Difficulties with Populations when Modelling DHTs: STI Case Study

Varghese A[1], Woods S[1], Kelly L[1], Holmes H[1]

1 York Health Economics Consortium

INTRODUCTION

New health interventions are implemented into the healthcare system on a regular basis. When modelling the potential impact of new interventions and their comparator, the population affected are typically identical. However, within digital health technologies (DHTs), it is common for new interventions to alter the patient pathway, which can also impact the population that the intervention is targeted at.

The differentiation in populations can be challenging to model. For example, differences in populations may mean that the underlying prevalence of the condition explored might be altered for the intervention population. A good example of this would be the introduction of a home testing kit for diseases. The home testing kit would reach a much larger population compared to standard testing procedures. This poster uses a case study of an economic evaluation YHEC has conducted to present this problem, where differing populations were used for the intervention and comparator.

METHODS

An economic model was developed to investigate the health and cost impact of implementing home testing kits for sexually transmitted infections (STIs) when compared with standard in-clinic testing. The model aimed to capture downstream effects of detecting and treating STIs which remain undiagnosed. This analysis was originally conducted for the National Institute of Health and Care Excellence (NICE) for guidance on reducing sexually transmitted infections [1].

Table 1: Decision problem

Population	General population (age 16+)
Intervention	Home testing for STIs
Comparator	Standard clinic-based STI testing
Type of evaluation	Cost-utility analysis
Perspective	NHS and Personal Social Services

The model estimates the impact of an increase in testing coverage across three STIs (chlamydia, gonorrhea, and syphilis), allowing for independent and combined STI analyses. Based on a meta-analysis of 7 studies, use of home testing resulted in an increase in positive tests of 71% [2]. Complications for each untreated STI were included in the model where it was assumed to be averted if the STI is diagnosed, and therefore treated. The cost and health impact was estimated by calculating the number of complications averted from excess cases being detected through home testing, which would have otherwise remained untreated. Additional considerations included how many tests, once ordered, are used and returned and the usability of the returned samples. As well as primary cases, secondary effects are also captured by exploring transmission from partner and the consequent prevention of complications attributable to STIs.

In the base case analysis, we assume that the intervention and comparator populations are equivalent. Put another way, we assume that the increase in number of completed tests is linear to the increase in positive tests (71% increase). We then ran a more conservative scenario where the positive diagnosis yield from home testing is lower using evidence from a meta-analysis of RCTs. This analysis reported that a 93% increase in completed tests [2]. Therefore, in the lower risk scenario we applied a 93% increase in completed tests but kept increase in positive STI diagnoses as 71% [2].

We also undertook an additional scenario with a test return rate of less than 100%, assumed in the base case.

RESULTS

All results are presented per 10,000 people undergoing standard STI testing. The result focuses on the general population, considering testing for all 3 STIs together. All tests ordered are assumed to be returned, where all returned samples are fit for purpose, therefore, not requiring re-testing. A positive home test does not require a confirmatory clinic test before commencing treatment.

The use of the home test is estimated to be cost-effective with an ICER of £3,865 when compared with standard STI testing assuming equivalent prevalence. The inclusion of a differential increase in completed tests and positive diagnoses resulted in a larger ICER (£3,865 and £13,877 for the optimistic scenario and the lower risk scenario, respectively).

Table 2: Results

	ICER	NHB	Incremental cost	QALY loss prevented
Base case analysis	£3,865	3.09	£14,794	3.83
Lower risk scenario	£13,877	1.17	£53,112	3.83
Returned tests <100%	£21,632	-0.31	£82,795	3.83

The use of the home test is estimated to be cost-effective at a threshold of £20,000 per QALY in both the base case analysis and lower risk scenario. The additional cost of testing is compensated for by the QALY loss prevented. However, as we take a less optimistic approach on diagnostic yield in the lower-risk scenario, the total cost increased (total incremental cost of £14,794 and £53,112 for the base case and lower risk scenario, respectively). This shows that the total cost impact is sensitive to a change in the population between the intervention and comparator. Similarly, as we further reduced the proportion of returned tests, the total cost impact increased.

DISCUSSION

Modelling different populations between the intervention and comparator can be challenging but must be considered because this is likely to impact the estimates of economic impact. This case study outlines an approach to addressing this by leveraging evidence to draw assumptions and guide scenario analyses.

The lower-risk scenario in this case-study was run to explore the impact of home testing kits reaching a much larger population with differing underlying risks than the comparator. The excess population have a lower prevalence of STI's than those who would usually engage with sexual health services and have in-clinic STI testing. The results showed that by changing the underlying prevalence of the conditions in the excess population it increased the incremental costs and, therefore, the ICER.

The issue of population variation between the intervention and comparator is common to DHTs as well as technologies involving channel shifting. Examples outside of the home-testing case presented here include the use of mental health and dermatology diagnostic phone applications. Beyond DHTs, this issue would also be relevant to analysis involving channel shifting such as moving faecal immunochemical tests and faecal calprotectin tests from a secondary care to a primary care setting.

This case study had limitations such as data uncertainties and assumptions applied. However, it highlights a potential solution in modelling differing populations between the intervention and comparator and how impactful these can be on the model results.

CONCLUSIONS

New health interventions can lead to differing populations between the intervention and comparator, which creates challenges when conducting economic analyses. The current case study outlines an approach to talking this challenge. This exampled used an additional parameter for the differential rate of completed tests in the new population, who may not have had the same underlying risk of STI as those in the comparator arm. Sensitivity analyses was then conducted to highlight how this effected the results.

REFERENCES

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2. Bracebridge S, Bachmann MO, Ramkhelawon K, Woolnough A. Evaluation of a systematic postal screening and treatment service for genital Chlamydia trachomatis, with remote clinic access via the internet: a cross-sectional study, East of England. Sexually transmitted infections. 2012.88(5):375-81.

CONTACT US

hayden.holmes@york.ac.uk

+44 1904 323620 www.yhec.co.uk

York Health Economics Consortium

Providing Consultancy & Research in Health Economics