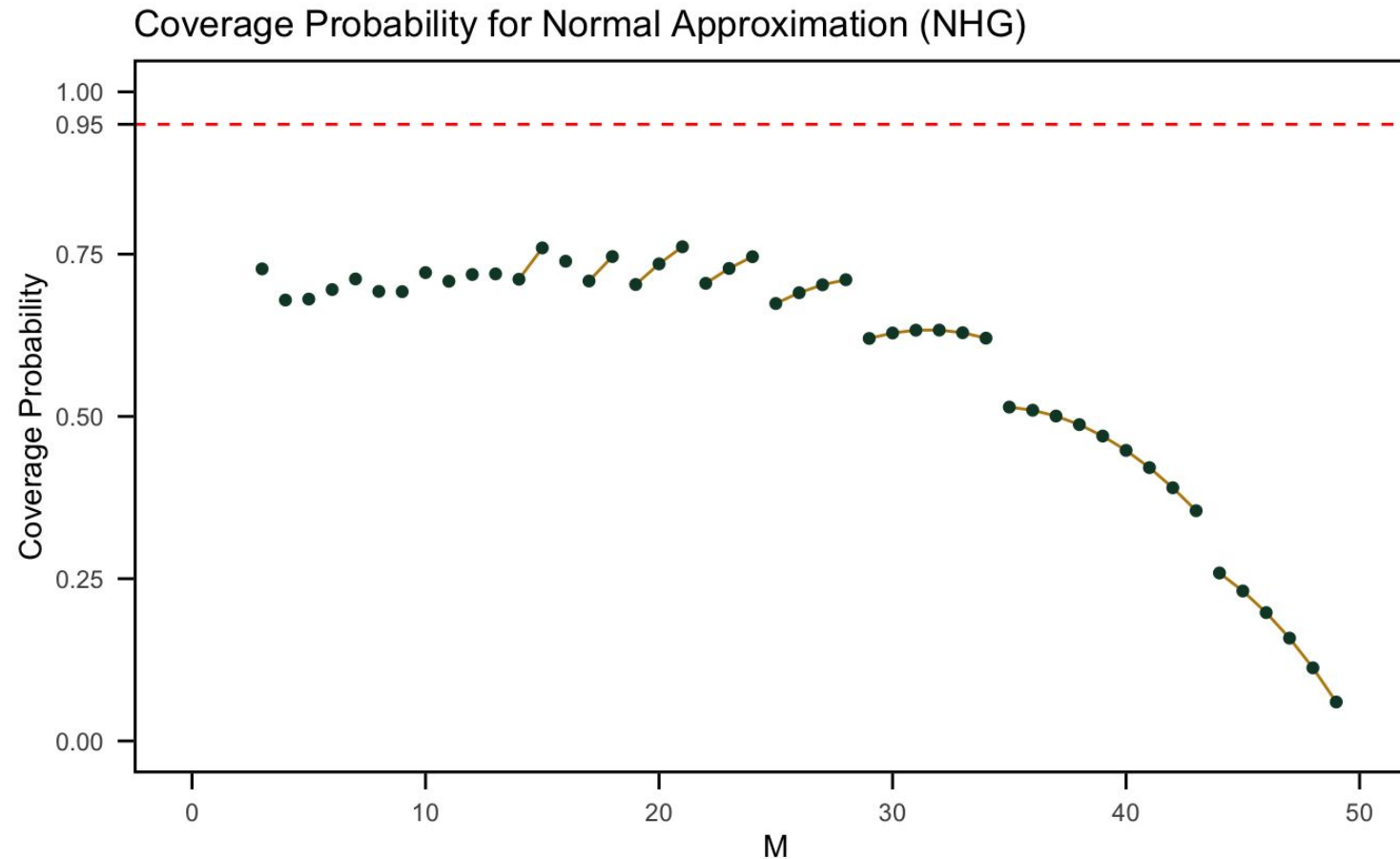
Contributions to Confidence Intervals for Parameters of Discrete Distributions

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Motivation



Large sample methods commonly used in practice often exhibit poor coverage for any discrete distribution.

Poisson

- CMC is new and has not been considered

Negative Hypergeometric

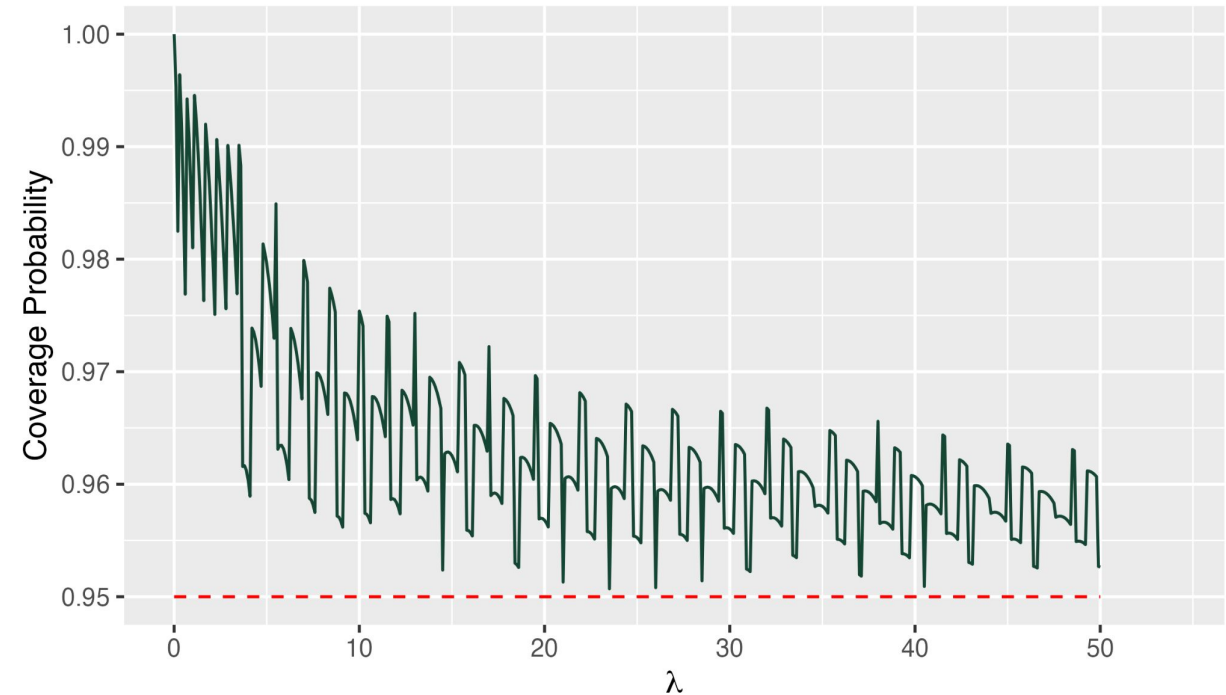
- Largely overlooked with minimal existing research and no exact methods available

Why is this research important?

Goal:

- Provide a Shiny app that is:
 - free for the general public
 - makes the newer, **better** methods accessible
 - is easy to use!

Coverage Probability for the Clopper-Pearson Method
for values of the Poisson mean parameter up to 50



Application for Poisson

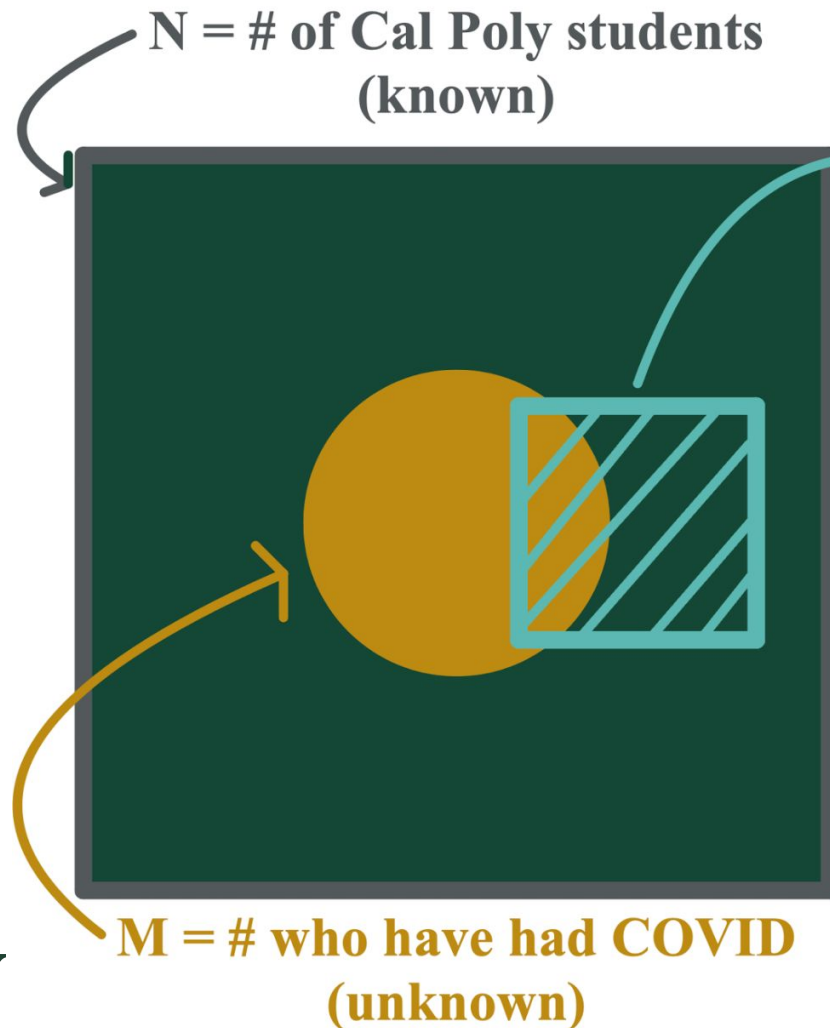
Meteors

- Data: Total number of larger meteors that hit Earth's surface (meteorites) over some period of time.
- Want to estimate: the average number of meteorites that hit Earth's surface over the same length of time.



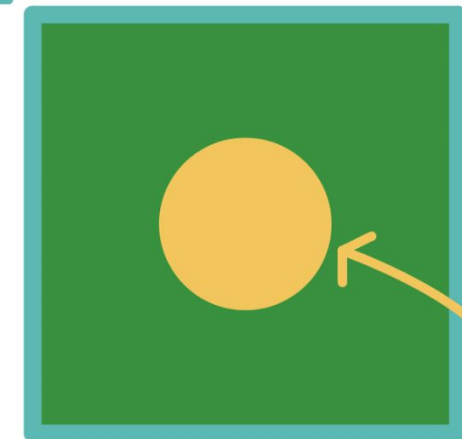
Application for Negative Hypergeometric

Population:



Sample:

$x = \#$ non-COVID
observed until
 m successes
(observed)



$m = \#$ who have
had COVID /
successes
(fixed)

Shiny App Demo



Poisson

https://s630ps-hpawig.shinyapps.io/Poisson_CI_Generator/

NHG

https://s630ps-rroggenk.shinyapps.io/NHG_CI_Generator/

Poisson Confidence Interval Generator

Select a Confidence Procedure

Wald

Specify Confidence Level %

80 95 99

Enter observed x

10

*Note: x must be an integer representing the number of total observed events over the time period of interest

Options

☐ Display intervals up to observed x

Choose up to 4 decimal places

2

Submit

Inputs

method: Wald (1812)
x-input: 10
confidence level: 95%

Confidence Intervals

x	lower	upper	interval
10	3.80	16.20	(3.8, 16.2)

Want the confidence interval for mean? Divide the confidence limits by the sample size n

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Results & Conclusions

Comparative Analysis: Expected Width & Average Width

Distribution	Poisson	NHG
<i>Exact Methods</i>	Analog to Clopper-Pearson (1934)	Analog to Clopper-Pearson (1934)
	Modified Sterne (2014)	Modified Sterne (2014)
	Crow & Gardner (1959)	Crow & Gardner (1959)
	Byrne & Kabaila (2005)	Byrne & Kabaila (2005)
	Blaker (2000)	Blaker (2000)
	Conditional Minimal Cardinality - CMC (2023)	Conditional Minimal Cardinality - CMC (2023)



Future Work

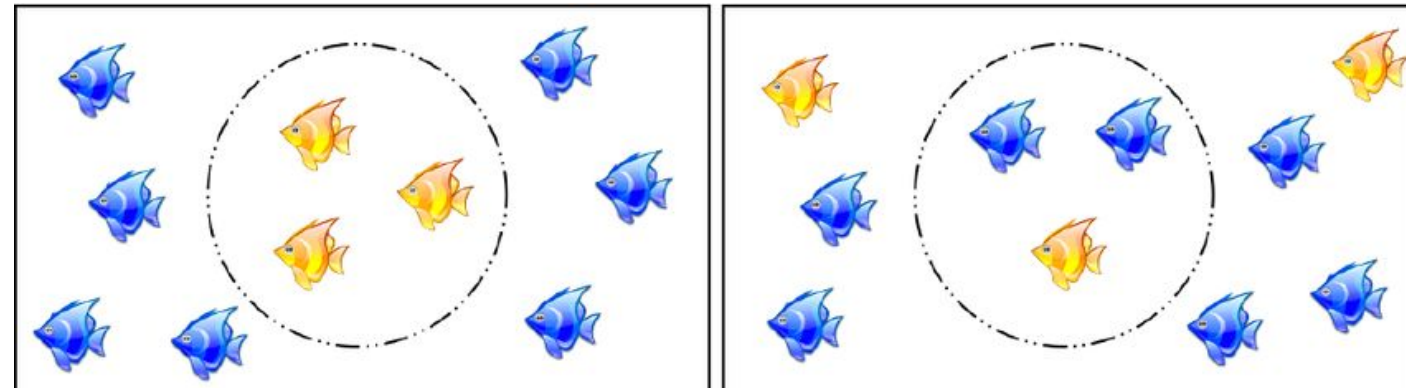
Poisson

- R package with all Poisson confidence procedures
- Comprehensive comparisons of CMC and CG



NHG

- Comprehensive comparison of MST and CMC, using larger collection of N , m pairs when M is unknown
- NHG with N as unknown parameter
- R package
- Publish



Thank you!



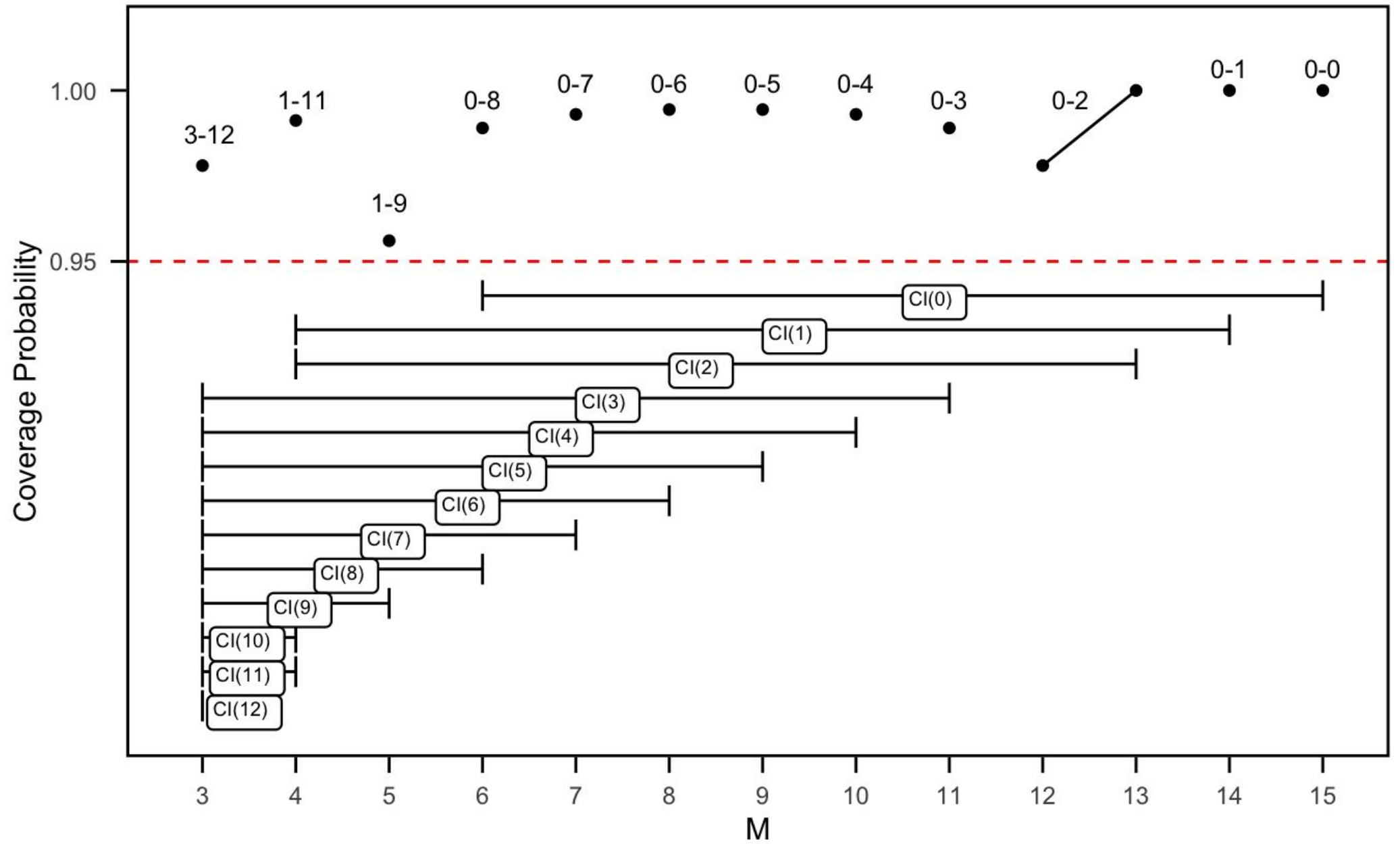
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**Thank you to our faculty advisor:
Dr. Bret Holladay!**



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Strict Methods Comparison: Expected Length

Relative Exp. Length to CMC Method (2023)

