What is the Economic Value of an AI-based Tool for the Triage of Skin Cancer in the UK?

Sam Woods[1], Angel Varghese[1]

[1]York Health Economics Consortium, University of York, York, YO10 5NQ

INTRODUCTION

Skin disease is a common medical problem, representing 8.4% of primary care cases [1]. People can present to a GP with a range of dermatological problems, some being easier to diagnose than others.

Artificial intelligence (AI) has been employed in healthcare to create diagnostic tools [2] and has taken an increasing role within skin cancer pathways [3]. However, the optimal placement within the pathway is yet to be decided.

The aim of this analysis was to estimate the potential impact of an AI triage tool in place of consultant-only triage of suspected skin cancer referrals to a dermatology clinic from primary care.

METHODS

An early cost-comparison model was developed to estimate the potential impact of an AI triage tool compared with consultant-led triage (Figure 1). The analysis was agnostic to the type of AI tool. Therefore, published evidence across a range of tools was used to inform the analysis.

The decision problem is presented in Table 1. The model estimated the resource use and costs associated with the current pathway with consultant triage, taking into account current referrals as well as true and false positive cases. This was compared with resource use and costs associated with a hypothetical pathway where a proportion of referrals are triaged by an AI tool instead. The model leveraged data on referrals and diagnosis from two Scottish NHS sites to present two case studies.

Figure 1: Model structure

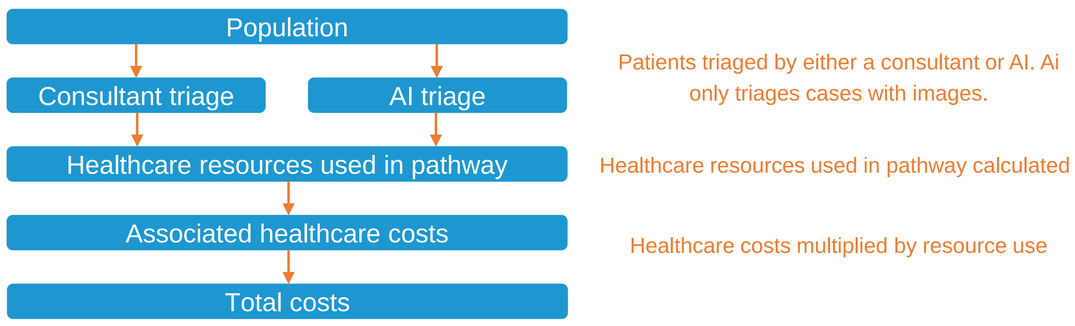


Table 1: Decision problem

Population	Individuals who have been referred to secondary care due to symptoms indicative of skin cancer
Intervention	Image-based AI triage tool alone for onward management
Comparator	Current pathway for onward management: (consultant triage with or without image)
Outcomes	Incremental costs and secondary care appointments avoided
Perspective	NHS Scotland
Time horizon	Three months

Model assumptions

- All false positive cases still have an appointment with a dermatologist.
- Discharged cases, both false and true negatives, accumulate no further resource use.
- True positives' outcomes post triage are the same with and without AI due to a lack of evidence to inform how the AI may triage true positive cases to the most appropriate resource compared with consultant triage.
- There would be an initial set up cost for the AI as well as a potential recurring cost per patient case that is triaged by the AI, these values are assumptions because the analysis did not consider a specific AI triage tool.

RESULTS

Case Study One

The results demonstrate that, for a yearly cohort of 10,800 patients in the Tayside area, AI triage has the potential to be cost saving by approximately £100,000 (£9 per person). The intervention incurs additional costs relating to the initial GP appointment due to more patients having a GP photo in their visit, leading to an extended appointment time. However, this is estimated to be offset by the savings observed from reduced consultant time for triage.

The model included functionality to capture multiple costing approaches for photos (e.g. GP-taken and self-taken images). In the base case, all patients used GP-taken images, so photography costs were included in GP costs (see Table 2).

It is important to note that current AI costs are hypothetical and, therefore, do not reflect true costs. There are no differences in healthcare appointments or true negatives correctly triaged and discharged because the intervention was assumed to have equivalent efficacy to consultant-alone triage.

Table 2: NHS Tayside per person cost breakdown

	Intervention	Comparator	Incremental
Triage cost	£3.02	£14.47	-£11.45
Initial GP appointment	£60.67	£58.48	£2.19
Photography cost	£0.00	£0.00	£0.00
Management cost	£0.37	£0.37	£0.00

Case Study Two

The results demonstrate that, for a yearly cohort of 5,500 patients in the Forth Valley area, the intervention has the potential to be cost saving by approximately £25,000 (£4.50 per person). The observed cost savings are again a result of the reduction in triage costs. All patients used self-taken images which resulted in no photography costs (see Table 3). The assumptions used in Case Study One regarding AI costs and efficacy are also applied in this case study, meaning the same outcome is also evident here.

Table 3: NHS Forth Valley per person cost breakdown

	Intervention	Comparator	Incremental
Triage cost	£9.89	£14.47	-£4.58
Initial GP appointment	£65.27	£65.27	£0.00
Photography cost	£0.00	£0.00	£0.00
Management cost	£0.38	£0.38	£0.00

Scenario Analysis

Scenario analysis was conducted to investigate the impact of triage effectiveness on incremental costs. Results for both NHS sites show that as AI specificity increases, the cost savings increase due to the AI being able to more accurately diagnose those without the disease to avoid unnecessary secondary care consultations. The opposite effect is observed when increasing consultant specificity because more appointments occur.

Scenario analysis was also conducted on the set-up cost and cost per triage associated with AI. The set-up cost was ranged from £0 to £50,000 and the cost per triage was ranged from £0 to £3. As expected, when the costs increase, the cost savings are reduced. For NHS Tayside, the intervention remained cost saving at all prices. Alternatively, in the NHS Forth Valley case study, the pathway becomes cost incurring at around £26,000 set-up cost but remains cost saving for all costs per triage.

CONCLUSIONS

The cost-comparison model demonstrates that the implementation of AI for skin cancer referrals has the potential to be cost saving when implemented in NHS Tayside and NHS Forth Valley. For both sites, the largest cost savings were due to decreased triage costs.

There are no monetary or health cost assigned to the false negative proportion of the patients. Therefore, the consequences of missed cancers is not currently captured where this is likely to be an important point to consider in any future analysis. Additionally, the way that patients are triaged is not explicitly modelled. There are numerous outcomes post-triage, such as referral to surgical list or non-surgical treatment, where the impact on health outcomes where not captured. This is an important factor that should be considered in the future.

The current analysis does not investigate the difference in clinical outcomes between AI and consultant triage. Future research should explore these differences and the effect this has on the clinical outcomes, and ultimately the cost-effectiveness.

REFERENCES

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CONTACT US

angel.varghese@york.ac.uk

+44 1904 326477

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www.yhec.co.uk

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