

# This presentation premiered at WaterSmart Innovations

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# Small Customer Meter Testing

Water Smart Innovations 2019

# W S O



**WATER SYSTEMS OPTIMIZATION**

# Outline

- AWWA Auditing Methodology
- Data Set Overview
- Sampling Simulation
- Impact on Audit Results
- Age vs. Accuracy
- Summary & Q/A



“...require each urban water supplier to sample and test its customer service meters to produce a **statistically sound** estimate of the accuracy of the urban water supplier’s meter fleet.”

- AB 3206

**How many small customer meters do you need to test?**

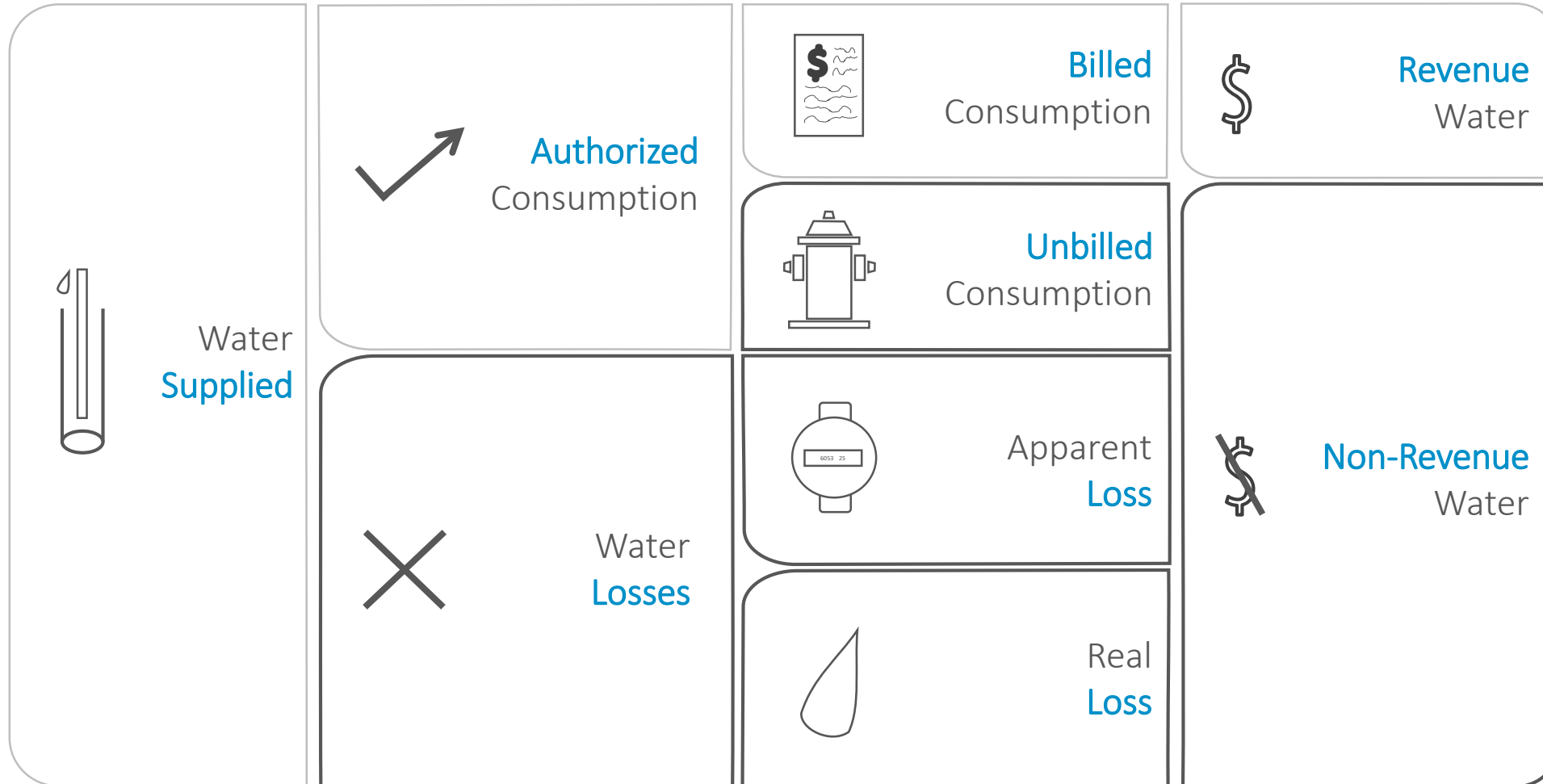
- 1. Evaluate the level of certainty required to meet management objective.**
- 2. Select a sample size that provides the required level of certainty.**



# Review of AWWA Water Audit Methodology

The water balance

# AWWA Water Balance



# Real vs. Apparent Losses

## Total Water Losses



### Apparent Losses

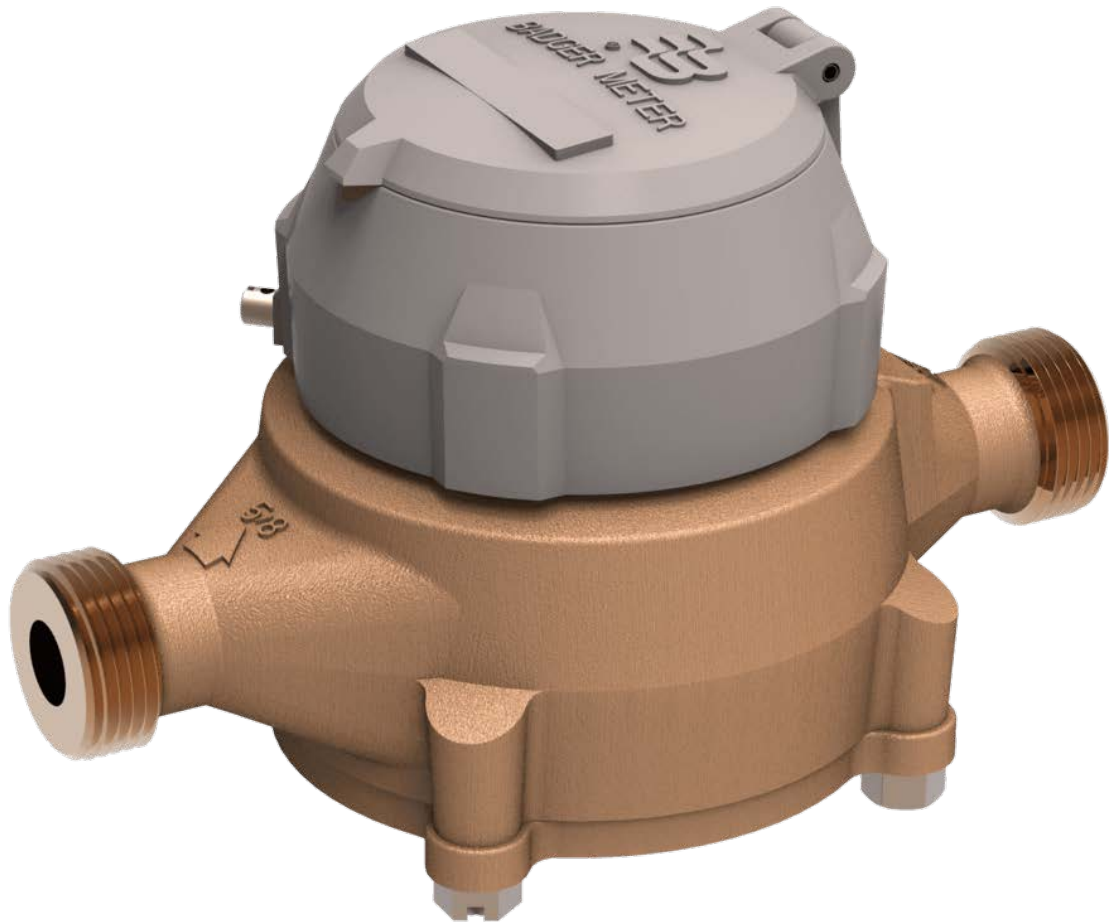


### Real Losses



Vs.



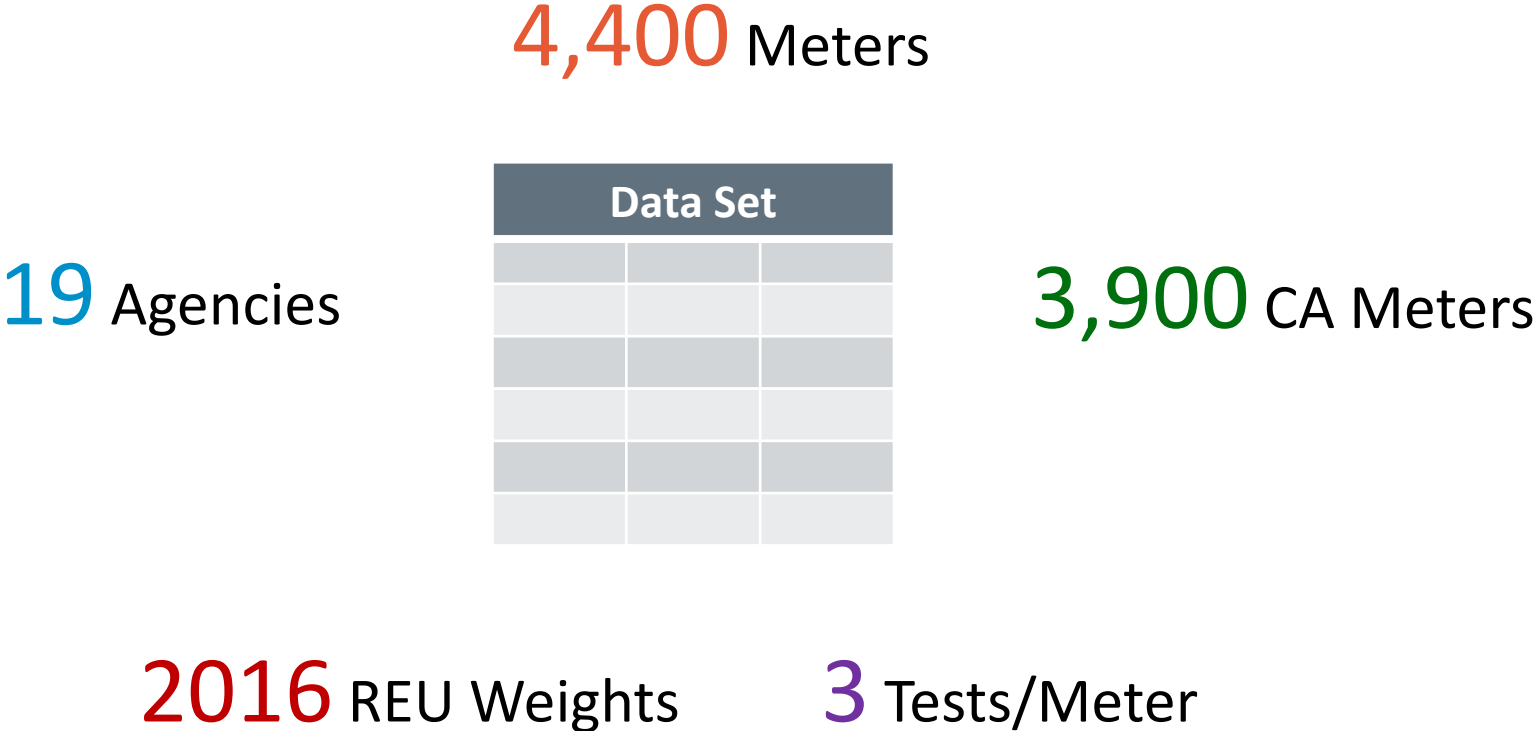


## Data Set Overview

Small customer meter test results

# Data Set Overview

## Random and Representative Small Meter Test Results

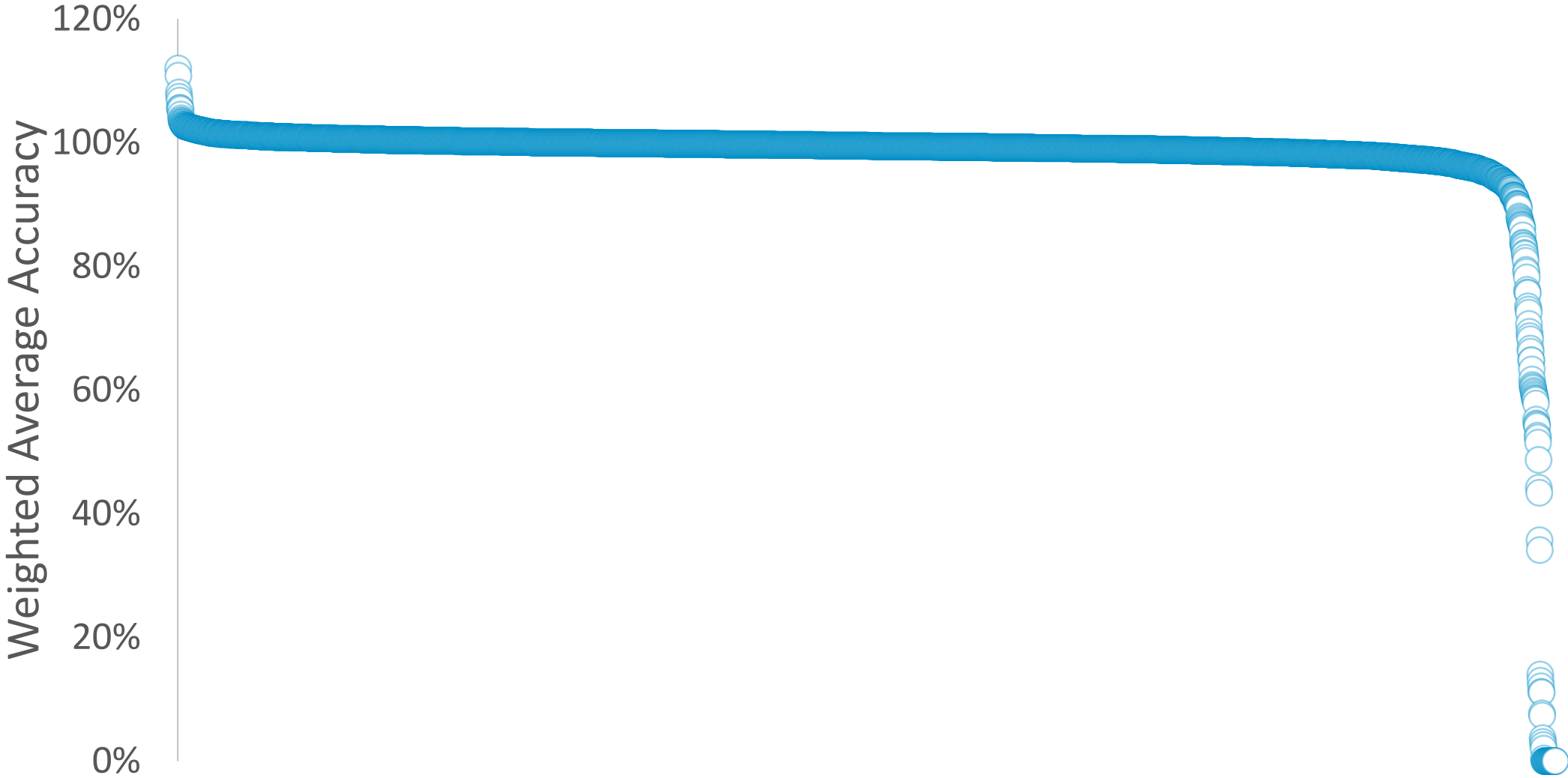


# Small Meter Weighting Factors

<b>Average of All Data Sets, % of Flow at Existing AWWA M6 Manual Minimum, Intermediate, &amp; Maximum Test Flow Rates for 5/8" Meters</b>	
<b>11.58%</b>	<b>% of Flow between 0 and 1/4 gpm</b>
<b>33.79%</b>	<b>% of Flow between 1/4 and 2 gpm</b>
<b>53.86%</b>	<b>% of Flow between 2 and 15 gpm</b>
<b>99.24%</b>	<b>Total</b>

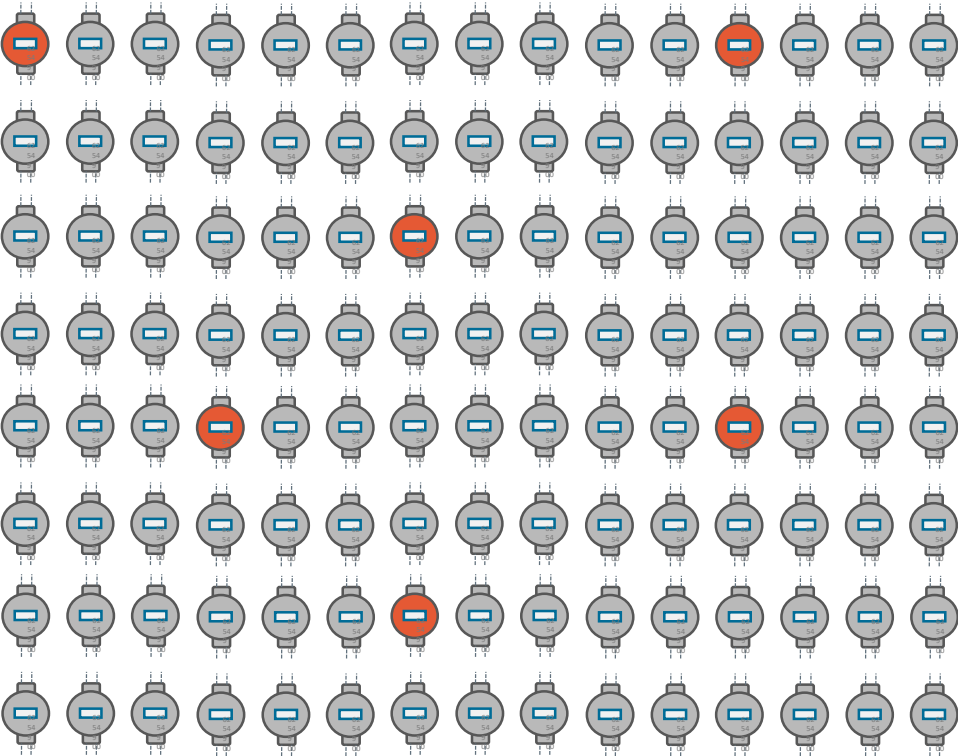
\*CREDIT: ACE 2017 Presentation of Residential Water Use Patterns 2016: Craig C. Hannah, P.E., Jonathan G. Gunn, EIT, and Robert J. Bowen

# Customer Meter Accuracy Distribution

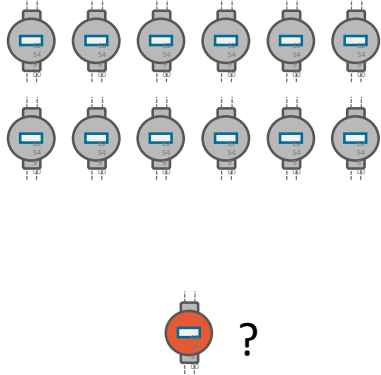


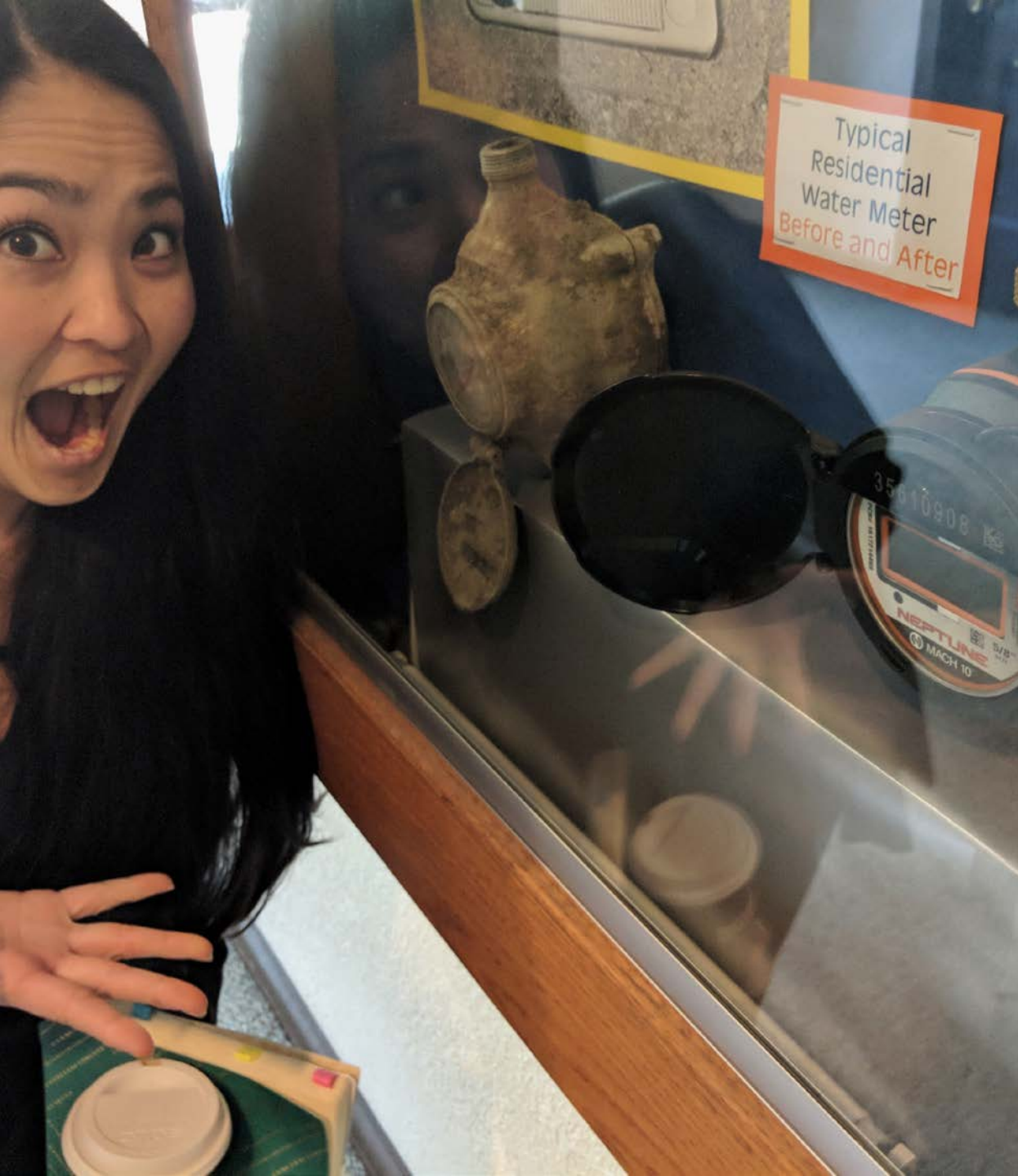
# Estimating Customer Metering Inaccuracy

Meter Population



Sample

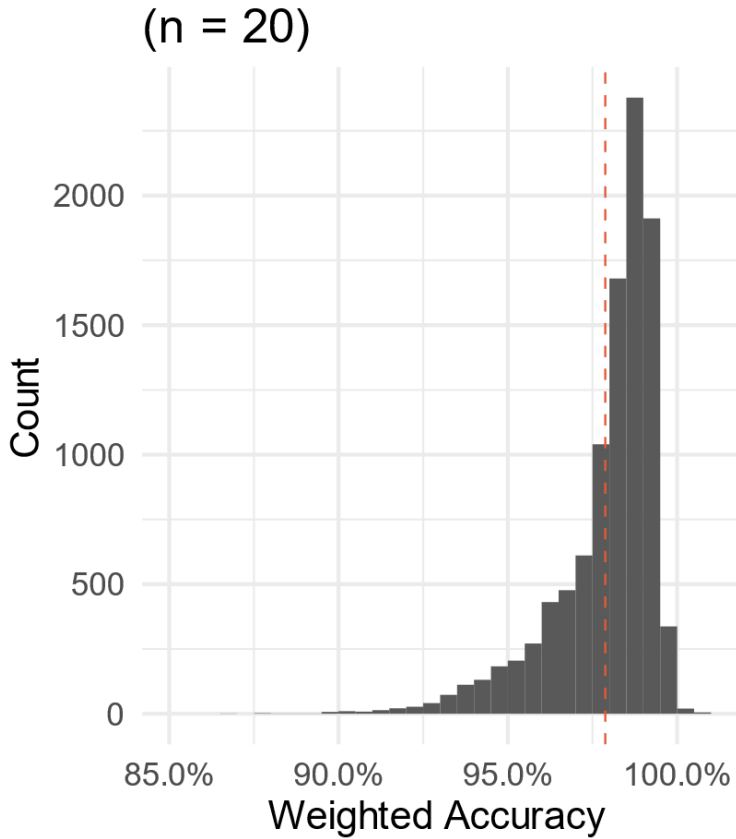




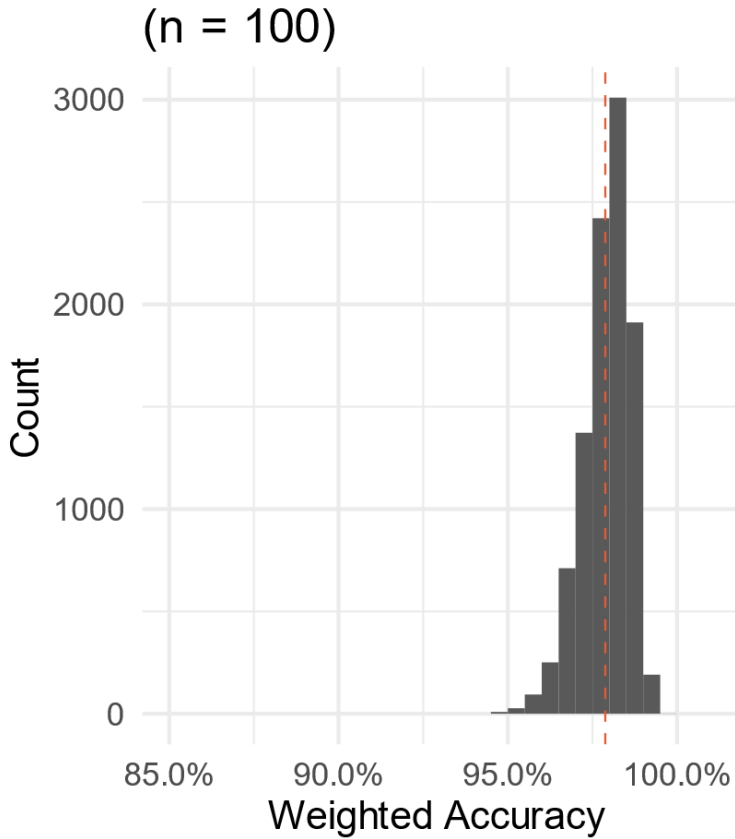
## Sampling Simulation

It's not that complicated!

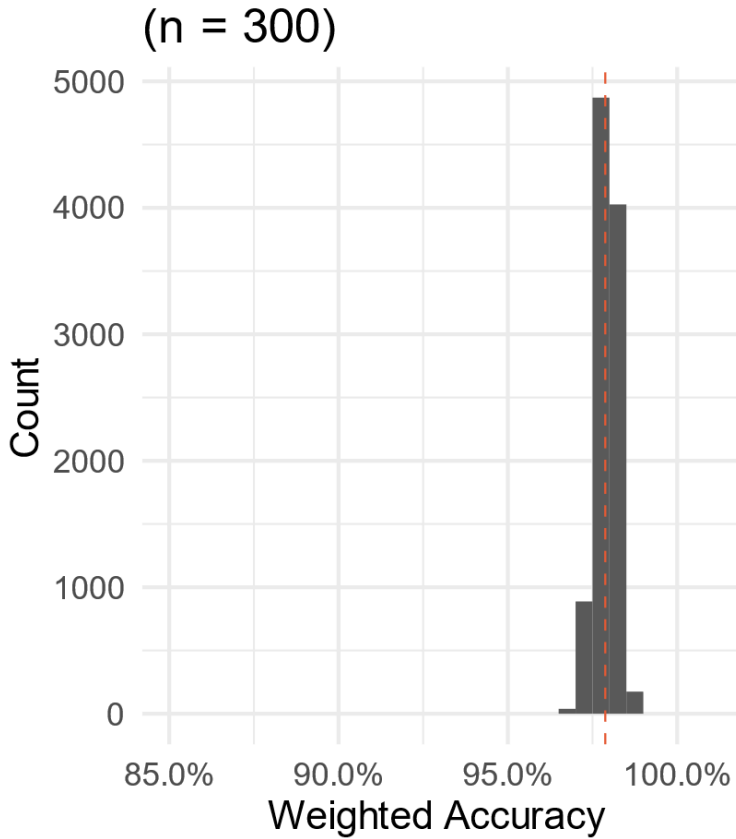
# Impact of Different Sample Sizes



**93.7% - 99.6%**

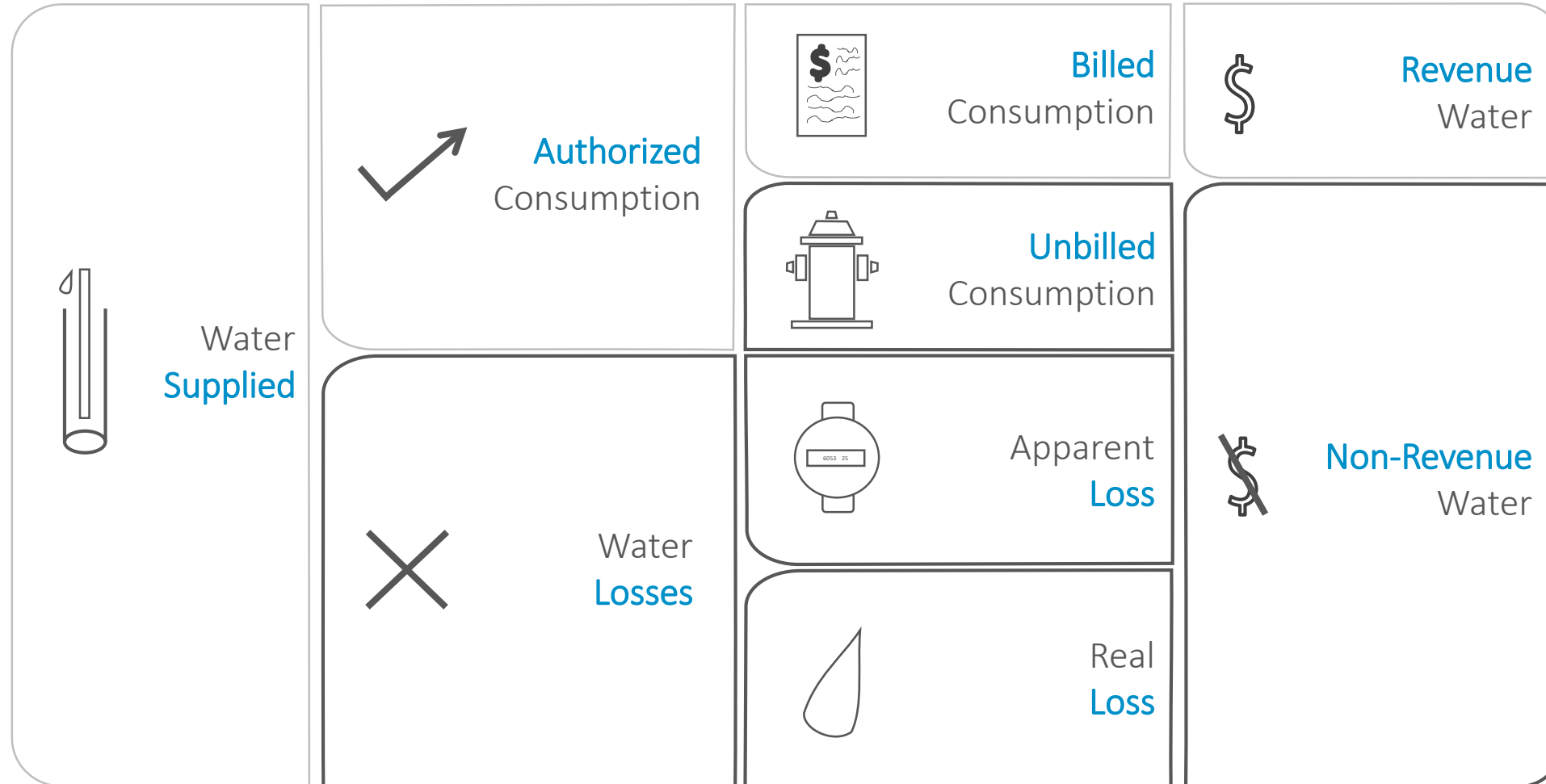


**96.3% - 99.0%**



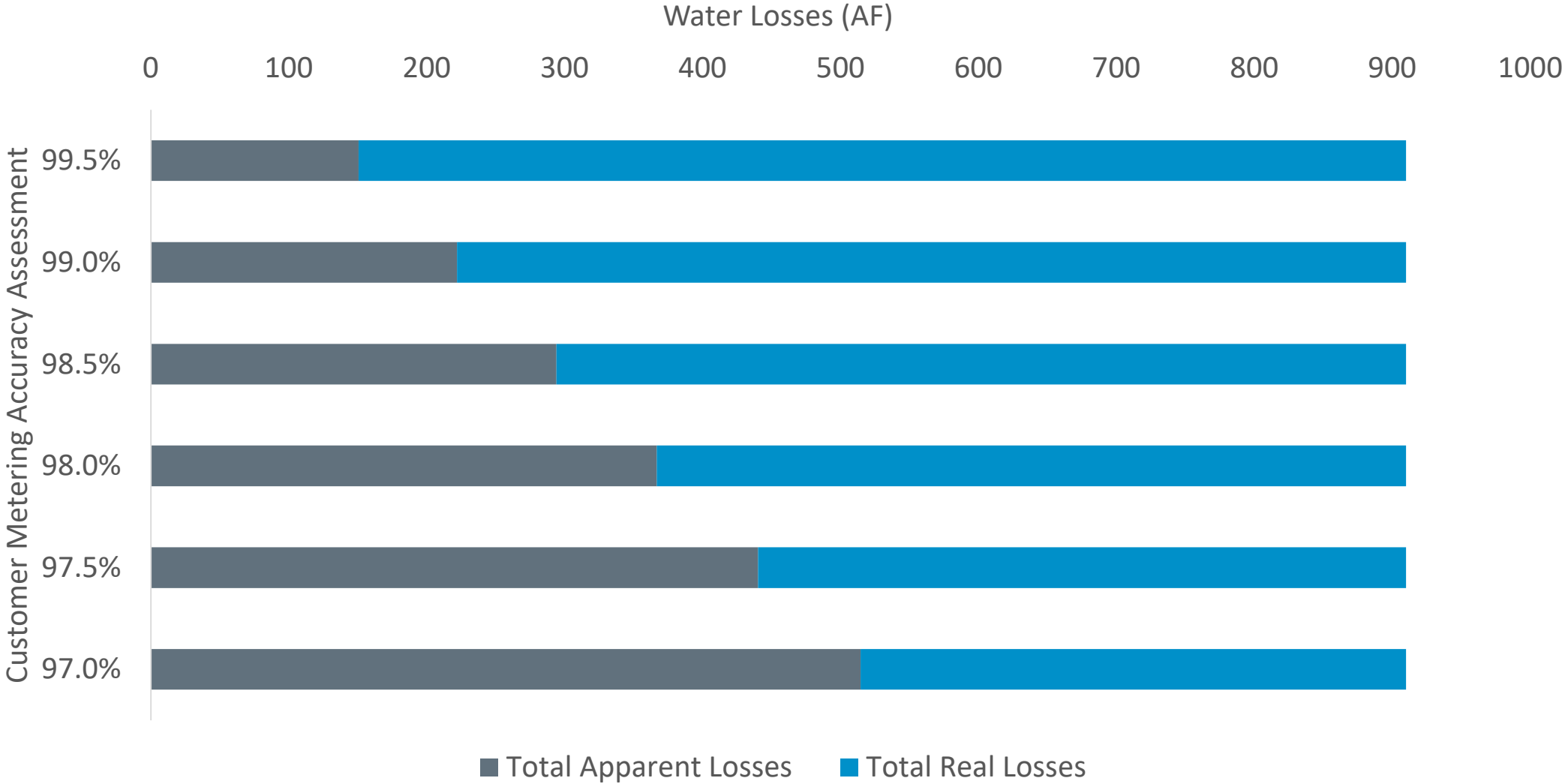
**97.0% - 98.6%**

# AWWA Water Balance



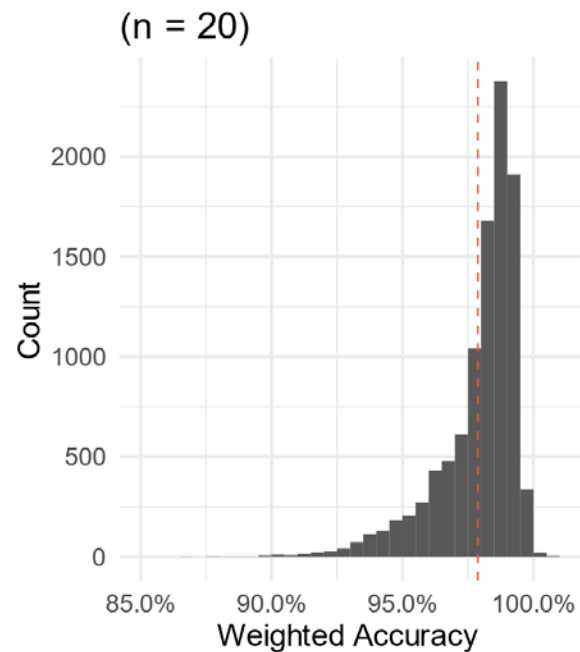


# Impact of Uncertainty on Audit Results

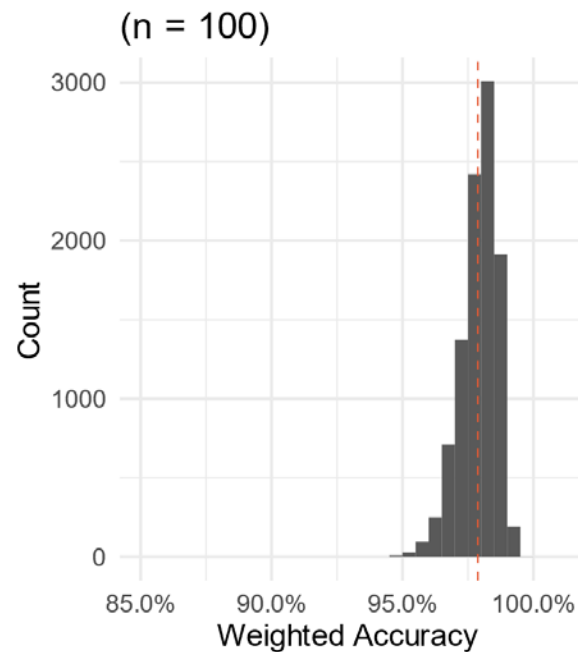


**1. Evaluate the level of certainty required to meet management objective.**

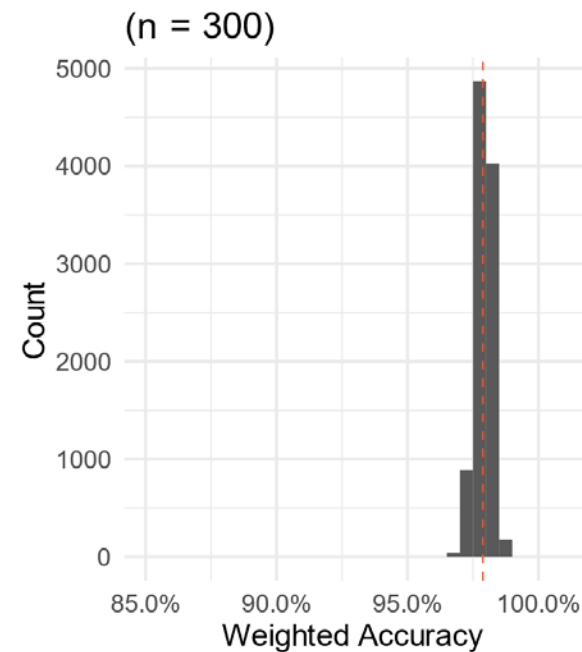
**2. Select a sample size that provides the required level of certainty.**



**93.7% - 99.6%**

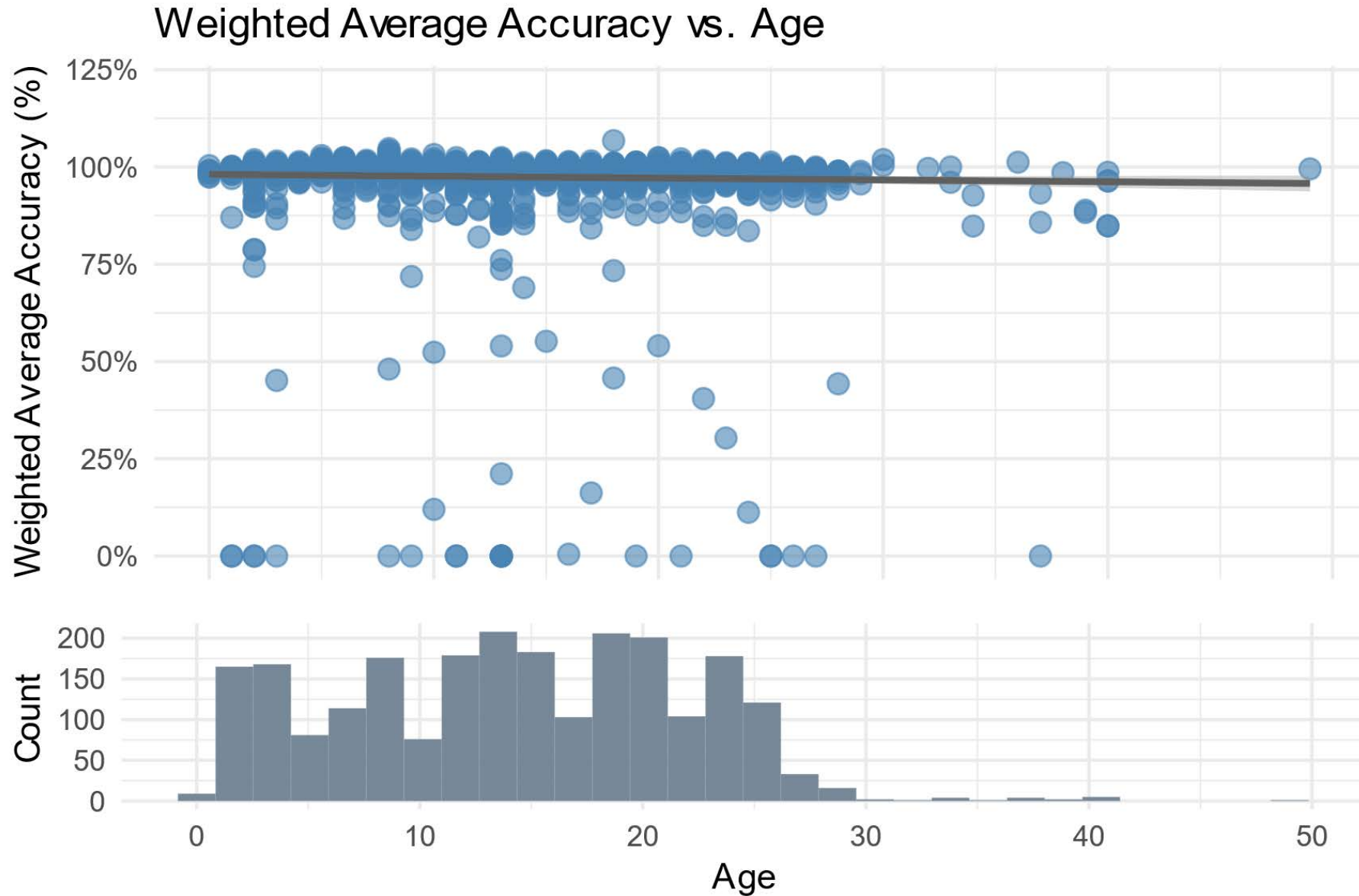


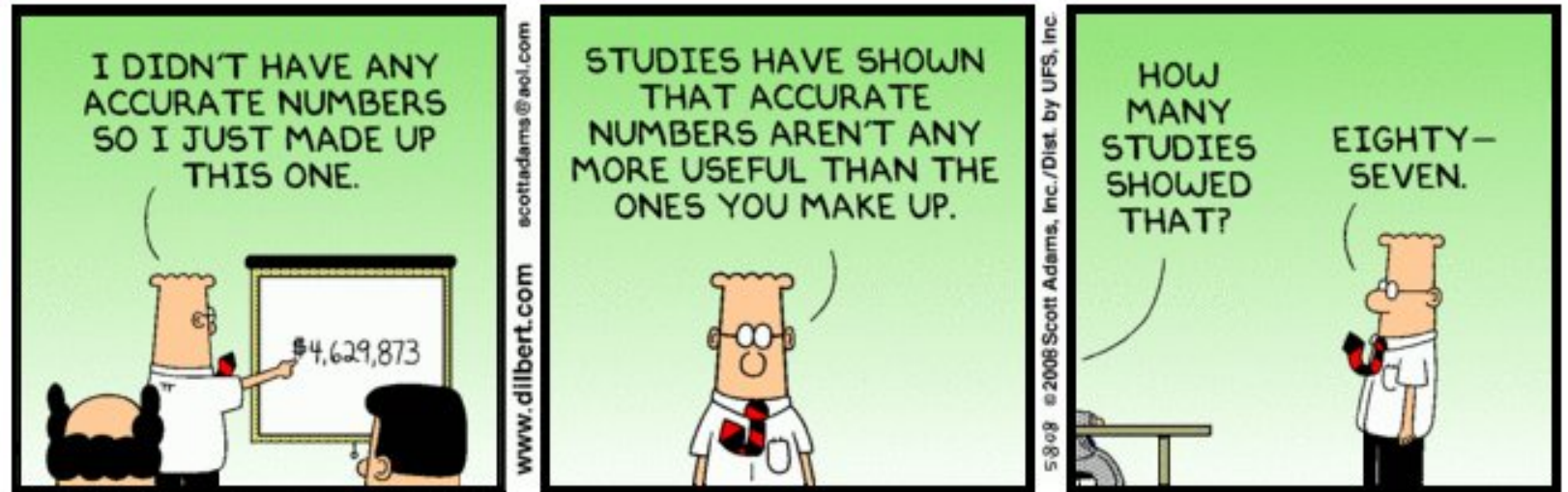
**96.3% - 99.0%**



**97.0% - 98.6%**

# Accuracy and Age





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# Questions?

Kris Williams

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# Confidence Limits

## 95% Confidence Limits for Various Sample Sizes

