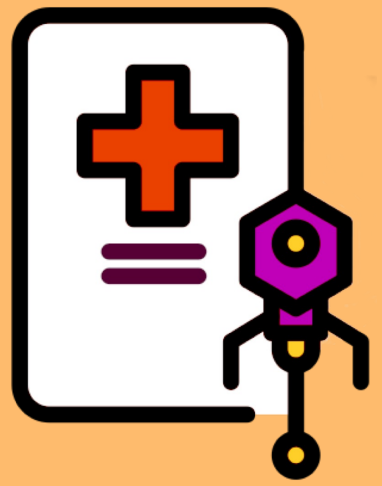
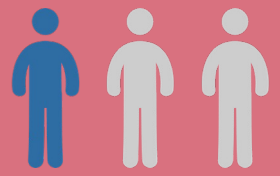


Investigating Mechanisms Driving Trust In Medical AI

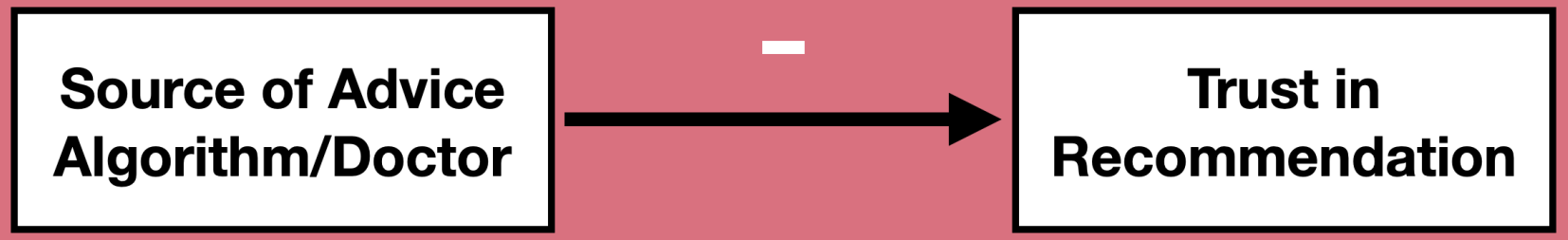
Matthew Leitao



- Approximately 1 in 3 American adults use or have used health apps to track and improve their health and wellbeing (McCarthy, 2019).

The Recommendation Dilemna

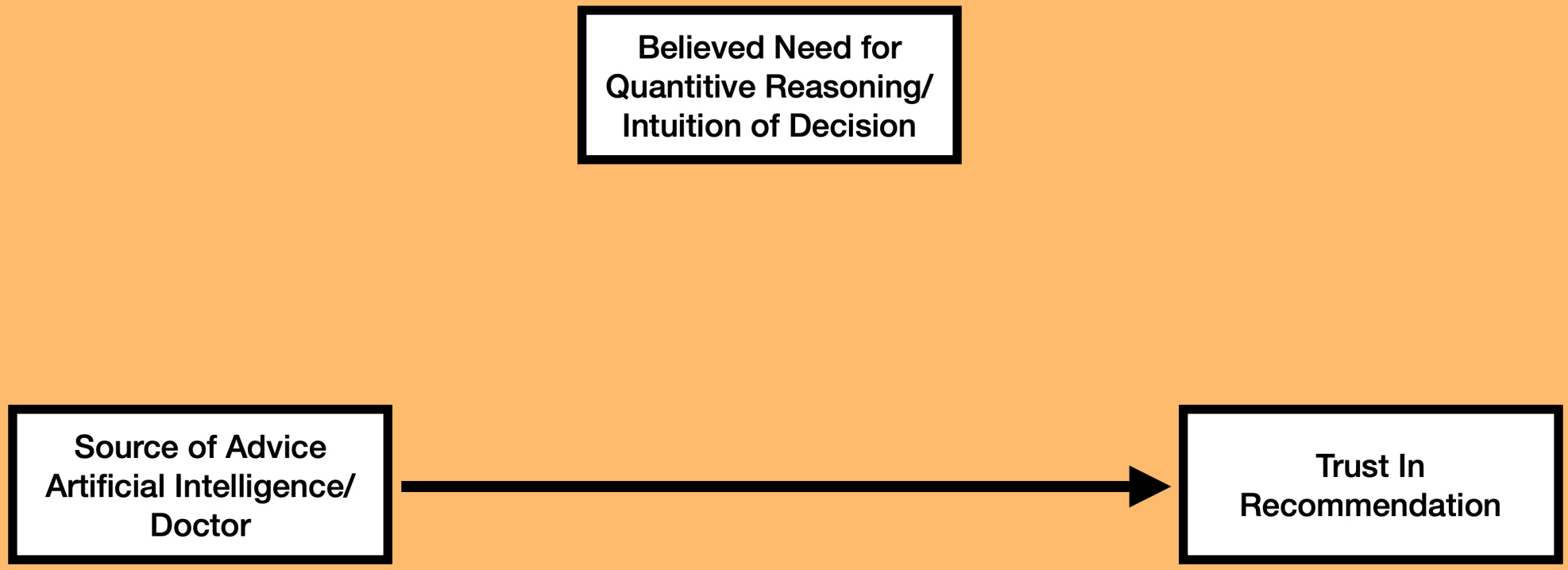
- Despite algorithms providing the same recommendation as doctors or even an AI offering preferential treatment to the patient, people tend to prefer doctors over AI recommendation (Promberger & Baron, 2006; Yokoi et al., 2021).
- Patients prefer clinical experts who rely on their knowledge paired with their prior experience and intuition to make recommendations over experts who relies solely on quantitative reasoning (Eastwood et al., 2012).
- Researchers have proposed that what differentiates how people perceive algorithms and humans is the perception of a "mind" (Bigman & Gray, 2018).



Study 1

Understanding Medical Decisions & Medical Decision Makers

Method


Believed Need for Quantitive Reasoning/ Intuition of Decision
Source of Advice Artificial Intelligence/ Doctor
Trust In Recommendation

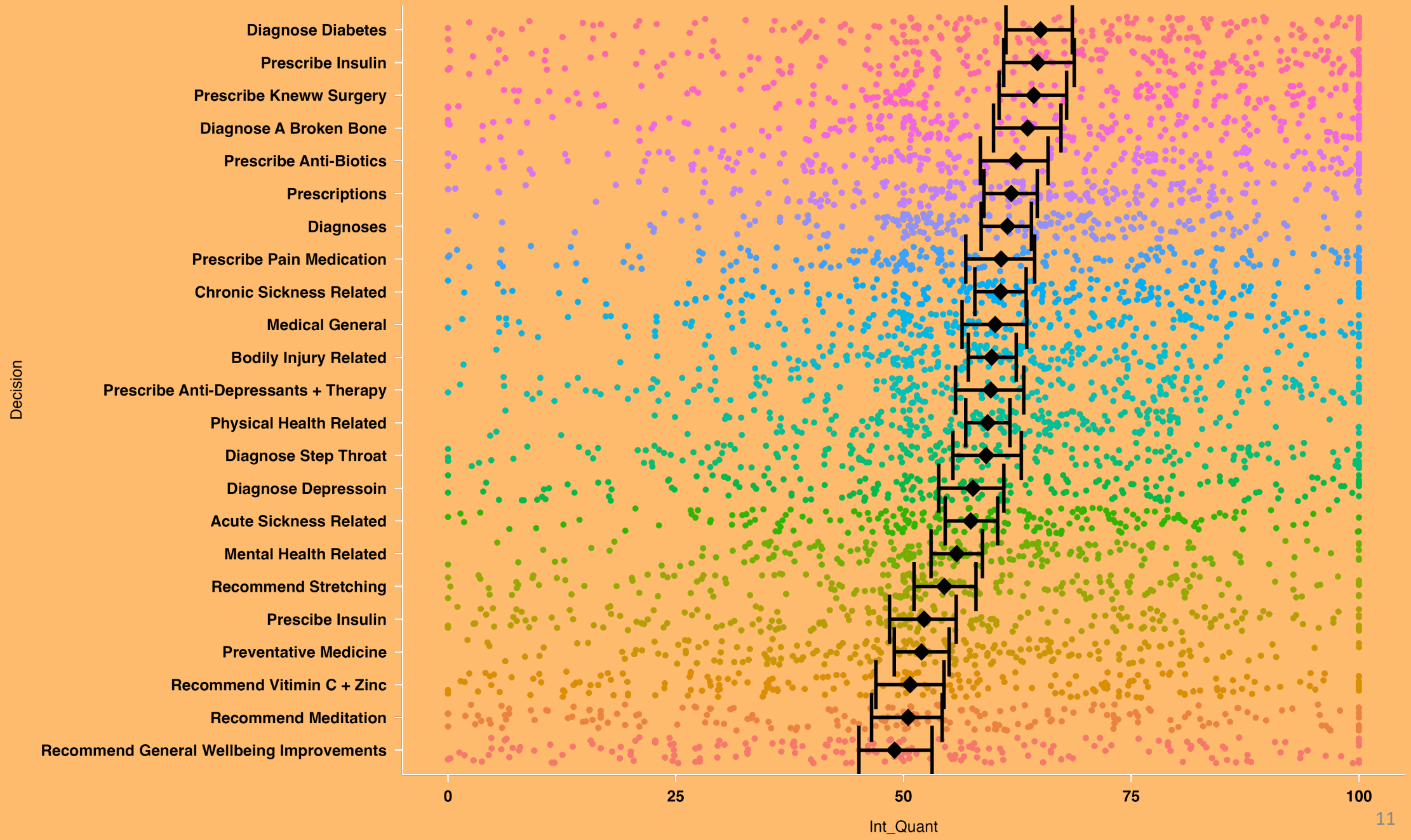
Method

Study Info

A within-subjects survey (n = 202) where participants read and rated various medical decisions on the amount of quantitative reasoning versus intuition was necessary to make accurate decisions. Participants also rated how capable various medical decision-makers were at utilizing quantitative reasoning and intuition, as well as, how much they would trust the medical decision-maker's decision.

Medical Decisions

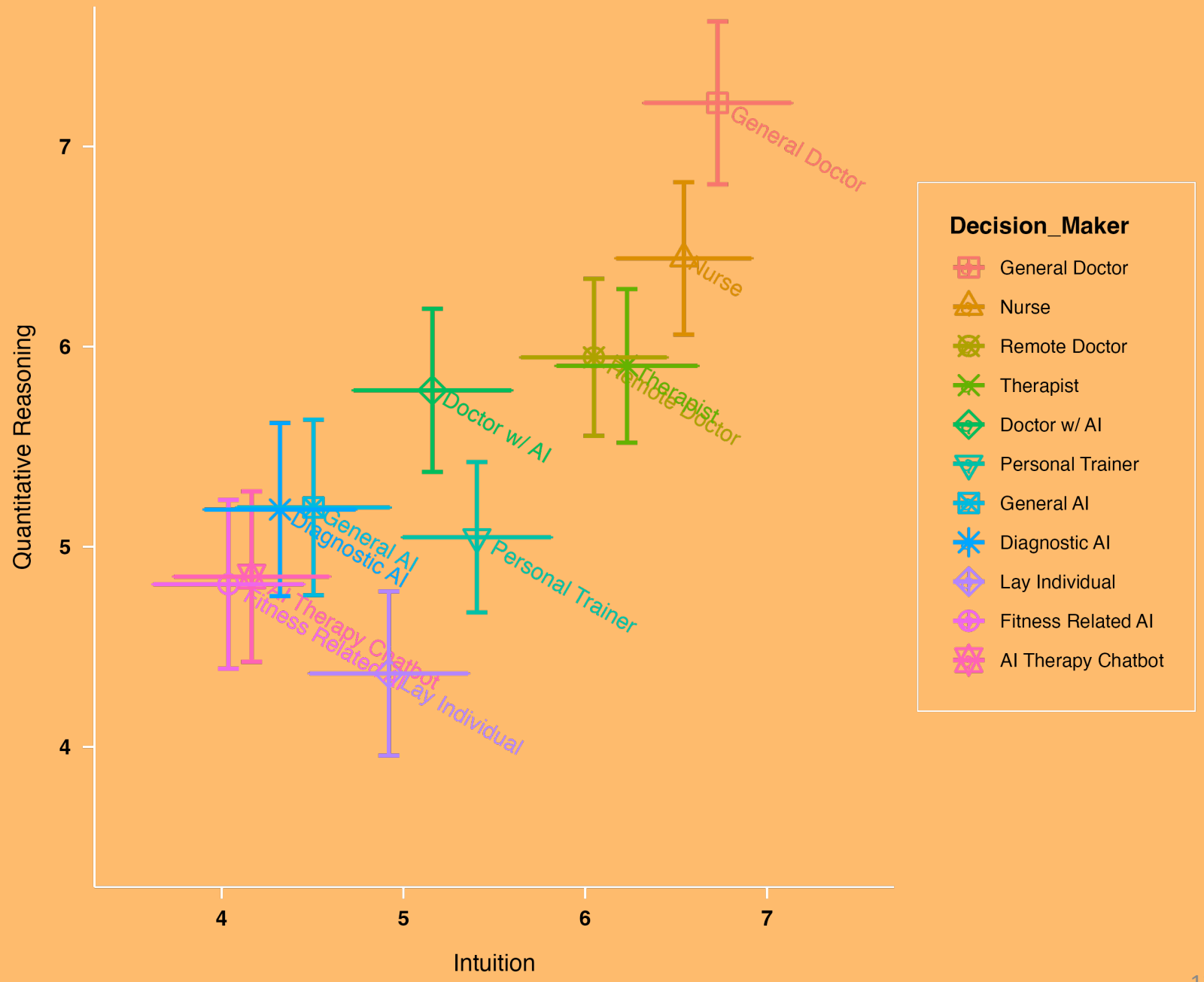
1. Recommending Stretching to Prevent Injury
2. Diagnosing a Bone is Broken
3. Recommending Knee Surgery
4. Prescribing Pain Medication for a Knee Injury
5. Recommending Meditation and Exercise to Promote Mental Health
6. Diagnosing Depression
7. Prescribing Anti-Depressants and Cognitive Behavioral Therapy for Depression
8. Recommending Vitamin C + Zinc to Fight Off Infections
9. Diagnosing Strep Throat
10. Prescribing Anti-Biotics for Strep Throat
11. Recommending a Strict Diet to Promote Better Physical Health
12. Diagnosing Diabetes
13. Prescribing Insulin and a Change in Diet for Diabetes
14. Recommending Walking 3 Kilometers a day, 50 Deep Breaths, and 8 Hours of Sleep Each Night to Promote Wellness
15. Medical Decisions in General

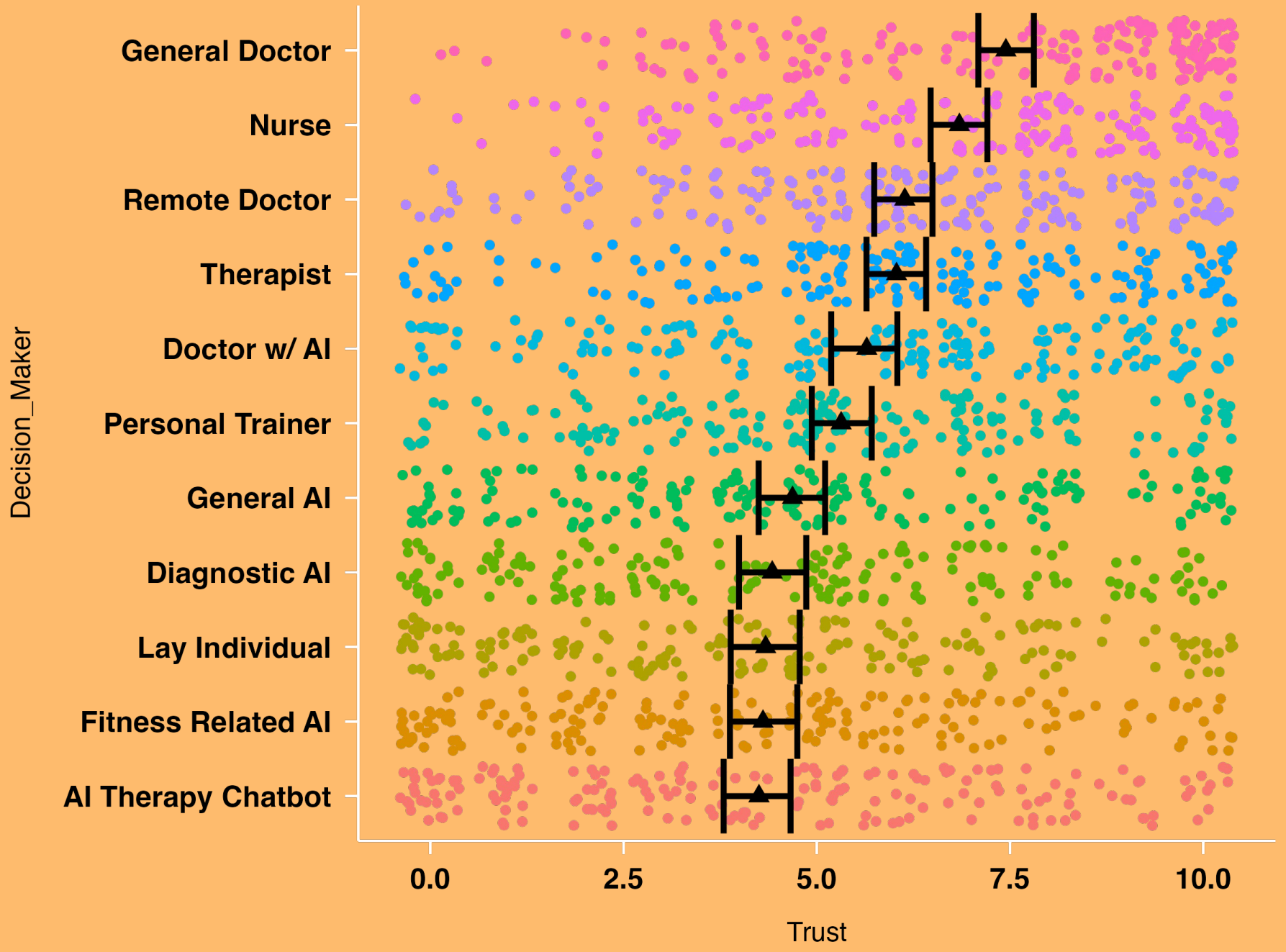

Diagnose Diabetes
Prescribe Insulin
Prescribe Kneww Surgery
Diagnose A Broken Bone
Prescribe Anti-Biotics
Prescriptions
Diagnoses
Prescribe Pain Medication
Chronic Sickness Related
Medical General
Bodily Injury Related
Prescribe Anti-Depressants + Therapy
Physical Health Related
Diagnose Step Throat
Diagnose Depressoin
Acute Sickness Related
Mental Health Related
Recommend Stretching
Prescibe Insulin
Preventative Medicine
Recommend Vitimin C + Zinc
Recommend Meditation
Recommend General Wellbeing Improvements
Decision
0
25
50
75
100
Int_Quant

Medical Decision Makers

1. Doctor
2. Registered Nurse
3. Virtual/Remote Doctor
4. Therapist
5. Personal Trainer
6. Medical Artificial Intelligence (AI)
7. AI-Powered Diagnostic Tools
8. AI-Powered Therapy Chat Bot
9. AI-Driven Diet & Fitness App
10. Doctor Utilizing AI
11. A Lay Individual

Capability of Using Quantitative Reasoning & Intuition



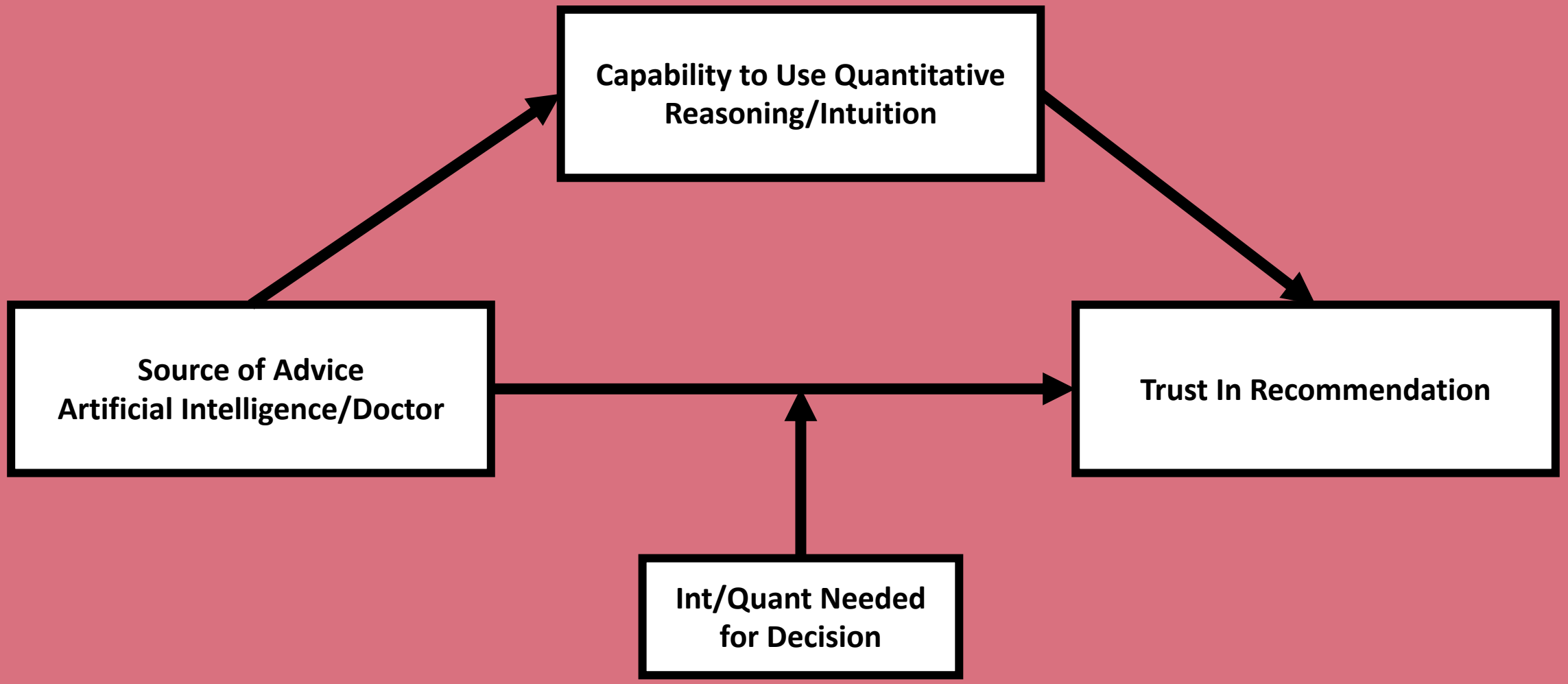


Trust In Decision-Maker

Study 2

Evaluating Medical Decisions & Medical Decision Makers

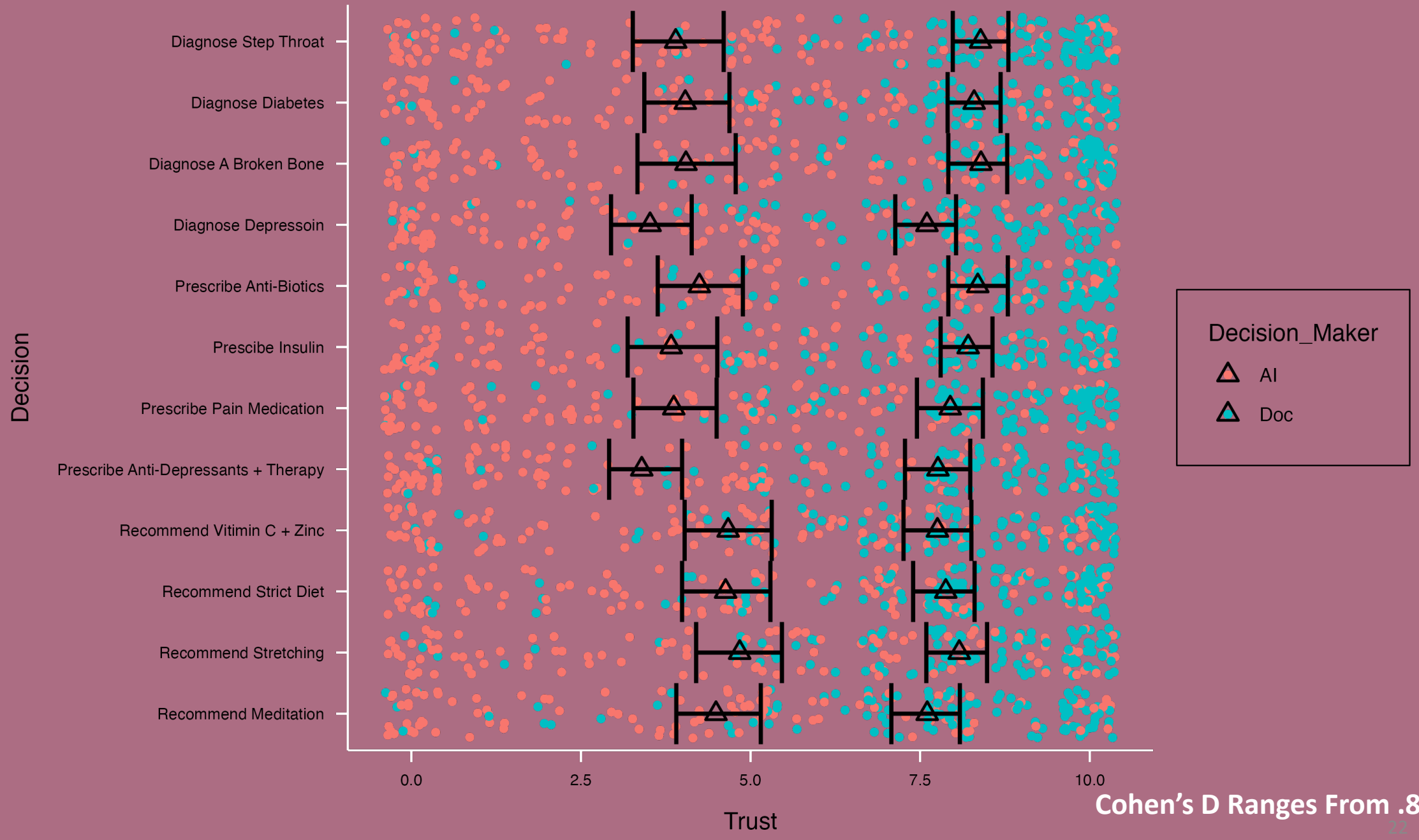
Method


Capability to Use Quantitative Reasoning/Intuition
Source of Advice Artificial Intelligence/Doctor
Trust In Recommendation
Int/Quant Needed for Decision

Method

Study Info

A within-subjects survey (n = 106) where participants read and rated various medical decisions on the amount of quantitative reasoning versus intuition was necessary to make accurate decisions. Participants also rated how capable various medical decision-makers were at utilizing quantitative reasoning and intuition, as well as, how much they would trust the medical decision-maker's for each medical deicions.

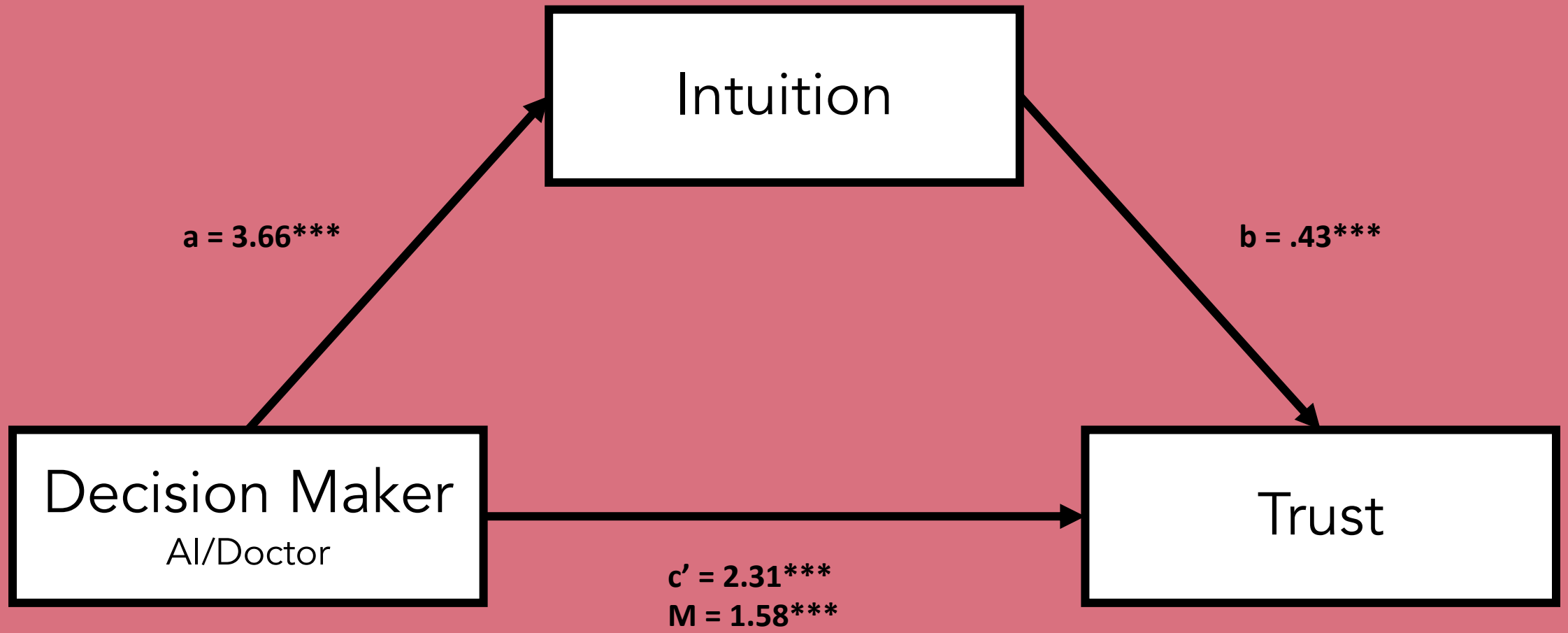


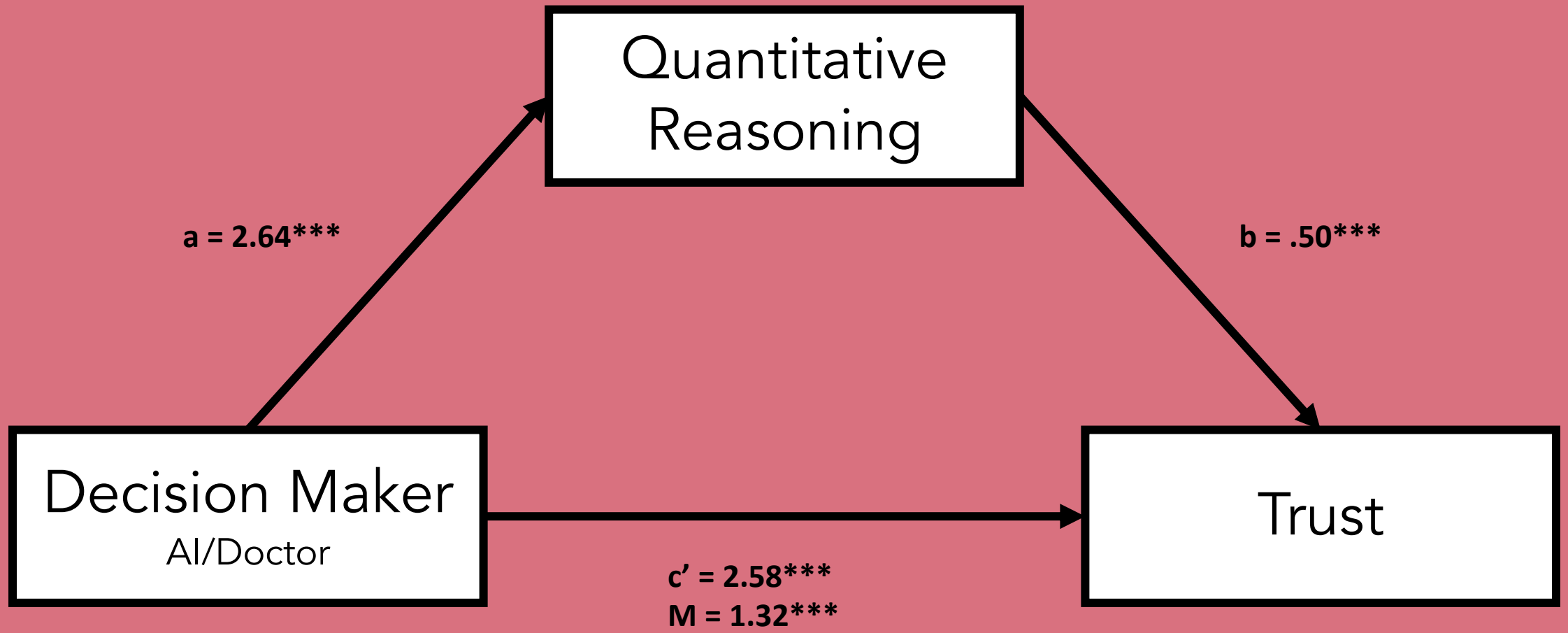
Cohen's D Ranges From .84-1.24

Trust (0-10)

Fixed Effect	Estimates	Std. Beta	95% CI	p
(Intercept)	.31	-.29	-1.00 – 1.61	.644
Decision Maker (Doctor = 1)	2.26***	.58	1.89 – 2.63	<.001
Intuition/Quantitative Reasoning (Decision)	.01	.04	-.00 – .01	.079
Age	-.00	-.01	-.02 – .02	.696
Gender (Male = 1)	.14	.02	-.49 – .77	.660
Intuition (Decision Maker)	.22***	.21	.17 – .26	<.001
Quantitative Reasoning (Decision Maker)	.40***	.36	.35 – .44	<.001
Decision Maker * Intuition/Quantitative Reasoning	-.00	-.03	-.01 – .00	.135
Random Effects				
σ^2	3.15			
$T_{00\ ID}$	3.45			
$T_{11\ ID*Intuition/Quantitative\ Reasoning}$	0			
$\rho_{01\ ID}$	-0.61			
ICC	0.43			
N_{ID}	105			
Observations	2514			
Marginal R^2 / Conditional R^2	0.545 / 0.743			

Note. * p<.05; ** p<.01; *** p<.001


Intuition
a = 3.66***
b = .43***
Decision Maker
AI/Doctor
Trust
c' = 2.31***
M = 1.58***

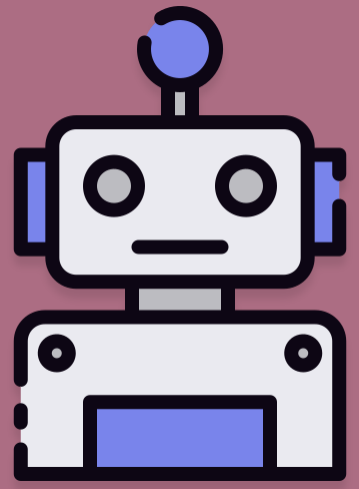

Quantitative Reasoning
a = 2.64***
b = .50***
Decision Maker
AI/Doctor
Trust
c' = 2.58***
M = 1.32***

Study 3

Testing Possible Mechanisms

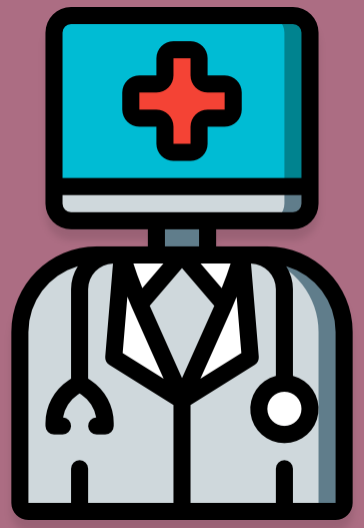
Conditions

Algorithm



VS

Humanized Algorithm

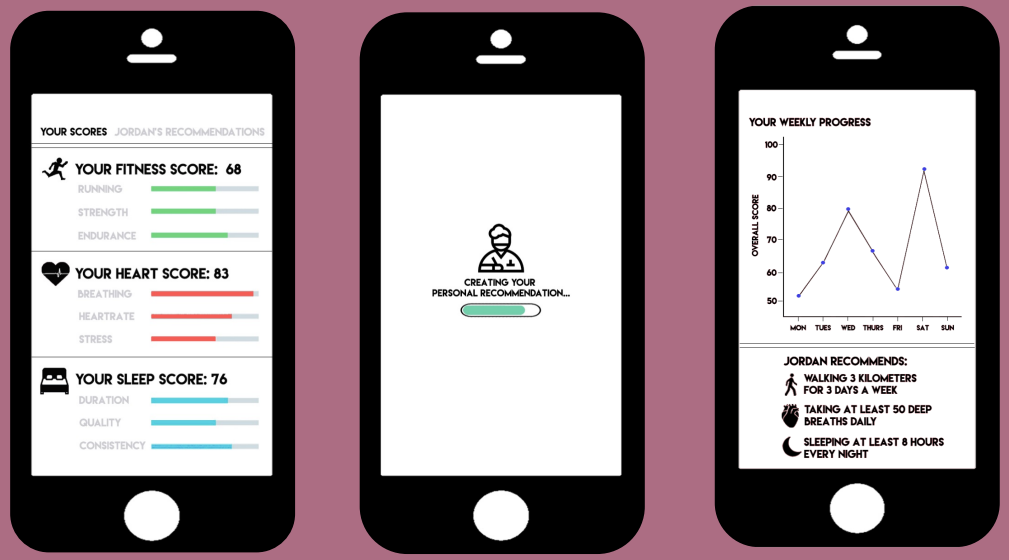


VS

Doctor



Method

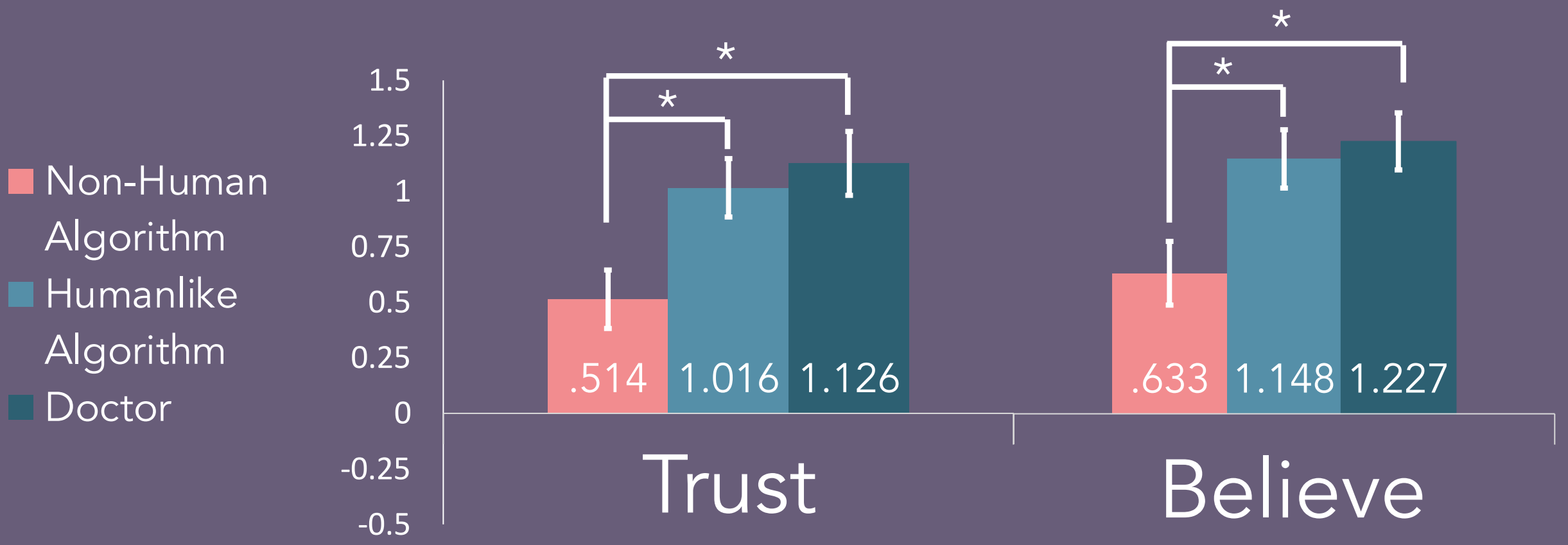


Study Info

A within-subjects experimental study (n = 556) where participants read and listened to a vignette about the process of making a health recommendation asked how much they would trust the recommendation and believe the health recommendation would improve their health. We used the same human voice for the doctor and humanized algorithm conditions. For the non-humanized algorithm condition, we used a more synthetic voice.

* Indicates significance at p < .05

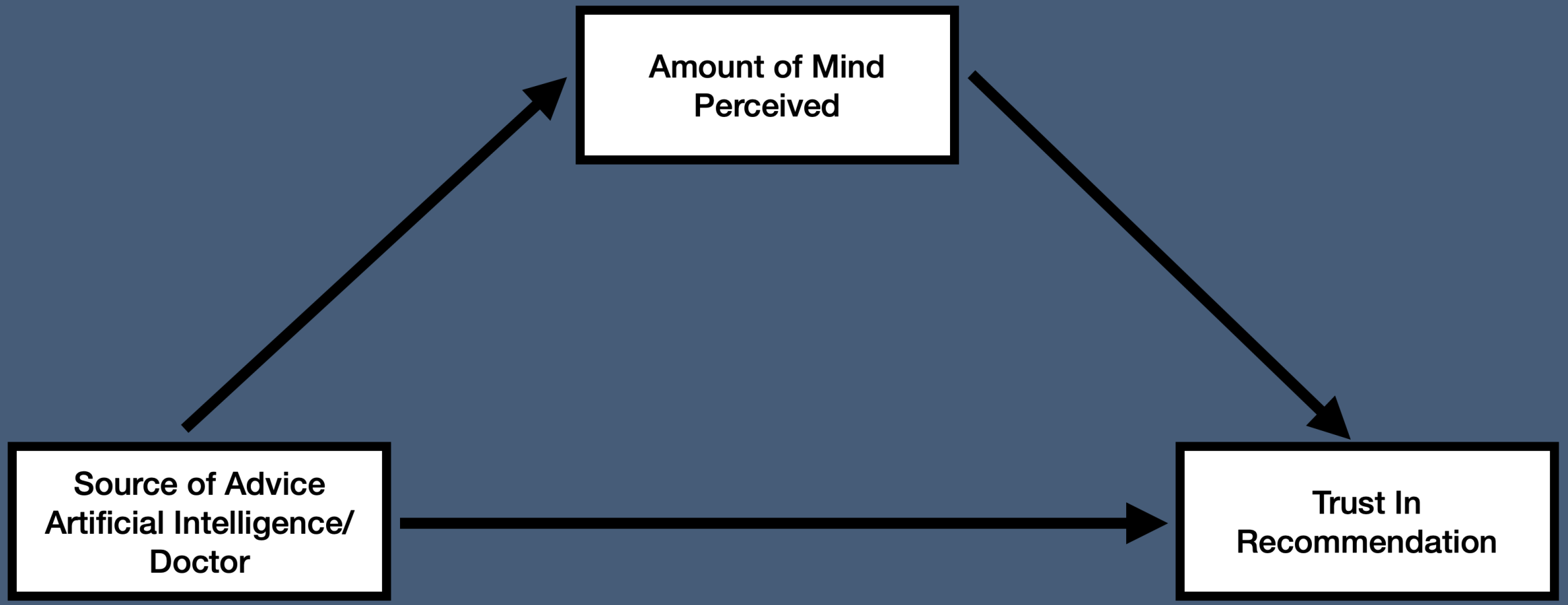
Results



Note - This was measured on a -3 to 3 scale, from Don't Trust/Believe at all to Completely Trust/Believe

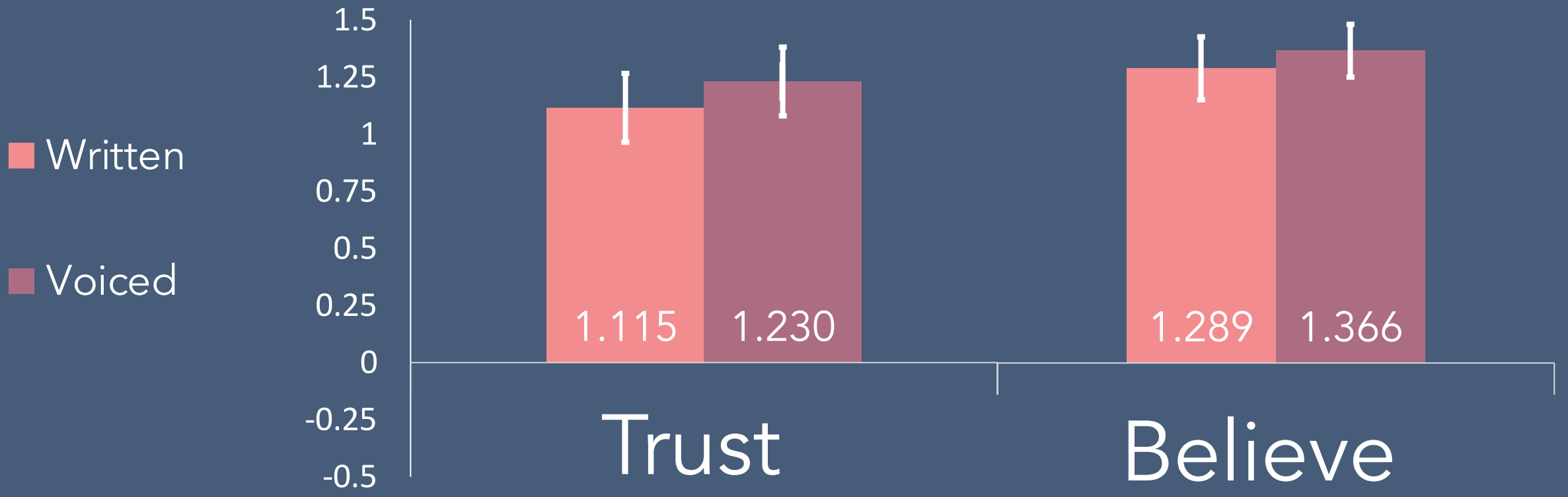
Study 4

Replicating Effects, Evaluating The Role of Voice, & Evaluating Mind


Amount of Mind Perceived
Source of Advice Artificial Intelligence/ Doctor
Trust In Recommendation

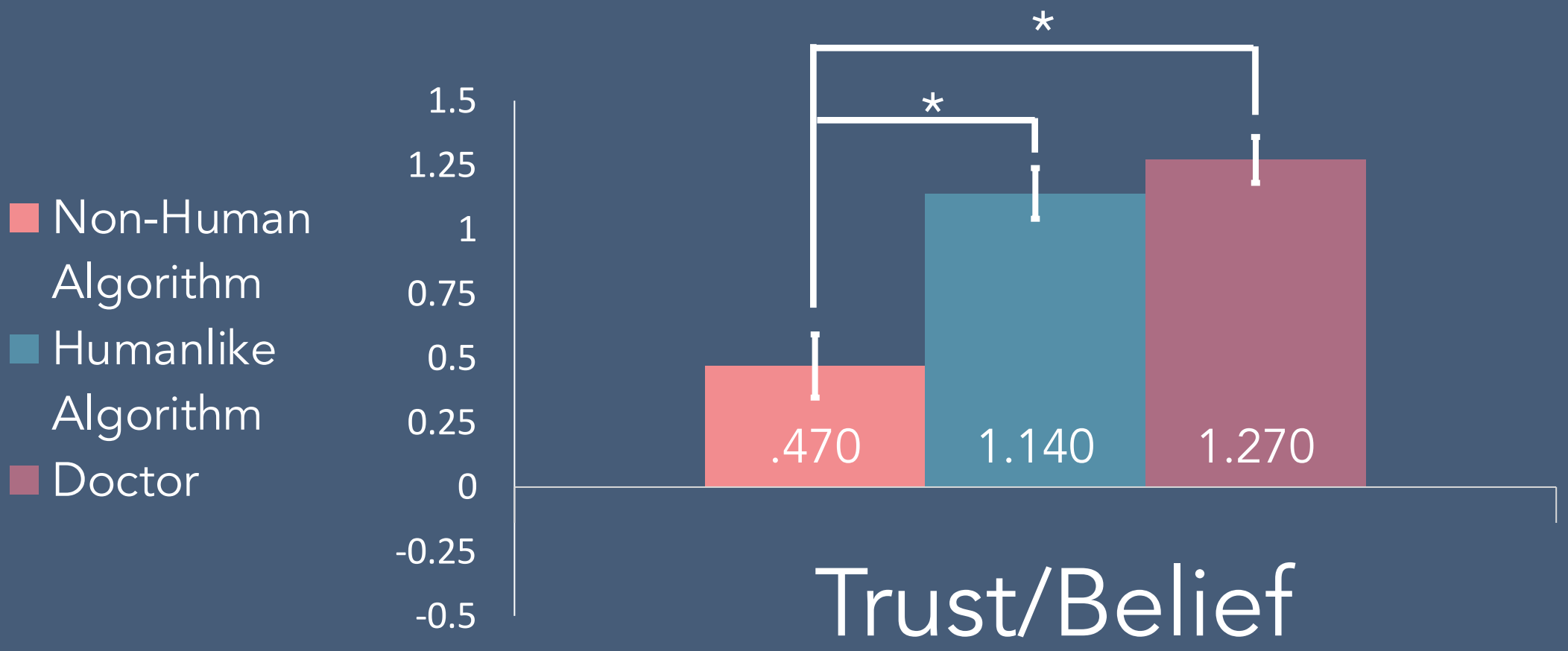
* Indicates significance at p < .05

Comparing Voiced to Written



* Indicates significance at p < .05

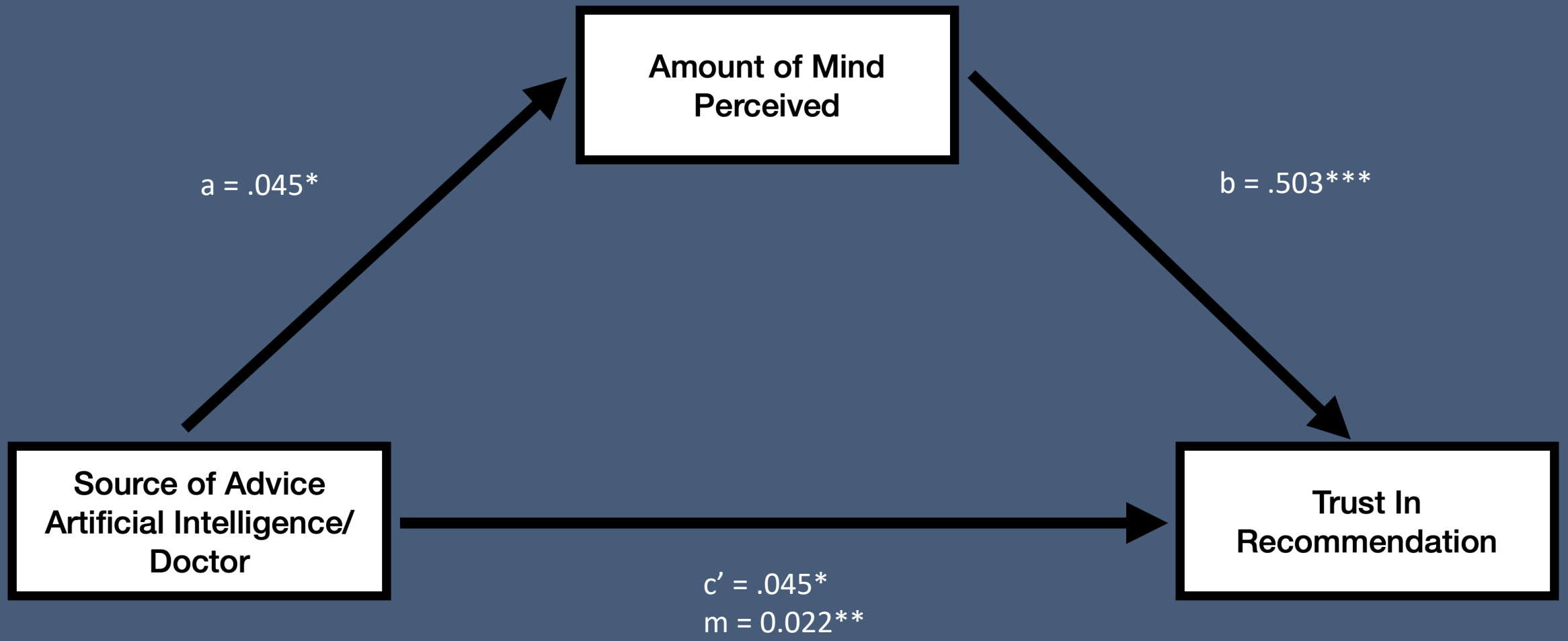
Results – Within Subjects



Note - This was measured on a -3 to 3 scale, from Don't Trust/Believe at all to Completely Trust/Believe

Trust/Belief

Fixed Effects	Estimates	std. Beta	CI	p
(Intercept)	-1.42***	0.03	-1.59 – -1.25	<0.001
Cond - Standard AI	-0.32***	-0.21	-0.40 – -0.23	<0.001
Cond - Doctor	0.1*	0.06	0.01 – 0.18	0.021
IsVoiced	0.04	0.02	-0.08 – 0.16	0.552
Mind_Perception	0.4***	0.66	0.38 – 0.42	<0.001
Random Effects				
σ^2	0.69			
$\tau_{00\ ResponseId}$	0.51			
ICC	0.43			
$N_{\ ResponseId}$	853			
Observations	2367			
Marginal R^2 / Conditional R^2	0.472 / 0.698			


Amount of Mind Perceived
a = .045*
b = .503***
Source of Advice Artificial Intelligence/ Doctor
Trust In Recommendation
c' = .045*
m = 0.022**

General Discussion

- We found that people generally trust doctor’s recommendations over Algorithm's recommendations
  - This is partially due to the level of intuition and quantitative reasoning individuals believe the decision-making entity can employ.
- One of the ways we may be able to decrease this trust disparity is through “humanization” of the algorithm.
  - This would work by increasing the “mind” the individual believes the decision-making entity has.

Future Directions & Next Steps

- Determining Other Mechanisms
  - Did not explain all of the differences
- Mapping Onto Behavior
  - Behaviors may be different than attitudes
- Tracking this Effect Across Time
  - As people become more familiar with these technologies, this effect may change.


OSF Page

Thank you!

Quantitative Reasoning

- Quantitative reasoning is the process of using mathematical concepts and skills to make sense of numerical information and to solve problems. It involves understanding and manipulating numerical data, interpreting graphical representations of data, and using mathematical models to make predictions or draw conclusions.
- Quantitative reasoning results from the analysis of experimental and observational data with the objective to build mathematical models that describe natural phenomena.

Intuition

- Intuition can be described as a natural ability to understand or perceive things without conscious reasoning. It is often described as a gut feeling or a hunch that can guide an individual's decision-making process.
- Intuition is believed to arise from knowledge that an individual has accumulated throughout their life, such as past experiences, memories, and insights gained through observation.

Results

Within Group

	Competence	Quant	Warmth	Intuition
Competence	1.00			
Quant	.77***	1.00		
Warmth	.84***	.67***	1.00	
Intuition	.78***	.73***	.78***	1.00

Between Group

	Competence	Quant	Warmth	Intuition
Competence	1.00			
Quant	.64***	1.00		
Warmth	.61***	.51***	1.00***	
Intuition	.61***	.76***	.59***	1.00