Balancing Innovation and Public Trust: A Survey of Public Preferences for AI in Healthcare Decision-Making in Singapore

Australasian Association of Bioethics and Health Law (AABHL)

Toh Hui Jin

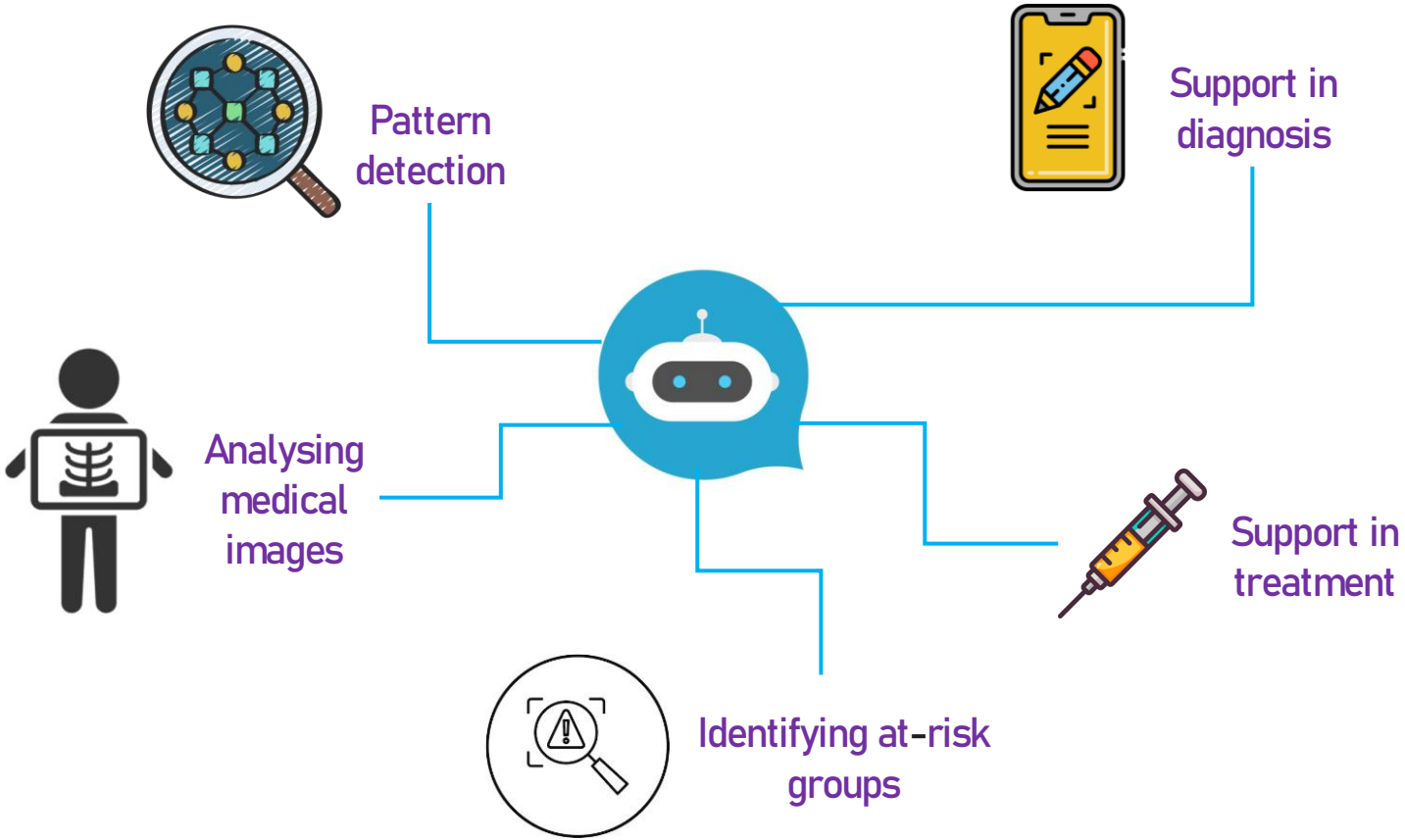
2 December 2024

Imagine that you need to be admitted to a hospital because you have a condition that needs to be diagnosed and treated.

Which AI system would you prefer?

	AI System 1	AI System 2	AI System 3
Decision:	Suggests a diagnosis.	Suggests a treatment.	Suggests a treatment.
Severity:	Used for both minor and severe illnesses.	Used for both minor and severe illnesses.	Used for minor illness.
Explainability:	Cannot be explained at all.	Can be explained like a doctor's.	Cannot be explained like a doctor's.
Quality:	Somewhat better than a doctor's.	Much better than a doctor's.	Somewhat better than a doctor's.
Responsibility:	The AI system is responsible.	The doctor is responsible.	The doctor is responsible.
Discrimination:	Has been tested for discrimination.	Has been tested for discrimination.	Has not been tested for discrimination.

Modern AI is rapidly transforming healthcare.



The black box nature of modern AI has led to social and ethical concerns.

Explainability vs. quality

Potential challenges/harms:

- Misdiagnoses and adverse patient outcomes
- Worsening of racial and gender inequalities stemming from algorithm bias
- Lack of diversity in training datasets
- Concerns in establishing responsibility and legal liability

Existing AI governance frameworks

WHO calls for safe and ethical AI for health

16 May 2023 | Departmental update |Reading time: 2 min (507 words)

J Am Med Inform Assoc. 2019 Nov 4;27(3):491–497. doi: 10.1093/jamia/ocz192

A governance model for the application of AI in health care

Sandeep Reddy [1,✉], Sonia Allan [2], Simon Coghlan [3], Paul Cooper [1]

JMIR Form Res. 2022 Jan 31;6(1):e31623. doi: 10.2196/31623.

Governing Data and Artificial Intelligence for Health Care: Developing an International Understanding

Jessica Morley [# 1], Lisa Murphy [# 2], Abhishek Mishra [3], Indra Joshi [2], Kassandra Karpathakis [4]

Artificial Intelligence in Healthcare Guidelines (AIHGle)

Internal Governance Structures and Measures

- Clear roles and responsibilities in your organisation
- SOPs to monitor and manage risks
- Staff training

Determining the Level of Human Involvement in AI-augmented Decision-making

- Appropriate degree of human involvement
- Minimise the risk of harm to individuals

Operations Management

- Minimise bias in data and model
- Risk-based approach to measures such as explainability, robustness and regular tuning

Stakeholder Interaction and Communication

- Make AI policies known to users
- Allow users to provide feedback, if possible
- Make communications easy to understand

Ministry of Health Singapore. Artificial Intelligence in Healthcare Guidelines (AIHGle). 2021.

The public voice matters!

Existing AI governance frameworks are abstract, broad, and do not address ethical complexities and nuances inherent in AI applications in practice within local contexts.

Social license to operate (SLO):
Informal acceptance and approval granted by society to research activities, extending beyond regulatory compliance. It is context dependent.

Study aim

To conduct a choice-based conjoint (CBC) analysis survey to examine what ethical values are important to Singaporeans in AI decision-making in health care.

What is conjoint analysis?

- A survey method that examines how people make complex decisions.
- Assumes that people make decisions based on a combination of factors/attributes.
- Measures relative importance (i.e. how important one attribute is compared to another) and utility.

Methodology

- 596 survey respondents completed this survey.
- This survey was adapted from an instrument developed by Ploug et al (2021).
- Six attributes that influence AI decision making in health care were used in the analysis.

Decision

1. Suggests a diagnosis.
2. Suggests a treatment.

Severity

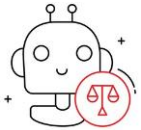
1. Used for minor illness.
2. Used for both minor and severe illnesses.

Quality

1. Much better than a doctor's.
2. Somewhat better than a doctor's.
3. As good as a doctor's.

Explainability

1. Can be explained like a doctor's.
2. Cannot be explained like a doctor's.
3. Cannot be explained at all.



Responsibility

1. The doctor is responsible.
2. The AI system is responsible.

Discrimination

1. Has been tested for discrimination.
2. Has not been tested for discrimination.

An example of a hypothetical scenario with 3 AI systems

Which AI system would you prefer?

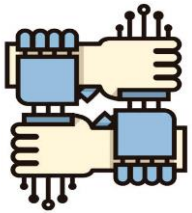
(Page 1 of 12)

	AI System 1	AI System 2	AI System 3
Decision:	Suggests a diagnosis.	Suggests a treatment.	Suggests a treatment.
Severity:	Used for both minor and severe illnesses.	Used for both minor and severe illnesses.	Used for minor illness.
Explainability:	Cannot be explained at all.	Can be explained like a doctor's.	Cannot be explained like a doctor's.
Quality:	Somewhat better than a doctor's.	Much better than a doctor's.	Somewhat better than a doctor's.
Responsibility:	The AI system is responsible.	The doctor is responsible.	The doctor is responsible.
Discrimination:	Has been tested for discrimination.	Has been tested for discrimination.	Has not been tested for discrimination.

Trust in healthcare and technology, and fears and hope about AI

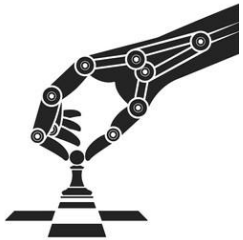
Trust in healthcare and technology

- I have trust in the health care system.
- I have trust in physicians.
- I have trust in technology.



Hope about AI

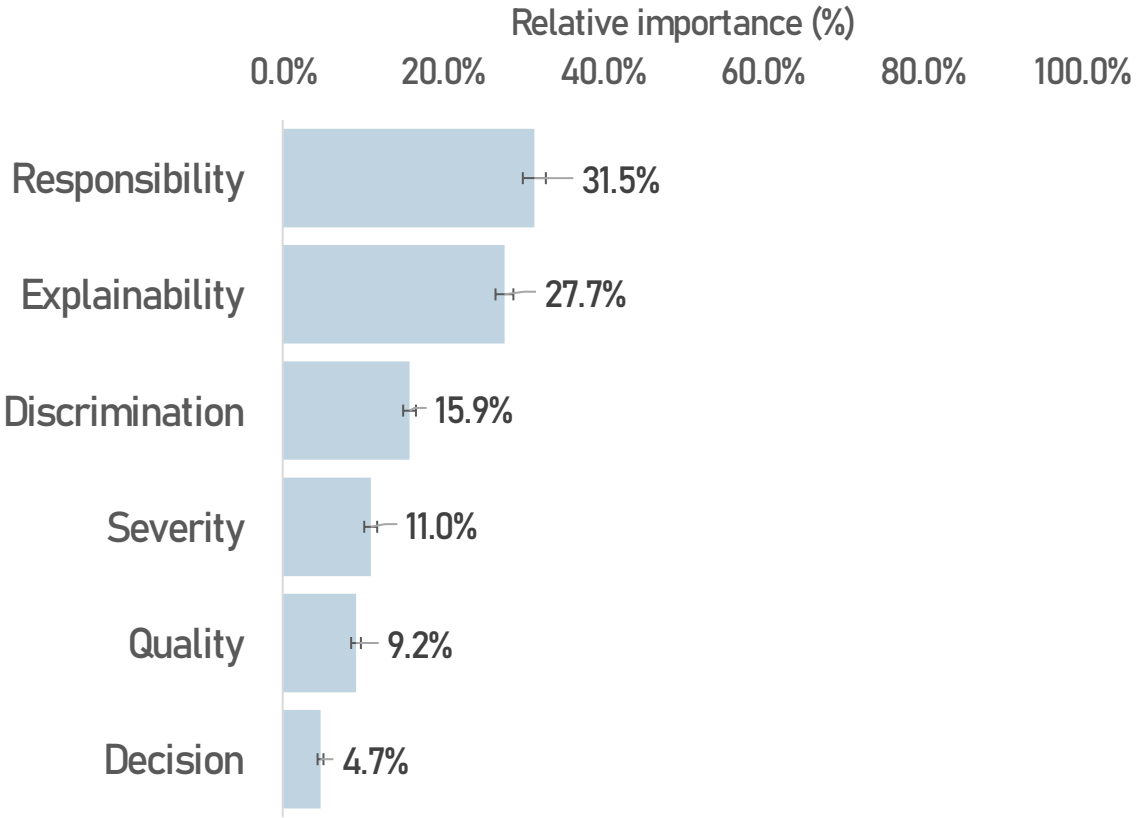
- I believe that AI will lead to more jobs.
- I believe that AI will lead to longer lives.
- I believe that AI will lead to more quality of life.
- I believe that AI will lead to peace and political stability.



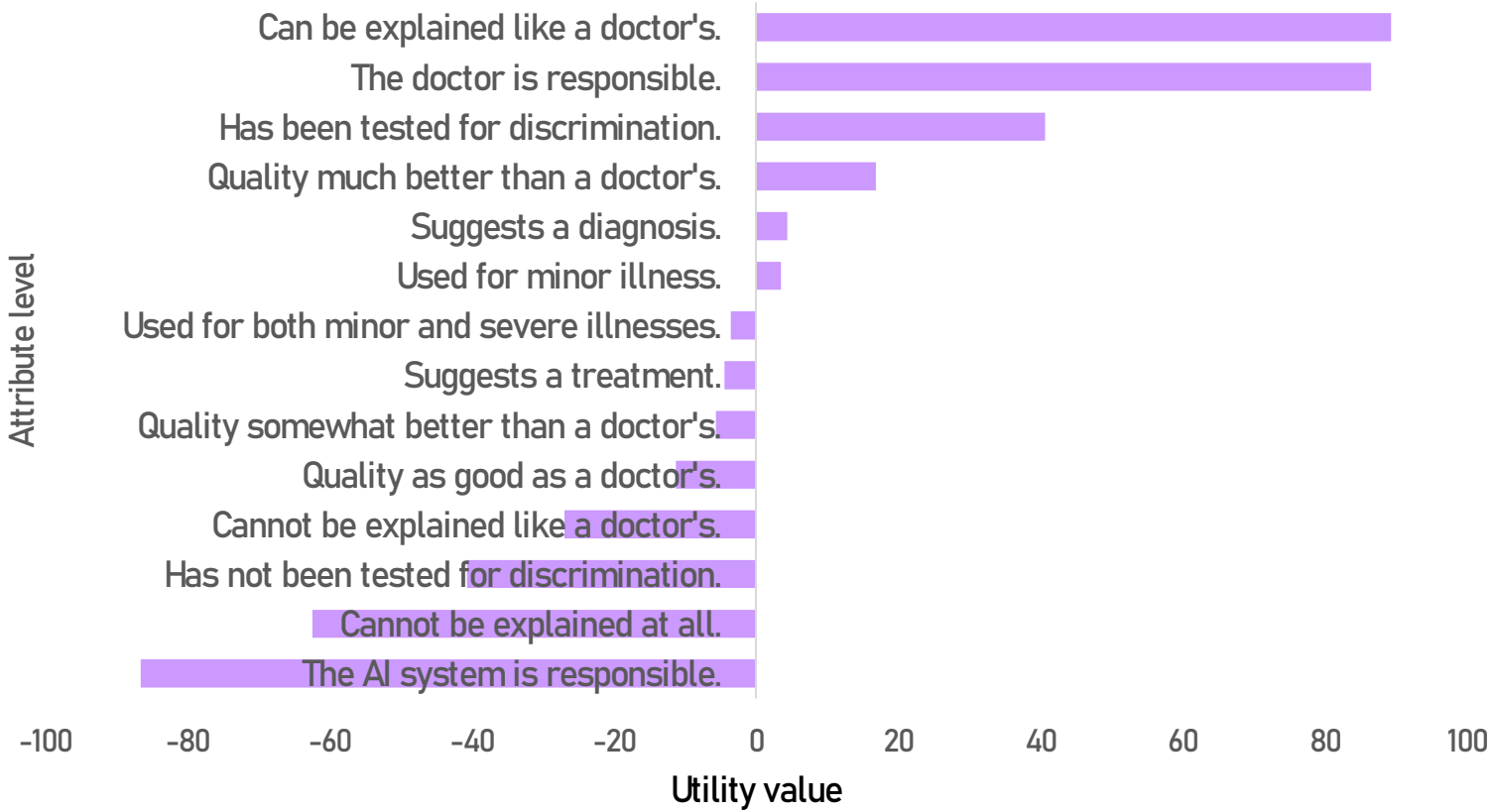
Fears about AI

- I believe that AI will lead to unemployment.
- I believe that AI will cause unintentional harm to humans.
- I believe that AI will lead to loss of control to machines.
- I believe that AI will lead to increased data collection and mass surveillance.

Relative importance of attributes



Utility values of attribute levels



Trust in healthcare and technology, and fears and hope about AI

Trust in healthcare and technology	I have some/a lot of trust in:	• Physicians	95%
		• Technology	88%
		• Health care system	83%
Hope about AI	I believe that AI will somewhat/ certainly lead to:	• More quality of life	62%
		• More jobs	48%
		• Longer lives	42%
		• Peace and political stability	27%

Trust in healthcare and technology, and fears and hope about AI

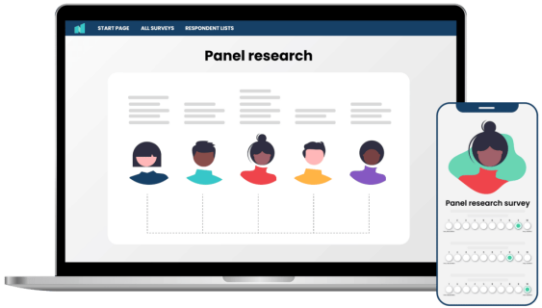
Fears about AI	I believe that AI will somewhat/ certainly:	• Lead to increased data collection and mass surveillance.	87%
		• Lead to unemployment.	58%
		• Cause unintentional harm to humans.	51%
		• Lead to loss of control to machines.	45%

Discussion

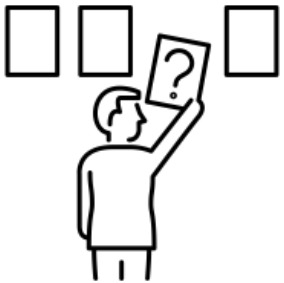
Prior Singapore research	• Key principles identified: responsibility/accountability, transparency, fairness
Comparison with Danish survey (Ploug et al. 2021)	• Similar in ranking attributes • Singapore showed a stronger preference for explainability, rather than the doctor being held responsible for the AI's recommendations. • Singapore showed higher trust in AI, and scored higher in both the fear and hope scales.
International comparison	• Contrasts with a US study where quality was prioritized over explainability • Other studies did not carry out trade-off experiments

Limitations

Survey panel is more familiar and knowledgeable about the topic.



Hypothetical scenarios might not reflect actual future preferences.



The attributes tested might not be directly applicable to Singapore.

Conclusion

Prior to advancing the technological quality of the AI system, there is a social and ethical obligation to first fulfil the following requirements:

- the AI system's suggestions to be explainable like a doctor's,
- subject to human doctors' oversight,
- rigorously tested to minimize discrimination.

Future work

- Fine-tune approaches for integrating AI into clinical decision-making that serve the public good

- Conduct additional empirical studies
  - To analyse trade-offs between explainability and responsibility
  - To identify which values should be added, emphasized, or de-emphasized to best align with local cultural norms and values.

Acknowledgements

- Funder: Singapore-ETH Centre

- Dr Hui Yun Chan
  Centre for Biomedical Ethics, National University of Singapore

- A/Prof Tamra Lysaght
  Sydney Health Ethics, University of Sydney

- Dr Owen Schaefer
  Centre for Biomedical Ethics, National University of Singapore

References

- Higgins, D.; Madai, V. I. From bit to bedside: a practical framework for artificial intelligence product development in healthcare, *Advance Intelligence Systems*. **2020, *2***.
- Romero-Brufau, S.; Wyatt, K. D.; Boyum, P.; Mickelson, M.; Moore, M.; Cognetta-Rieke, C. A lesson in implementation: a pre-post study of providers' experience with artificial intelligence-based clinical decision support., *International Journal of Medical Informatics*. **2019, *137***.
- Matheny, M.; Israni, S. T.; Auerbach, A.; Beam, A. Artificial intelligence in health care: The hope, the hype, the promise, the peril, *National Academy of Medicine*. **2020,** 94-97.
- He, J.; Baxter, S. L.; Xu, J.; Xu, J.; Zhou, X.; Zhang, K. The practical implementation of artificial intelligence technologies in medicine, *Nature Medicine*. **2019,** DOI https://doi.org/10.1038/s41591-018-0307-0, 30–36
- Gómez González, E.; Gutiérrez, G. *Artificial Intelligence in Medicine and Healthcare: applications, availability and societal impact*, Luxembourg, 2020.
- Reddy, S.; Allan, S.; Coghlan, S.; Cooper, P. A governance model for the application of AI in health care, *Journal of the American Medical Informatics Association*. **2020, *27,*** 491–497.
- Morley, J.; Murphy, L.; Mishra, A.; Joshi, I.; Karpathakis, K. Governing Data and Artificial Intelligence for Health Care: Developing an International Understanding, *JMIR Formative Research*. **2022, *6,*** e3162.
- Ministry of Health Singapore. Artificial Intelligence in Healthcare Guidelines (AIHGle). Singapore, 2021.
- Ploug, T.; Sundby, A.; Moeslund, T. B.; Holm, S. Population Preferences for Performance and Explainability of Artificial Intelligence in Health Care: Choice-Based Conjoint Survey, *Journal of Medical Internet Research*. **2021, *23***.
- Ballantyne, A.; Lysaght, T.; Toh, H. J., et al. Sharing precision medicine data with private industry: Outcomes of a citizens' jury in Singapore, Big Data & Society. 2022, 9.
- Lysaght, T.; Ballantyne, A.; Xafis, V., et al. "Who is watching the watchdog?": ethical perspectives of sharing health-related data for precision medicine in Singapore, BMC Medical Ethics. 2020, 118.
- Lysaght, T.; Ballantyne, A.; Jin, T. H., et al. Trust and Trade-Offs in Sharing Data for Precision Medicine: A National Survey of Singapore, Journal of Personalized Medicine. 2021, 11.

Thank you for listening!