What Is the Role of Humans in a World of Artificial Intelligence: An Economic Evaluation of Human–AI Collaboration

HTA38

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KEY MESSAGE

- **Human expertise remains indispensable: annual copilot human–AI screening improved health outcomes while reducing costs among 270 human-AI collaboration scenarios compared to status quo.**

BACKGROUND

Artificial intelligence (AI) has demonstrated strong diagnostic performance and potential cost savings in diabetic retinopathy (DR) screening. However, evidence remains limited on **how AI and human graders should collaborate** to maximize long-term health and economic benefits.

OBJECTIVE

To compare alternative AI-based screening workflows and identify the most cost-effective human–AI collaboration strategy for DR screening in China.

MODEL & SCENARIOS

A hybrid decision-tree/Markov model simulated a cohort of 100,000 people with diabetes over their lifetime from a societal perspective. Using real-world screening data, eight AI-based strategies and manual screening were evaluated across **270 scenarios: nine workflows, six screening frequencies, and five target age groups**. Outcomes included costs, quality-adjusted life years (QALYs), and years without blindness.

NINE SCREENING STRATEGIES

Status quo Manual: M·M + M2

AI only: AI

Human review: AI + M

Expert review: AI + M2

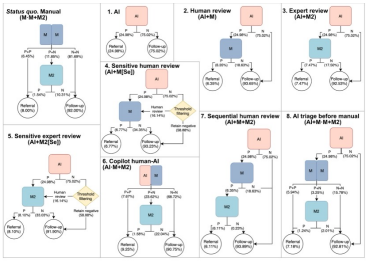
Sensitive human review: AI + M[Se]

Sensitive expert review: AI + M2[Se]

Copilot human–AI: AI·M + M2

Sequential human review: AI + M + M2

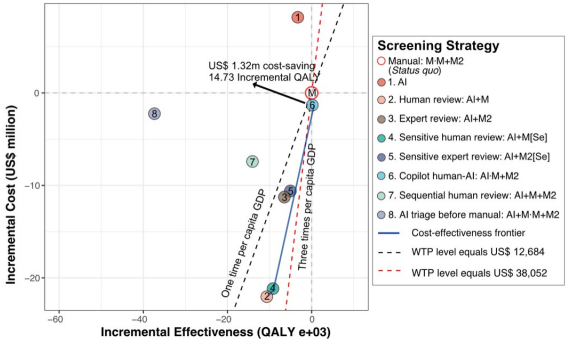
AI triage before manual: AI + M·M + M2



M, primary grader; M2, secondary grader; '·', independent parallel grading; '+', review/escalation; [Se], sensitivity-enhanced thresholding.

COST-EFFECTIVENESS

Copilot human–AI was the only strategy that reduced costs and gained QALYs.



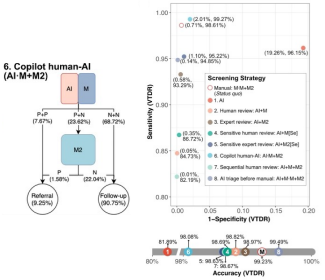
US$1.32m	cost savings versus manual screening
14.73	additional QALYs
49.33	additional years without blindness
US$1.88m	net monetary benefit

Annual screening at ages 20–79 per 100,000 people over a lifetime.

WHY COPILOT WORKS

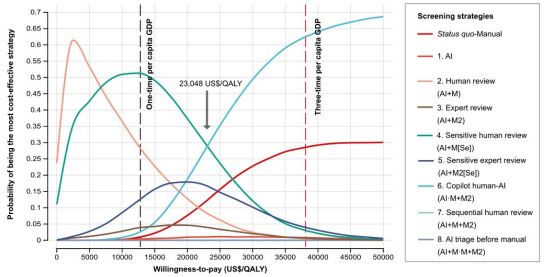
AI and a primary human grader assess all images **independently in parallel**, with disagreements resolved by a secondary grader.

By combining AI's typically high sensitivity with humans' high specificity, this workflow recovers cases missed by either grader, maximizes overall sensitivity, and delivers greater health gains at lower cost.



SENSITIVITY ANALYSES & SUBGROUP ANALYSES

Probabilistic and one-way sensitivity analyses showed robust cost-effectiveness. At a willingness-to-pay level higher than 23,084 US$/QALY, copilot human–AI screening retained to be the most cost-effective strategy compared to status quo.



Subgroup analyses showed consistent effectiveness advantages across age groups, screening frequencies and rural–urban settings, while the magnitude of cost savings varied by context.

REAL-WORLD IMPLEMENTATION & IMPACT

A scalable, human-centred model.

Accountability and trust: Human involvement supports diagnostic responsibility, routine monitoring of AI–human disagreements can detect performance drift and maintain safety.

Scalable deployment: Standardized training, quality control, low-cost imaging and offline/low-bandwidth systems may support implementation in resource-limited settings.

Local adaptation: Cost-effectiveness depends on AI price, labour costs, disease prevalence and healthcare infrastructure; in this study, AI costs below approximately **US$1** per person supported the optimal strategy.

CONCLUSION

AI-alone screening did not maximize health or economic value. Across 270 scenarios, combining AI efficiency with human clinical judgement through annual copilot screening produced the best outcomes while reducing costs versus manual screening.

Source: Wang, Y., Han, X., Hu, W. et al. Cost-effectiveness analysis of human–AI collaboration in disease screening. Nat. Health (2026). https://doi.org/10.1038/s44360-026-00142-w.

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