



Vanishing Acts:

Demystifying No-Shows in Healthcare

Dr. Adi Sarid, CEO
Sarid Research

Quirk's NY 2024

Meet Dr. Brown



Today < > DR.BROWN Washington, D.C. Today 45° F / 29° F Tomorrow 40° F / 25° F Tuesday 30° F / 26° F Week

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	2	3	4	5	6	7	8
08:00	Lisa Walls Dan Schwartz	Ken Addams Julie Pine	Keith March Daniel Joffrey	Lisa Walls Dan Schwartz	Ken Addams Julie Pine	Keith March Daniel Joffrey	
09:00	Michelle Knight David Mitchell	Dean Fischer Barney Stevens	Geoff Wexler Sophia Leamen	Michelle Knight David Mitchell	Dean Fischer Barney Stevens	Geoff Wexler Sophia Leamen	
10:00	Regina Falengi Betty Meister	Jolene Pen Dotty shief	Katy Pettinson Dotty shief	Regina Falengi Betty Meister	Jolene Pen Dotty shief	Katy Pettinson Dotty shief	
11:00	Zack Wild James Geller	Penny Lane Monika Price	Berry Stinson Debby Harries	Zack Wild James Geller	Penny Lane Monika Price	Berry Stinson Debby Harries	
12:00							
13:00	Steve Kessler Mike Perish	Dave Mustang Jerry Van dike	Ivan Seinfeld Joe kendle	Steve Kessler Mike Perish	Dave Mustang Jerry Van dike	Ivan Seinfeld Joe kendle	
14:00	Emma Gilmore Khloe Dean	Norra Rosenberg Johnny laurance	Allen Rhanson Mindy Farber	Emma Gilmore Khloe Dean	Norra Rosenberg Johnny laurance	Allen Rhanson Mindy Farber	
15:00	Jack Bronsen Terry Salzberg	Benny Green Sal Fischer	Scott Higgins Harry Bing	Jack Bronsen Terry Salzberg	Benny Green Sal Fischer	Scott Higgins Harry Bing	
16:00	Bruce Kennen Phil Colman	Garry Shein Phil Colman	Nicolas Gilman Antony White	Bruce Kennen Phil Colman	Garry Shein Phil Colman	Nicolas Gilman Antony White	
17:00	Nick Homles Max Drainen	John crowly Sharon Osbourne	Lenny Doverson Tommy Birch	Nick Homles Max Drainen	John crowly Sharon Osbourne	Lenny Doverson Tommy Birch	

Dr. Brown isn't bothered by the occasional **NO-SHOW**



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But it becomes more of a **problem on a weekly basis**



DR.BROWN

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12:00	Thomas Beak Joe Heart	Adam Jones Ella Grace	Britney Mikels NO SHOW	Thomas Beak Joe Heart	Adam Jones Ella Grace	Britney Mikels Eddie Vader	Thomas Beak NO SHOW
13:00	NO SHOW Mike Perish	Dave Mustang Jerry Van dike	Ivan Seinfeld Joe kendle	Steve Kessler Mike Perish	Dave Mustang NO SHOW	Ivan Seinfeld Joe kendle	Steve Kessler Mike Perish
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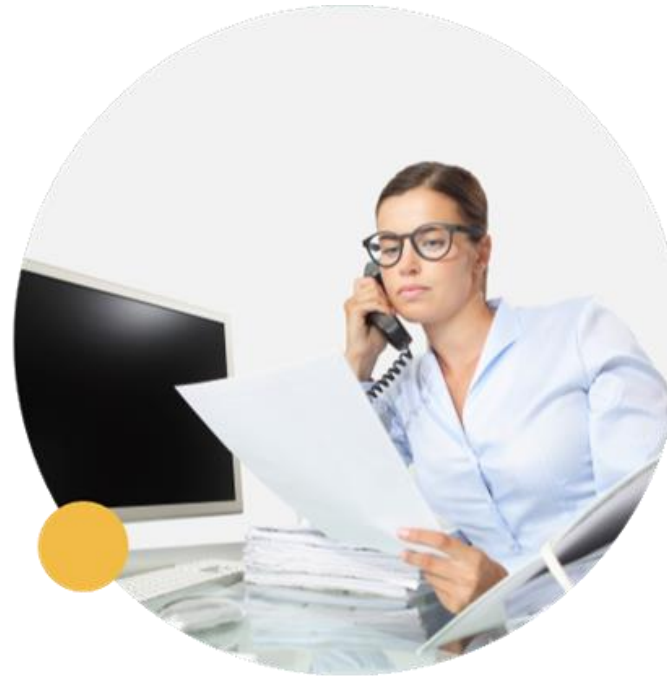
So what?

- Financial impact (lost revenue)
- Wasted resources (physician idle time)
- Extra admin time to reschedule
- Impact on patient care
 - Other patients could have come
 - The no-show patient misses treatment
- No-shows occur in other fields as well
(e.g., aviation, hospitality, and any pre-appointed meetings)

Common No-Show Remediation



SMS/IVR



Human Reminder



Overbooking

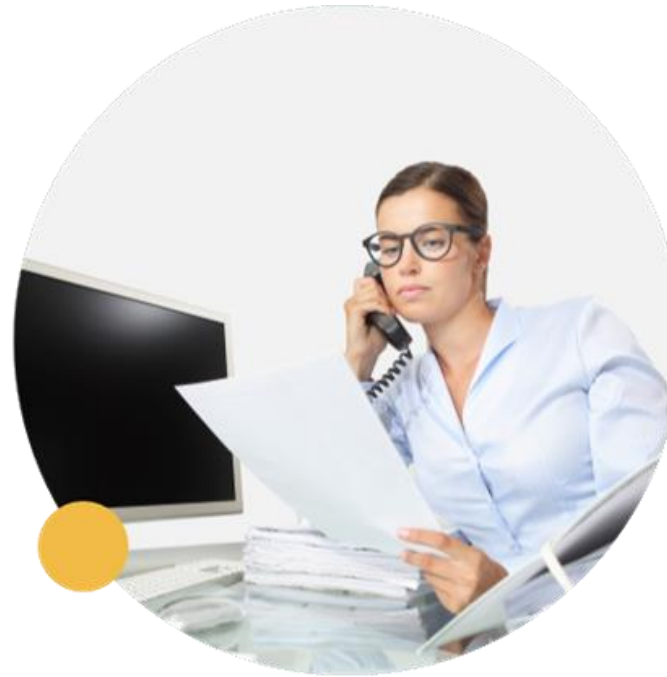
Common No-Show Remediation

And why they fail...



SMS/IVR

Limited Effect



Human Reminder

Labor Intensive



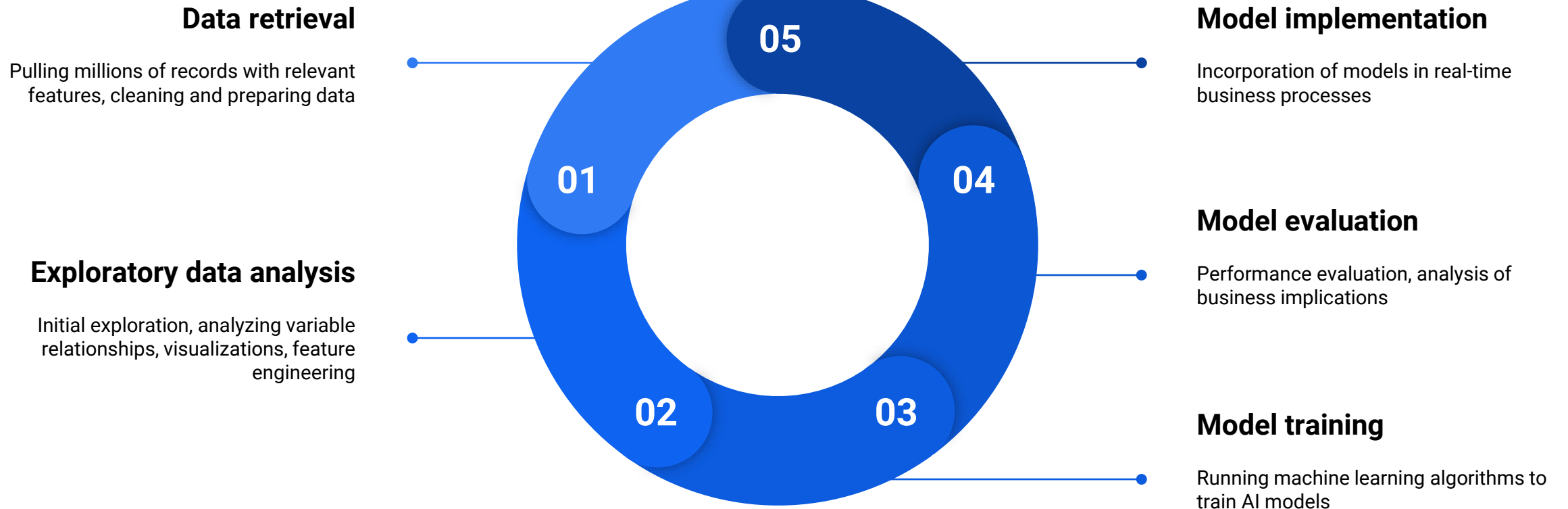
Overbooking

**Lowers
Service Level**

How to Predict a No-Show?

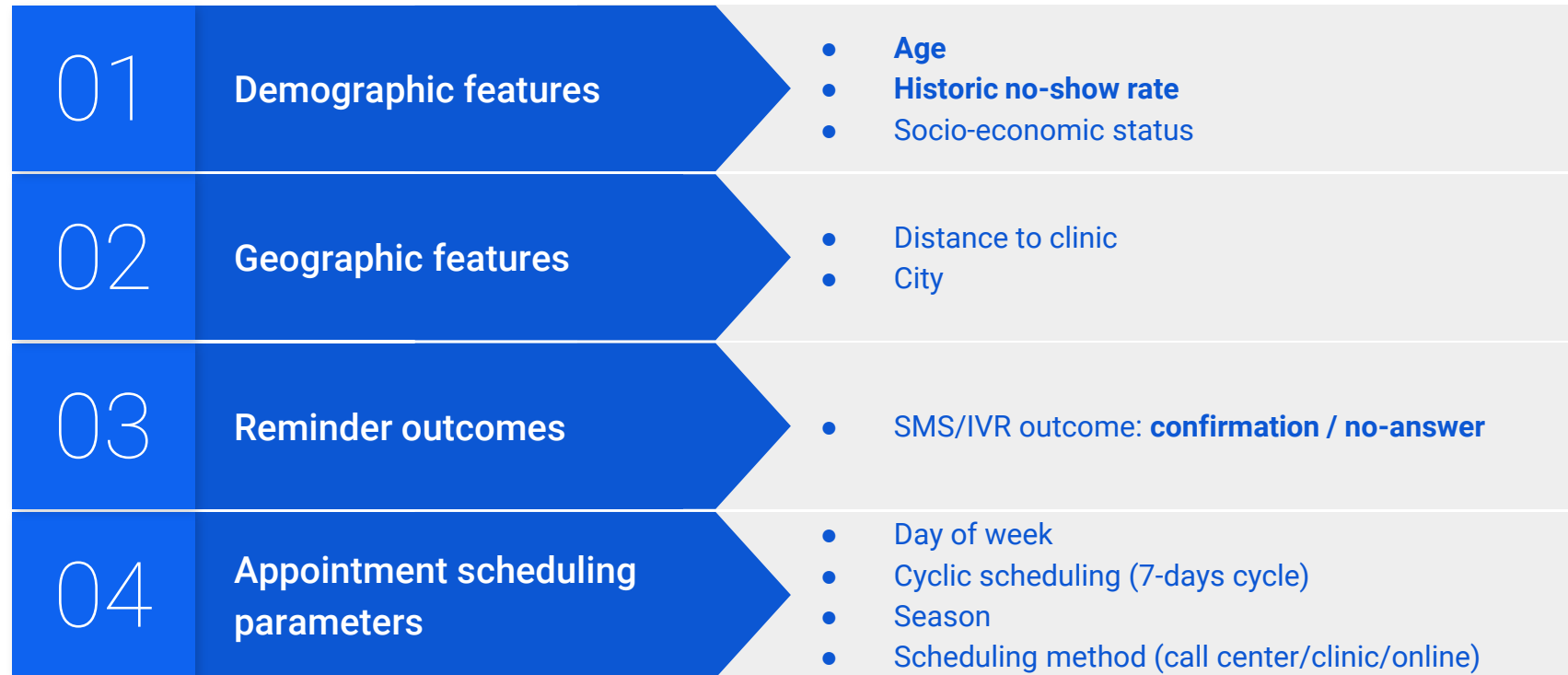
- No-show predictions allow for targeted interventions
- We analyzed 8 million appointment records of a large HMO
- Specific healthcare field, with a 24% no-show rate
- We created an AI model to predict no-shows
- Saving millions of dollars

Methodology Pipeline: Building a Model



Features That Correlate With No-Shows

(Some Examples)

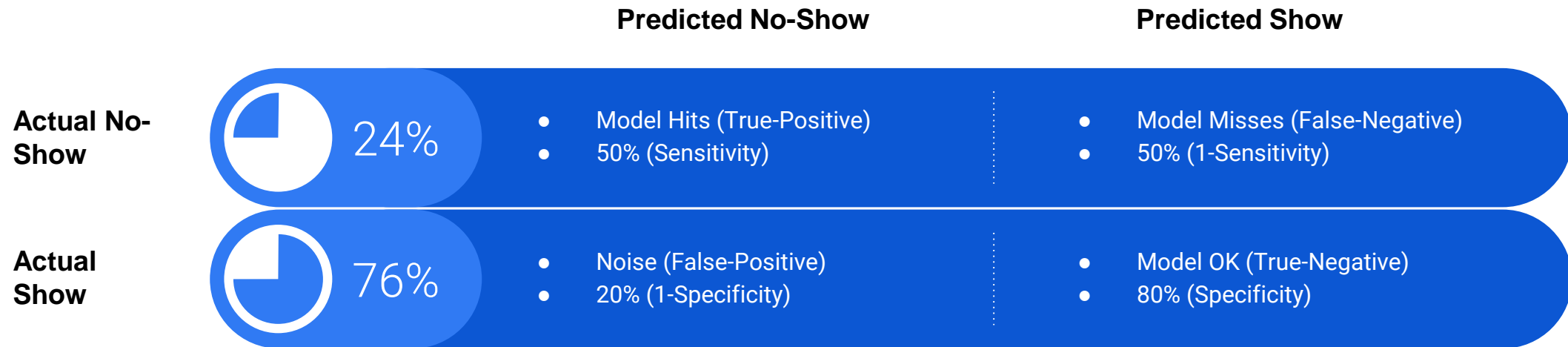


Overall, the model incorporates 32 different features relating to these four groups

Model Accuracy and Usefulness

Sensitivity = Detect actual no-show (True-Positive); Specificity = Detection actual shows (1 - False-Positive)

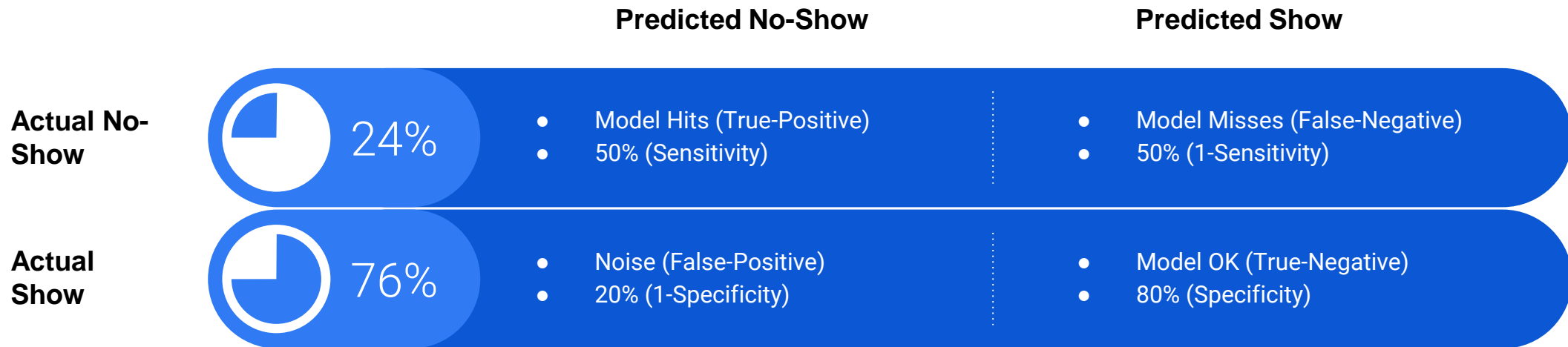
Precision = Actual no-shows out of total detected no-shows



Model Accuracy and Usefulness

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Precision = Actual no-shows out of total detected no-shows



Out of 100 random patients:

24 are no-shows, 12 were detected
76 are shows, ~15 were falsely flagged as no-show
The model's **precision is 44.4%** = $12/(12+15)$

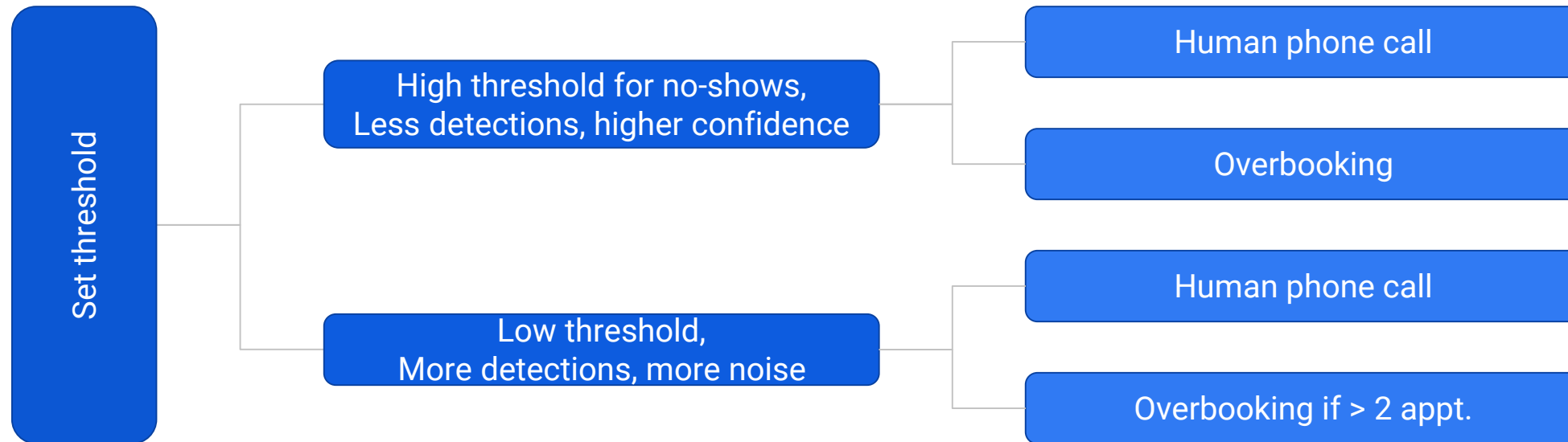
From Model to Actionable Recommendations

- The AI model outputs predictions in the range of 0-1
 - 0 = high confidence for show, 1 = high confidence for no-show
- We can **set a desired threshold** to tune sensitivity \leftrightarrow noise



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Interactive Sim: Engaging Decision-Makers

AI is hard to explain, therefore, its hard to trust.
How can you increase trust in models? **No-Show sim**

Predict (individual prediction screen)

In this screen you can see the no-show probability and the estimated duration of specific meetings.
Change the parameters below and click on "Predict" to see how they affect the expected no-show/duration.

Expected Appointment Duration [min]
13.4

No-show Rating
26%

Appointment related information

Reminder method
 SMS Phone Call (Human)
 Phone Call (IVR)

Response to reminder
Received message

Source
Clinic

Creation date
2022-05-20

Appointment time
2022-06-23 11:06

Treatment
Xray

Planned duration [minutes]
15

Patient's data

Age
40

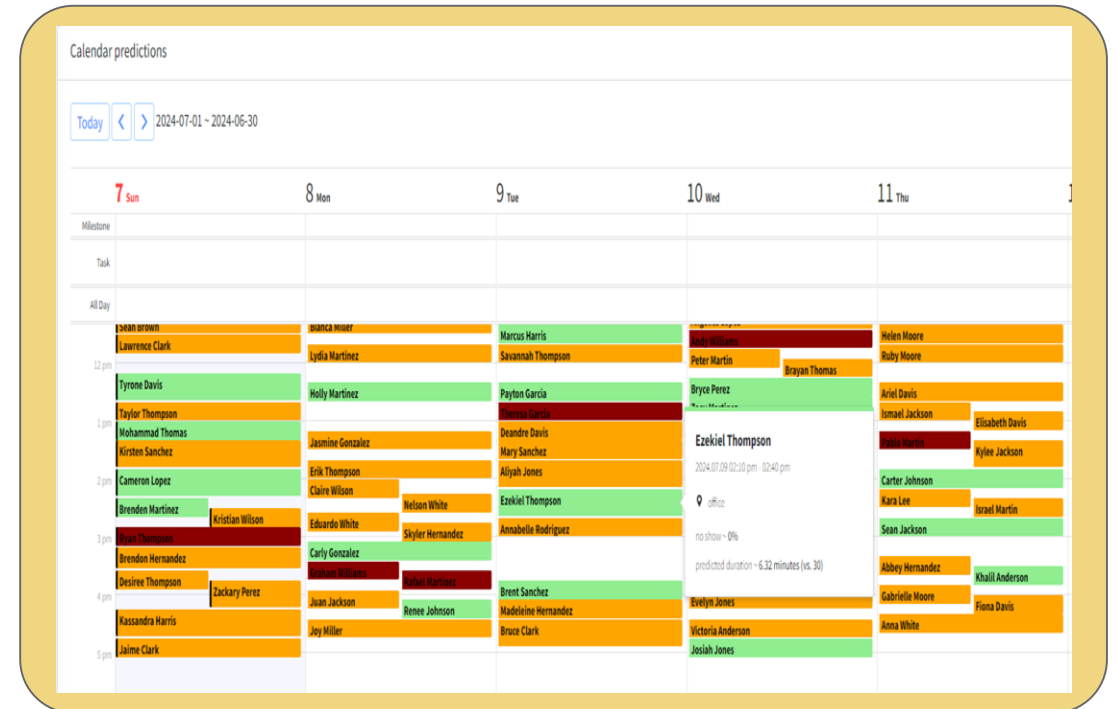
Gender
Male

Previous no-shows
1

Insurance Type
Platinum Insurance

Outstanding balance
0

Patient city of residence
TEL AVIV - YAFO



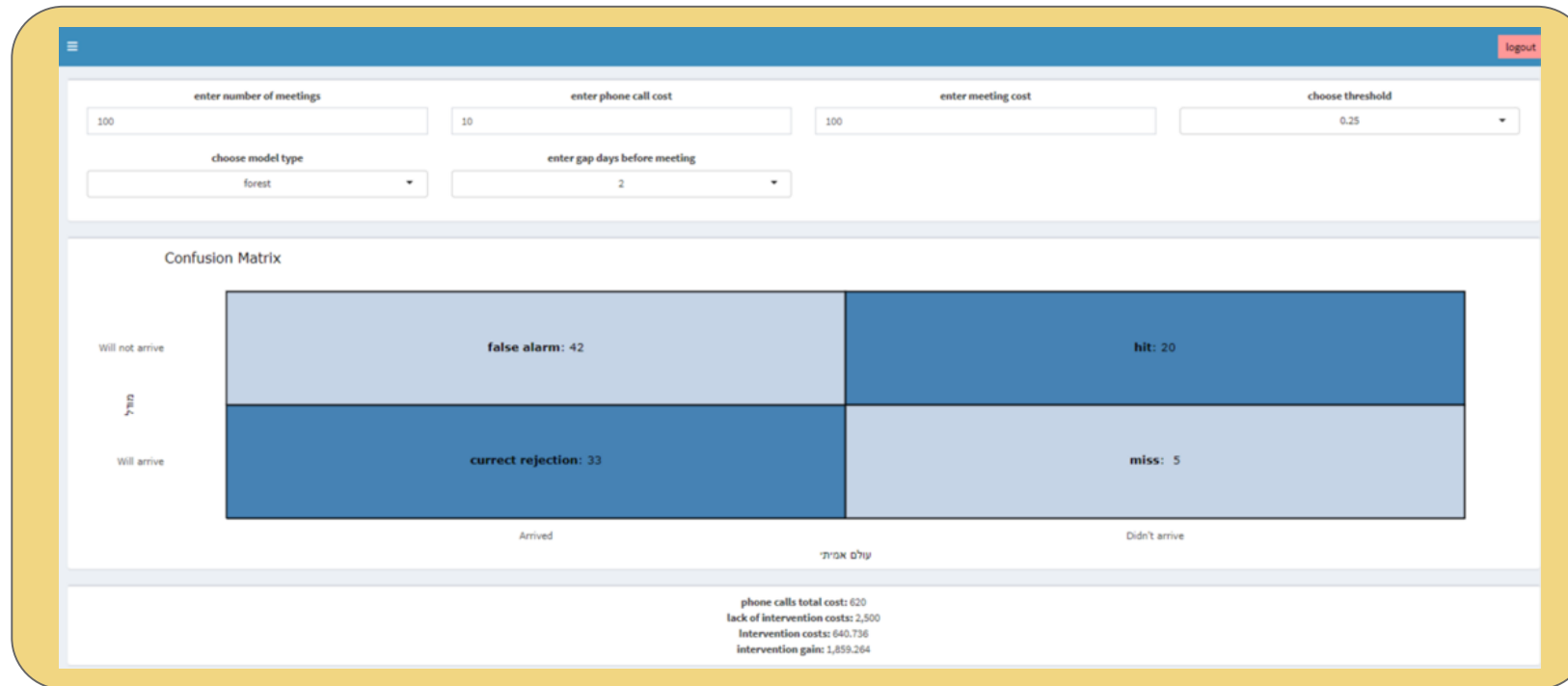
Interactive Sim: Engaging Decision-Makers

AI is hard to explain, therefore, its hard to trust.
How can you increase trust in models? **Potential Savings**

Annual meetings

Human phone call cost

Total savings



Threshold

No-show cost

Model performance (at threshold)

Implementation: Turning the Model into a Production Solution (work in progress)

1 Service Development

The model is converted into a scalable robust service with the predetermined threshold

3 Real-Time Utilization

The service is regularly invoked to provide actionable recommendations (e.g., calls, overbooking strategies)

2 Integration

The service is seamlessly integrated into the organization's workflow, automating interactions to minimize manual intervention

4 Continuous Improvements

A feedback loop monitors performance and iteratively enhances the model based on new data

Summary and Conclusions

- **Utilizing Large-Scale Transactional Data:** Enhancing real-time decision-making through data science and AI
- **Practical Value of Models:** Models don't have to be perfect; even moderately accurate models can significantly improve outcomes
- **Building Trust with Interactive Simulators:** Using interactive simulators to explain models and gain stakeholder trust
- **Automating Processes with Model Implementation:** Integrating the predictive model as a service to streamline and automate operational processes

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