
# Beyond the Build—Model Implementation and Monitoring

CAS Webinar Series

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# About the Presenters

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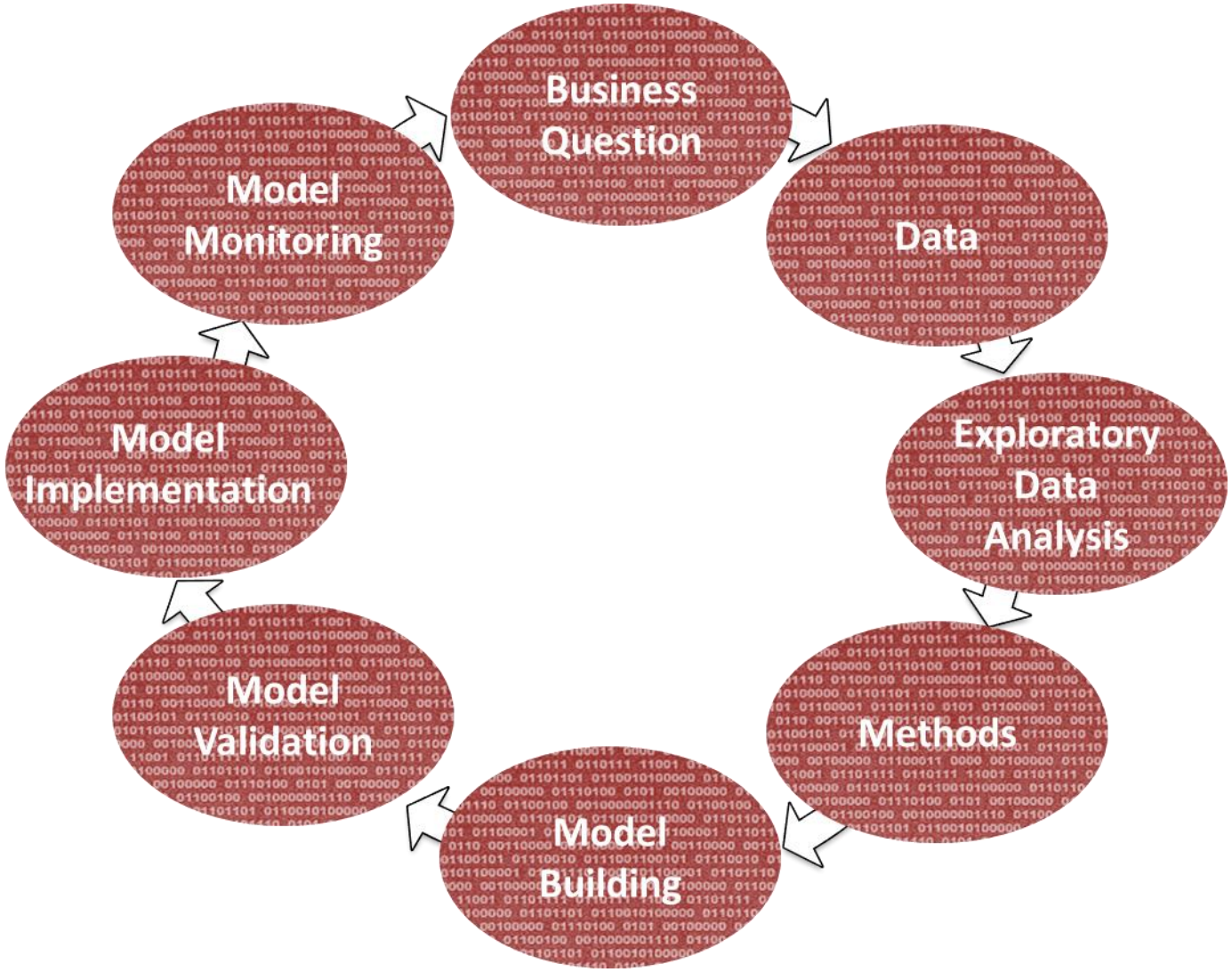
- Senior Consulting Actuary
- Bloomington, Illinois

# Agenda

- Overview of modeling lifecycle
- Implementation considerations
- Model monitoring
- Additional considerations
- New skills needed

# Modeling Lifecycle




- Many uses of analytics/modeling for insurance
- Opportunity to utilize data more fully to address business challenges

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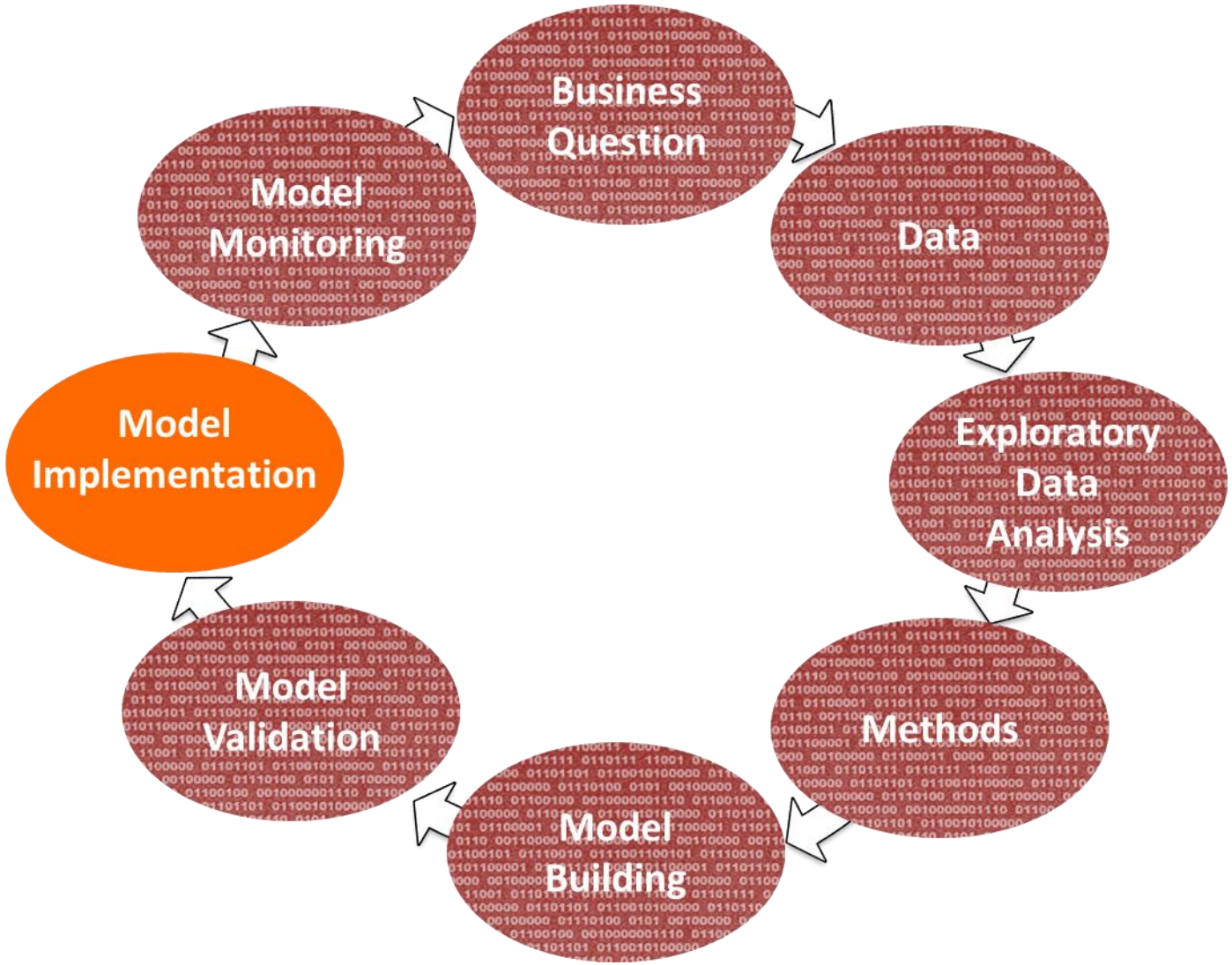
# Model Implementation

# Modeling Lifecycle

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# Implementation Considerations

- Business considerations
- Technical considerations
- New skills required

# Business Implementation Consideration #1

- Securing funding and resources
- Getting buy-in

# Business Implementation Consideration #2

- Who is the decision maker(s)?

# Business Implementation Consideration #3

- Production model vs. pure research
- Conflict of the I's—innovation vs. implementation

# Business Implementation Consideration #4

- To file or not to file? (Or, what to file)?
- Confidentiality

# Business Implementation Consideration #5

- Who is going to use the model?
- End users/change management

# Business Implementation Consideration #6

- Applicable laws, regulations, and bulletins

# Business Implementation Consideration #7

- Decision vs. recommendation

# Business Implementation Consideration #8

- All models are wrong, but some are useful….

# Implementation Considerations—Business

- Additional thoughts from the audience?

# Technical Implementation Consideration #1

- Checking, peer review, and model validation

# Technical Implementation Consideration #2

- Third party validation

# Technical Implementation Consideration #3

- Pre-implementation testing
- Post-implementation testing

# Technical Implementation Consideration #4

- Software used/IT considerations

# Technical Implementation Consideration #5

- Bug fixes/resolution of issues

# Technical Implementation Consideration #6

- Ongoing quality control

# Implementation Considerations—Technical

- Additional thoughts from the audience?

# Regulatory and Professional Considerations

- NAIC CASTF White Paper
- ASOP 23 – Data Quality
- ASOP 41 – Actuarial Communications
- ASOP 56 – Modeling

# NAIC CASTF White Paper

- Casualty Actuarial and Statistical Task Force (CASTF)
- “Regulatory Review of Predictive Models”
- Identifying best practices to guide state insurance departments in their review of predictive models for underlying rating plans

# NAIC CASTF White Paper

- Other Considerations section:
  - "Provide guidance, research tools, and techniques for regulators to **monitor** consumer market outcomes resulting from insurers' use of data analytics underlying rating plans."
  - Actual market outcomes may differ from those intended

# ASOPs

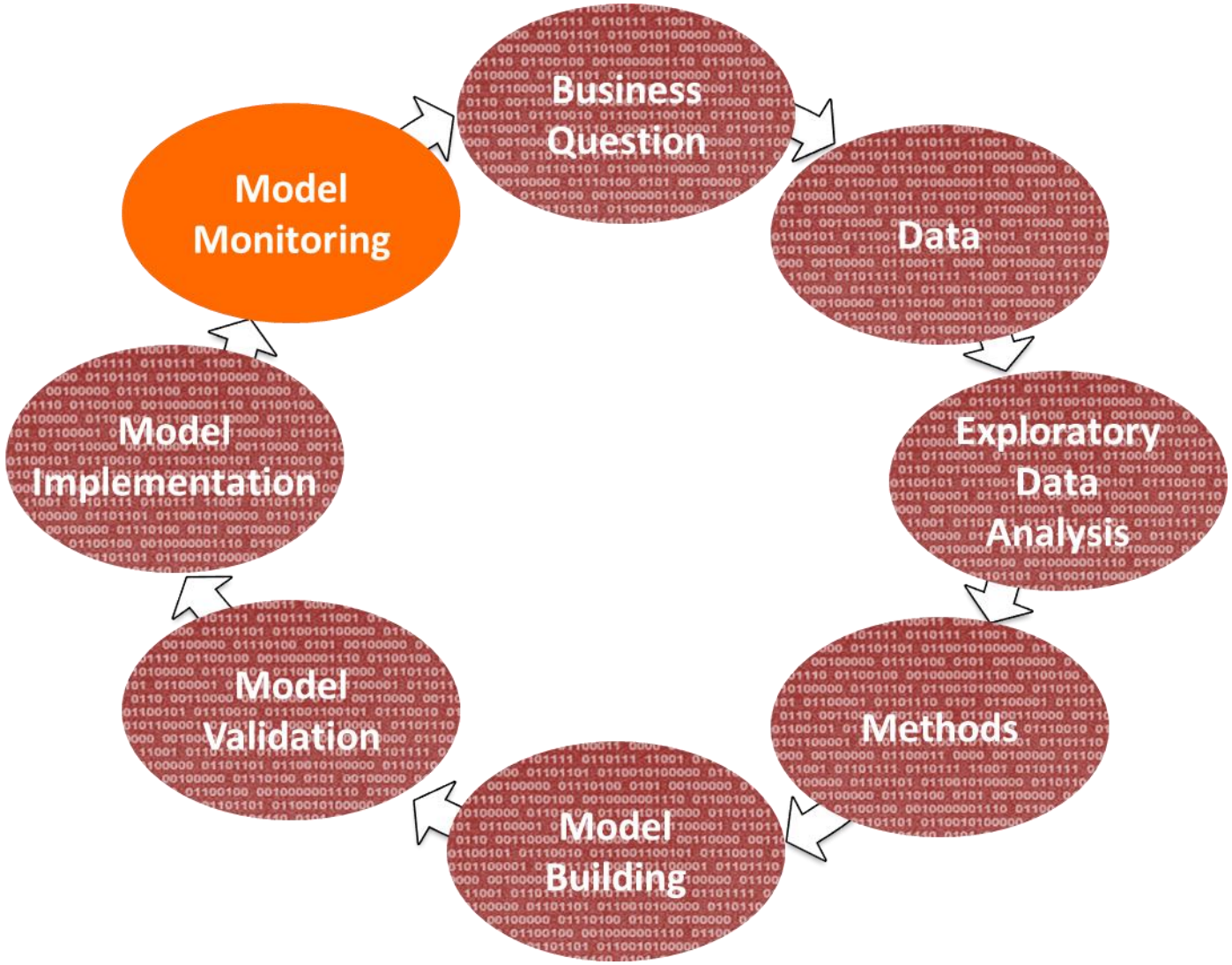
- ASOP 23 – Data Quality
- ASOP 41 – Actuarial Communications
- Should be considered with implementation and modeling work

# Modeling ASOP (#56)

- Adopted December 2019
- Effective for work October 2020 and later
- Data refers back to ASOP 23
- Not a specific mention of “monitoring” but controls for model risk

# Model Monitoring

# Modeling Lifecycle

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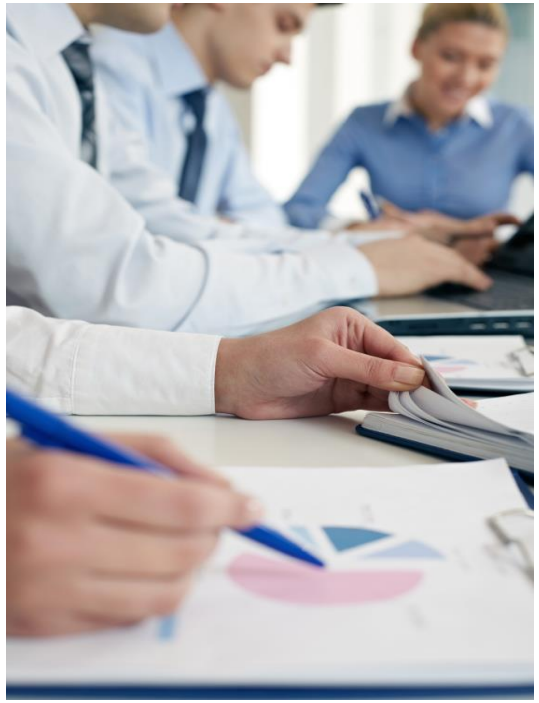
# Model Monitoring

- Two aspects of monitoring: accuracy and business outcomes desired
  - Business is trying to accomplish something, monitoring is to see if you are doing that
  - Want to monitor inputs and outputs

# Model Monitoring

- Need to have
  - The right focus on monitoring
  - The right people
  - The right tools



# Model Monitoring

- Suggest starting small and building up—focus on final outcome
- Setting tolerances can streamline the monitoring process
- Goal is to look at more without having a person do so
- Actions taken if out of tolerance

# Model Monitoring

- Case #1—Data Stops Coming Through to Model
  - Not always apparent in results
  - Need to be monitoring inputs and outputs

# Model Monitoring

- Case #2—Changes Elsewhere
  - Insurer systems can be complex and intertwined
  - A change made can impact something “unrelated”

# Model Monitoring

- Case #3—Data Shifts
  - Internal data can change
  - External data can change

# Model Monitoring

- Case #4—Population Shifts
  - New business written can shift
  - Book of business renewing can shift

# Model Monitoring

- Case #5—Model Degrades
  - Model ages and loses power
  - Data can be fine
  - Many ways to monitor performance—what was expected?

# Model Monitoring

- Case #6—New Business is Unexpected
  - New business written can often be different than expected (different than development dataset)
  - Don't have good or full new business sample
  - Marketing focus can change
  - External/environmental factors cause a shift

# Model Monitoring

- Case #7—Underwriting Guidelines Change
  - Rating and Underwriting must communicate
  - Can impact business written or renewed
  - Model still may be working well!

# Model Monitoring

- Case #8—Distribution Shifts
  - Business is not changing but characteristic shifts
  - Deductibles, amounts of insurance, value/years of cars, etc.
  - Can trigger alerts but not necessarily be a model issue

# Model Monitoring Use Cases

- Additional thoughts from the audience?

# Model Monitoring

Techniques

# Model Monitoring—PSI

- Population Stability Index (PSI)
- Measure how much a variable's distribution has changed
- PSI = ∑ ((%Actual - %Expected) x ln(%Actual / %Expected))

  - <0.1 => Very slight change
  - 0.1 – 0.2 => Minor change
  - >0.2 => Significant change

# Model Monitoring—PSI

- Population Stability Index (PSI)

| Age Group | Initial Percent | New Percent | PSI |
|---|---|---|---|
| 16-20 | 1.5% | 1.8% | 0.0005 |
| 21-25 | 2.3% | 2.7% | 0.0006 |
| 26-29 | 1.8% | 3.0% | 0.0061 |
| 30-39 | 14.0% | 17.0% | 0.0058 |
| 40-49 | 25.0% | 22.6% | 0.0024 |
| 50-59 | 22.3% | 19.4% | 0.0040 |
| 60-69 | 17.8% | 15.5% | 0.0032 |
| 70-79 | 9.6% | 12.3% | 0.0067 |
| 80-89 | 3.2% | 2.5% | 0.0017 |
| 90+ | 2.5% | 3.2% | 0.0017 |
| Total | 100.0% | 100.0% | **0.0329** |

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# Model Monitoring—Dispersion

- Can use standard deviation or variance of a sample
- A way to identify if values of inputs or outputs are further than expected from historical

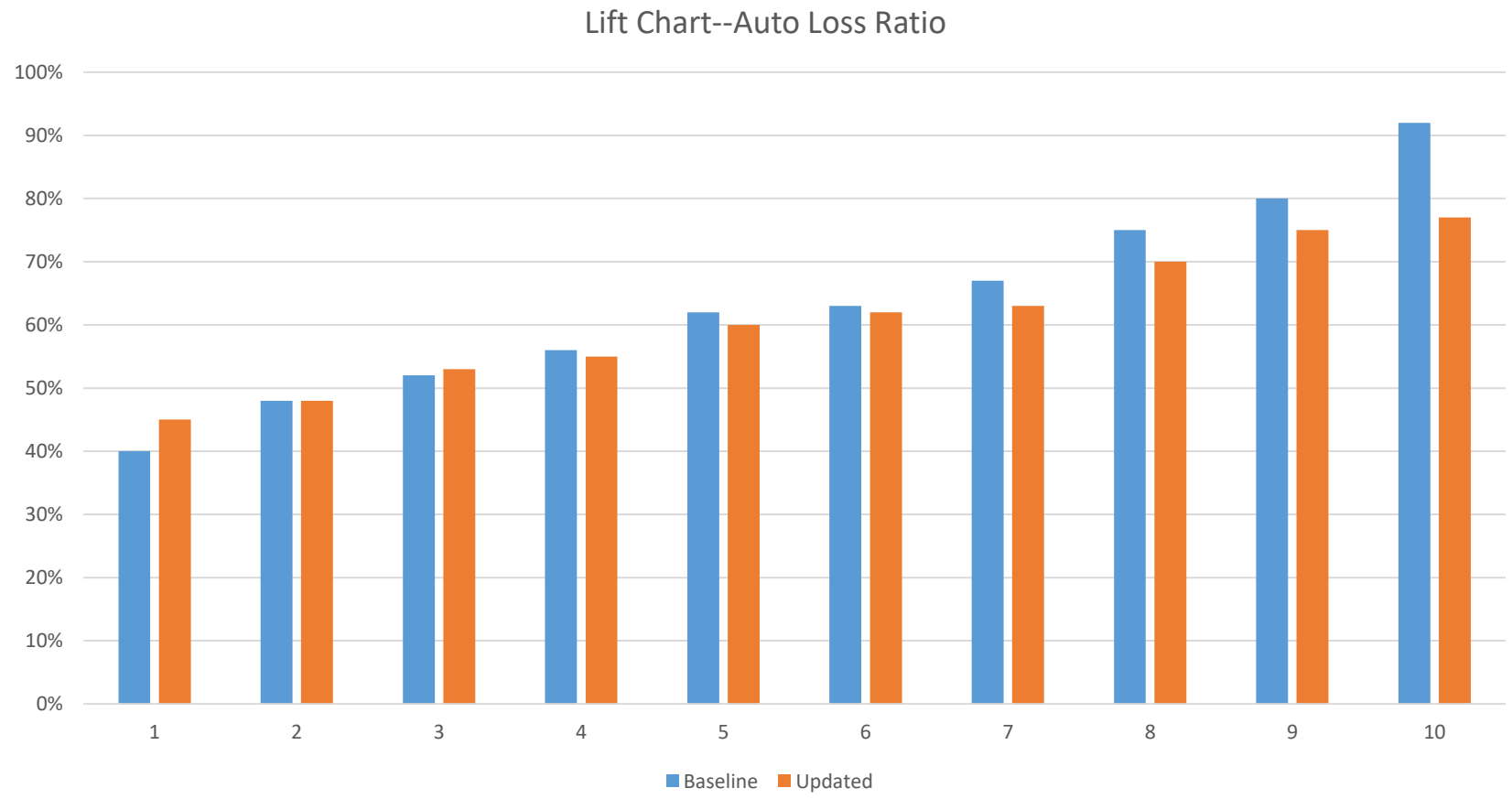
# Model Monitoring—Metrics

- Quick Losses/Fast Losses
  - Distribution changes easier to spot
  - Loss emergence and development a challenge
  - Look at quicker emerging coverages
  - Look at shorter time periods
  - Compare to baselines

# Model Monitoring—Lift Charts/SQPs

- Using lift charts to validate ongoing performance (or SQPs)
- Can look at lift or absolute difference of the Actual minus Expected to see shifts over time

# Model Monitoring—Lift Charts




**Lift decreased from 2.30 to 1.71**

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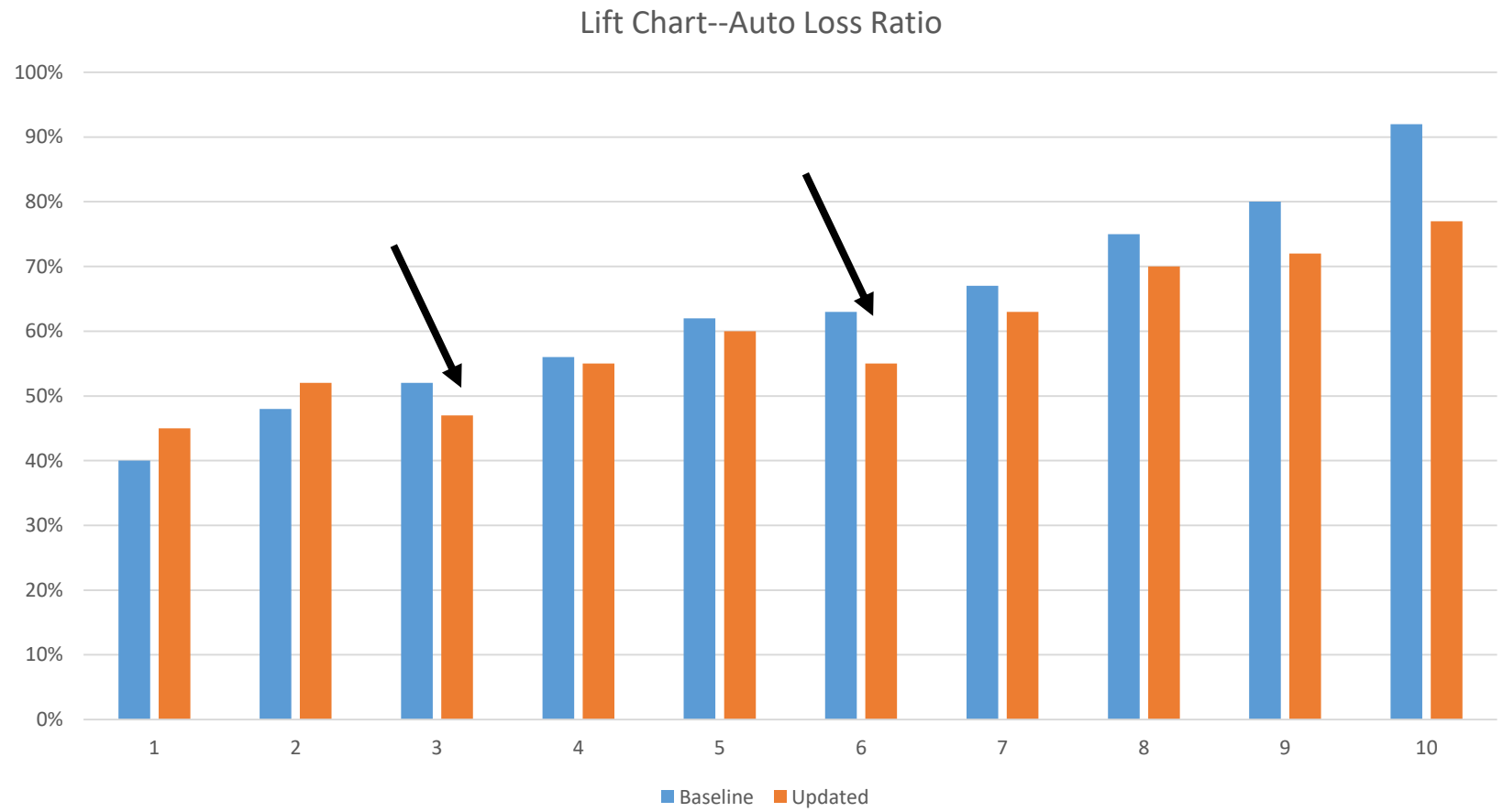
# Model Monitoring—Lift Charts




**Lift decreased from 2.30 to 1.71 and reversals happening.**

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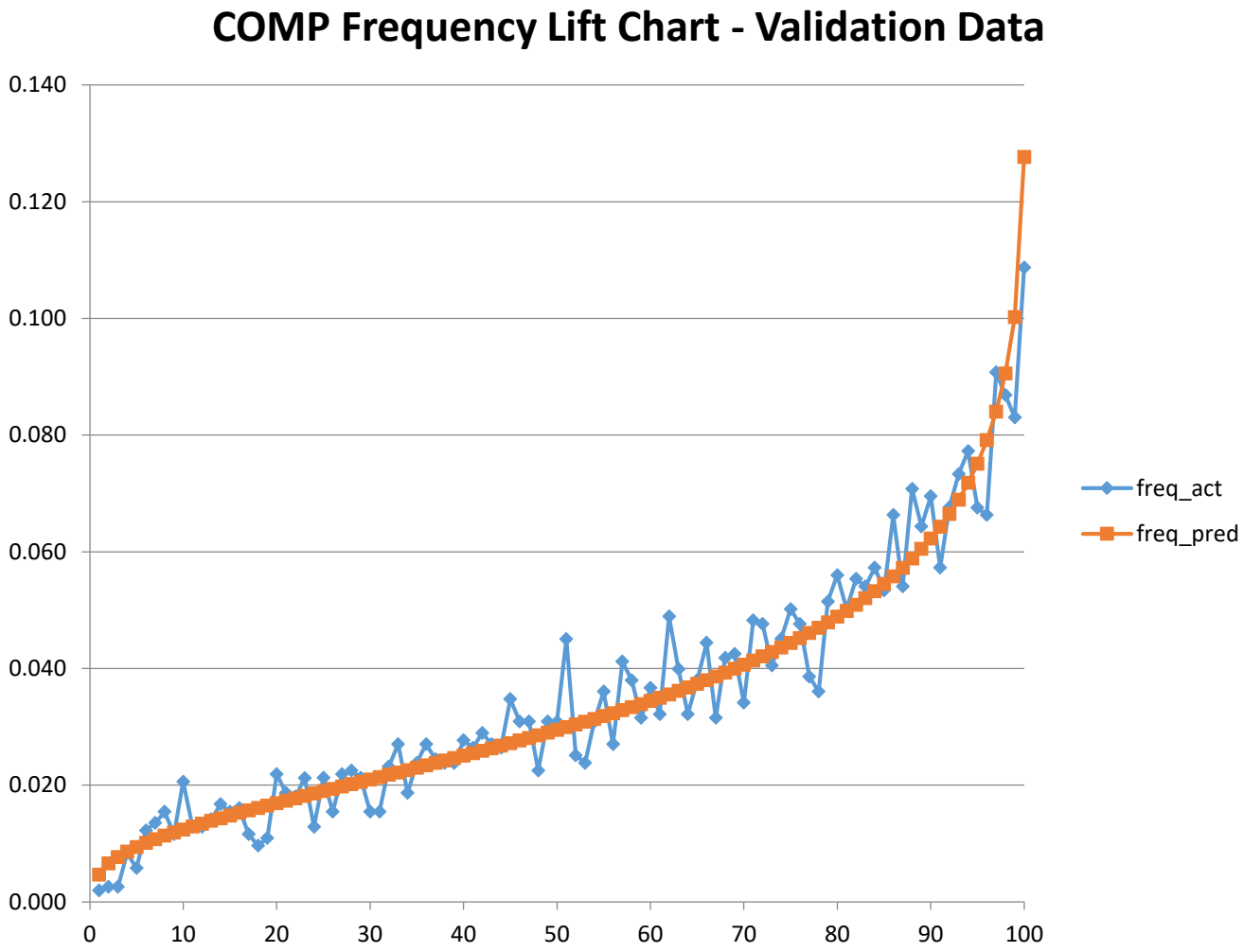
# Model Monitoring—SQPs

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# Model Monitoring—Lift Charts/SQPs

- Can look at lift or absolute difference of the Actual minus Expected to see shifts over time

| Group | Expected | Actual 1 | Actual 2 | Actual 3 |
|---|---|---|---|---|
| 1 | 10 | 12 | 15 | 17 |
| 2 | 25 | 23 | 22 | 23 |
| 3 | 40 | 39 | 35 | 38 |
| 4 | 65 | 70 | 68 | 73 |
| 5 | 90 | 85 | 82 | 78 |
| **Abs. Diff.** | | **15** | **24** | **31** |

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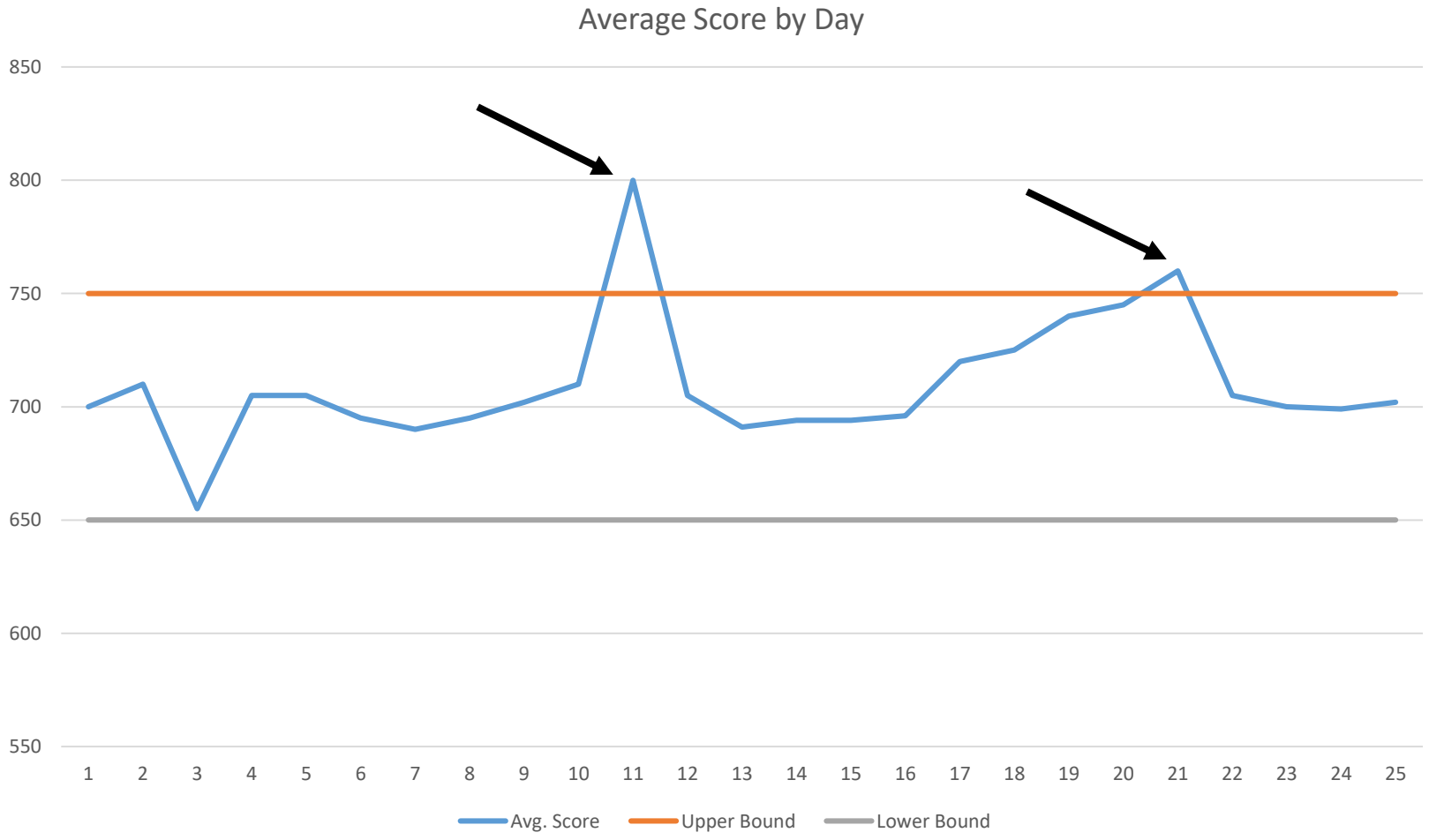
# Model Monitoring—Alerts

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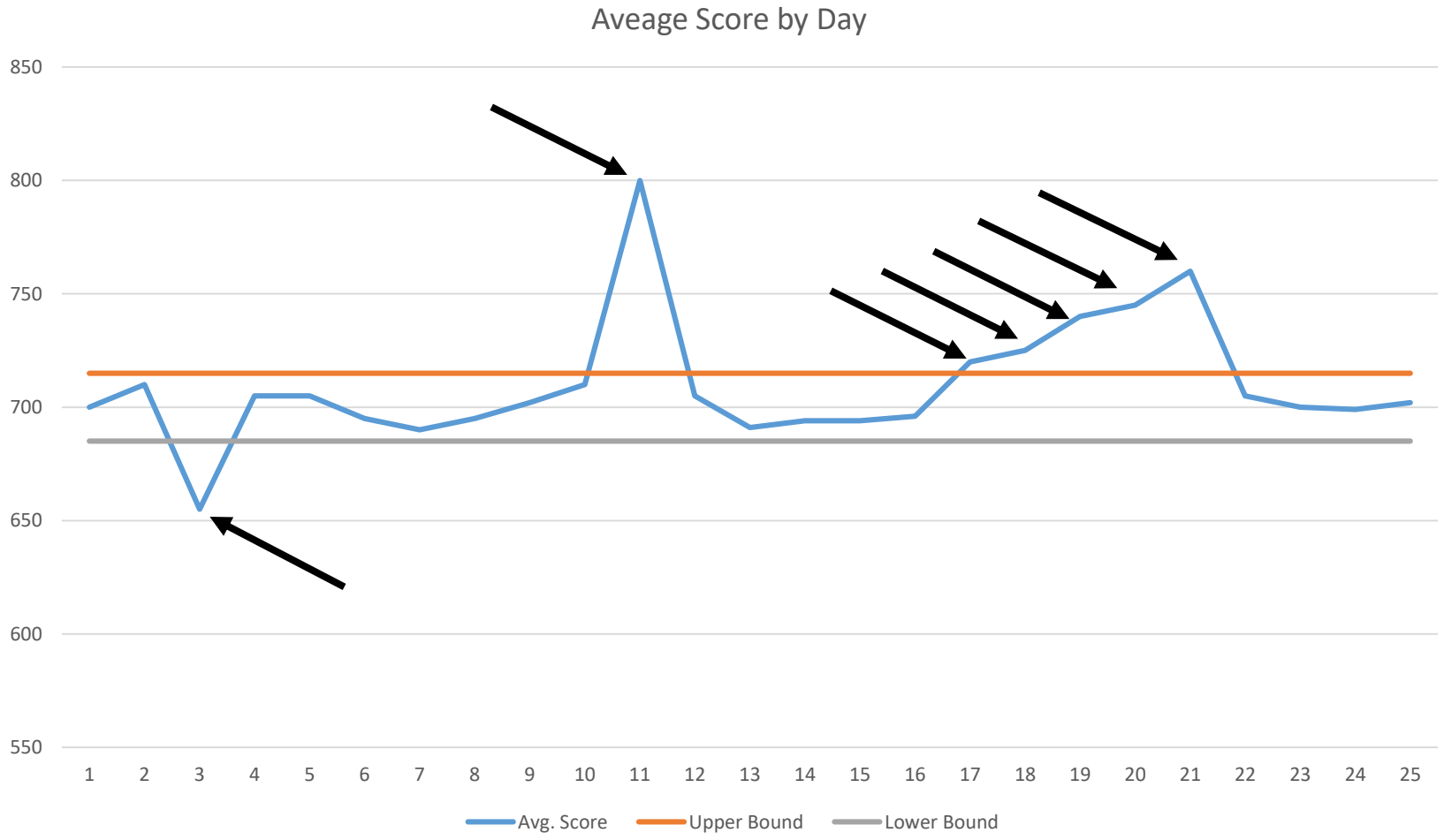
# Model Monitoring—Alerts

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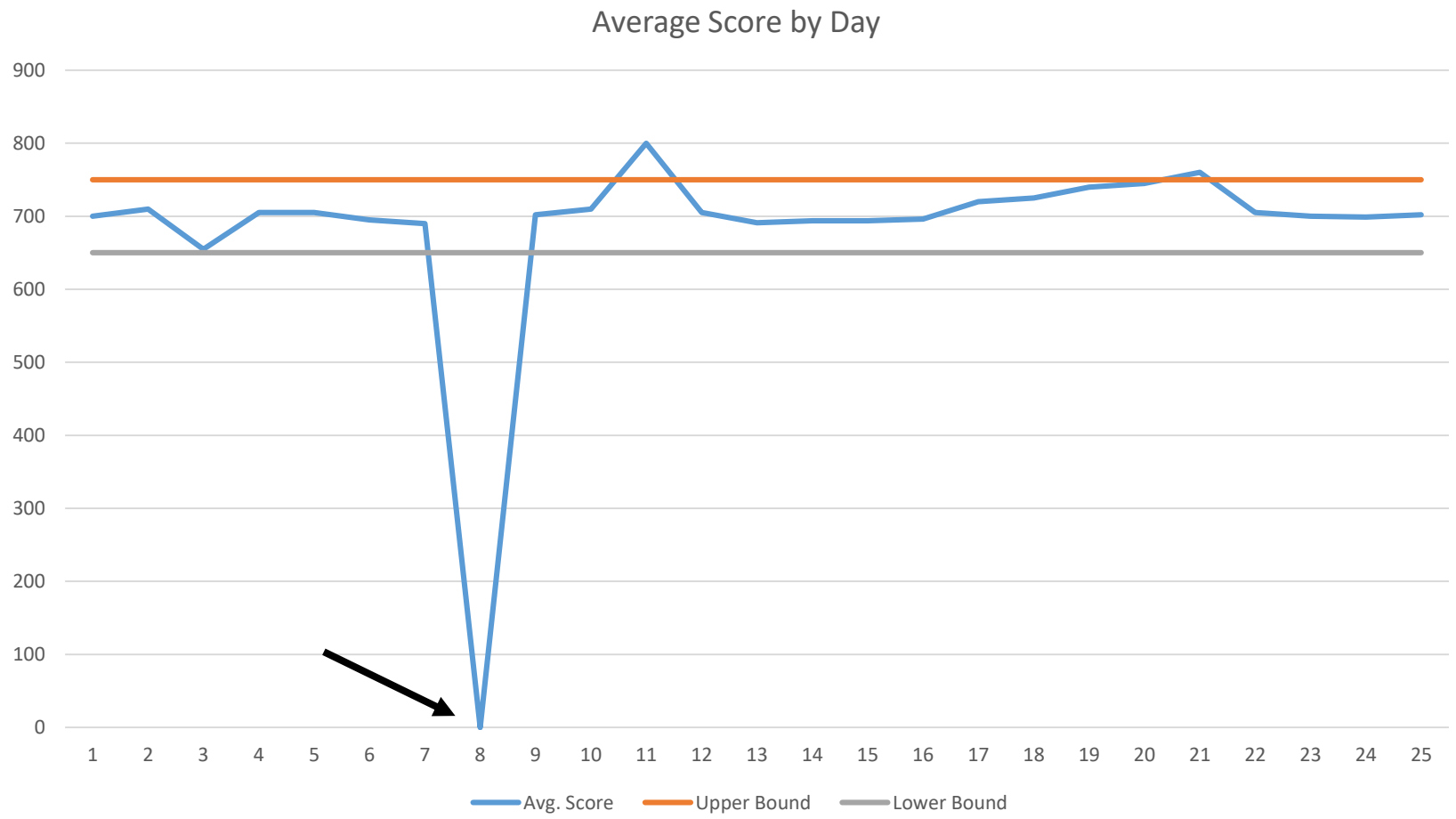
# Model Monitoring—Alerts

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# Model Monitoring—Additional Views

- Static dataset run periodically
- Industry sample analysis

# Additional Considerations

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# Model Monitoring—Additional Considerations

- Determine which models to monitor
- Criteria to consider
- Determine what metrics to use
- Actions to take
- Governance around models/updates

# Model Monitoring—Additional Considerations

- Need to consider how to share information
- Can get overwhelming
- Static reports vs. dynamic dashboards?

# Model Monitoring—Additional Considerations

- External environment shifts in the data
- Need to be aware of
  - Seasonality of the data
  - Shifts in claims values (trends)
  - Other external factors like economic trends

# Model Monitoring—Additional Considerations

- Internal shifts in the data
- Need to be aware of
  - Changes to underwriting/re-underwriting guidelines
  - Rate changes
  - New program introductions
  - New marketing campaigns
  - Data storage changes
  - Data definition changes
  - Claims or reserving process changes

# Model Monitoring—Additional Considerations

- Distributions of quotes
- Issues with truncated or censored data based on what a company has access to or what it writes
- For new business and renewal business—especially applicable for underwriting

# New Skills Needed

# New Skills Needed (or Developed)

- Business knowledge
- Communication
- Organizational/project management
- New software
- Data visualization
- IT/System knowledge

# New Skills Needed (or Developed)

- Teamwork
- Collaboration
- Different organization of teams?

# New Skills Needed (or Developed)

- Working with external vendors
  - Third-party data
  - Staff augmentation
- Knowing their system or specs
- Knowing and explaining your system or specs

# New Skills Needed (or Developed)

- Additional thoughts from the audience?

# Final Thoughts

- Begin with the end in mind
- Implementation includes business and technical considerations
- Must devote resources to monitoring
- Actuaries may need to develop new skills

# Questions

# Thank You


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