Cost-effectiveness of a complex adherence intervention to improve prevention in CF by empowering effective self-management: an exploratory health economic evaluation using UK registry data

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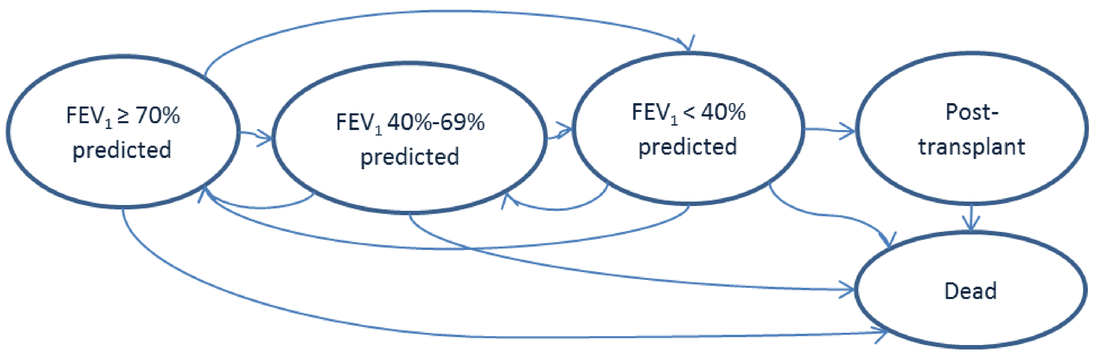
Background

Patients with cystic fibrosis (CF) experience exacerbations which may require treatment with intravenous (IV) antibiotics. Adherence to nebulised CF treatments is currently estimated to be <50%. Improving adherence is hypothesised to reduce the number of exacerbations experienced by CF patients and the rate of deterioration of lung function. This may reduce the costs associated with managing exacerbations and other treatment costs, whilst also increasing patients' health-related quality of life (HRQoL). CFHealthHub is a complex intervention linking systematic feedback of adherence data with strategies to empower self-management. This study presents an early health economic evaluation of the CFHealthHub intervention in advance of the full ACtiF RCT.[2]

Methods

A model-based economic evaluation was undertaken to estimate the incremental cost-effectiveness of the proposed adherence intervention compared with current care from the perspective of the NHS and Personal Social Services (PSS) over a lifetime horizon. The model structure was based on a previously published Markov model developed to inform the National Institute for Health and Care Excellence's (NICE) appraisal of dry powder antibiotics for treating *Pseudomonas Aeruginosa* lung infection in CF (see Figure 1). Health gains were valued in terms of quality-adjusted life years (QALYs) gained. The model estimates the trajectory of patients' lung function over three strata, measured in terms of FEV_1% predicted: (i) FEV_1 ≥70% (ii) FEV_1 40-69% and (iii) FEV_1 <40%. Additional health states are also included to represent post-lung transplantation and dead. The adherence intervention is assumed to reduce the number of IV days and consequently the rate at which patients progress through the FEV_1 strata. Sensitivity analyses were conducted to assess the extent to which the model assumptions influence the model results.

Figure 1: Model structure



The model was populated using the following evidence sources:

- Ordered logit regression analysis of longitudinal patient-level panel data obtained from the UK CF Registry
- Relative treatment effectiveness estimates (reduction in mean exacerbation rates) based on the power calculation for the ACtiF trial[2]
- CF-specific mortality data derived from the literature (Dodge *et al*[3])
- EQ-5D utility estimates derived from the literature (Bradley *et al*[4])
- Unit costs obtained from the British National Formulary, NHS Reference Costs, the UK CF banding tariff and local expert opinion.

Results

The model suggests that the adherence intervention is expected to produce an additional 0.27 QALYs and cost savings of approximately £84,855 per patient over their remaining lifetime (see Table 1). The main driver of cost-effectiveness relates to the significant reduction in hospital IV days due to reduced exacerbation rates. Across all sensitivity analyses, the adherence intervention remained more effective and less expensive than current care.

The sensitivity analysis suggests that across all of the scenarios considered, the adherence intervention is expected to dominate current care. This includes the highly pessimistic situation whereby the costs of high cost drugs are calculated exactly according to the level of patient adherence (36% for the current care group and 64% for the adherence intervention group). Even in this unlikely scenario, the costs of IV hospital days saved outweigh the additional costs of drug therapy due to increased adherence. Assuming that treatment costs are independent of adherence levels, over the course of 5-years, the model estimates discounted cost savings of £17,852 per patient; this is equivalent to approximately £106.5 million for the estimated 5,964 CF patients currently aged 16 or above in the UK.

Table 1: Central estimates of cost-effectiveness and sensitivity analysis results

Scenario / sensitivity analysis	Incremental (adherence intervention versus current care)		
	QALYs	Costs	ICER
Base case analysis	0.27	-£84,856	**Dominating**
SA1: 5-year time horizon	0.04	-£17,852	**Dominating**
SA2: 10-year time horizon	0.09	-£33,809	**Dominating**
SA3: 20-year time horizon	0.17	-£57,712	**Dominating**
SA4: Intervention impacts on IV days only	0.14	-£78,055	**Dominating**
SA5: 25% reduction in intervention effectiveness	0.20	-£63,549	**Dominating**
SA6: 50% reduction in intervention effectiveness	0.14	-£41,897	**Dominating**
SA7: Alternative CF Registry cohort	0.28	-£92,632	**Dominating**
SA8: Cost IV days halved	0.27	-£54,755	**Dominating**
SA9: Intervention cost doubled	0.27	-£82,430	**Dominating**
SA10: IV disutility doubled	0.42	-£84,856	**Dominating**
SA11: IV disutility halved	0.19	-£84,856	**Dominating**
SA12: Treatment costs based on patient consumption	0.27	-£37,309	**Dominating**

ICER – incremental cost-effectiveness ratio; SA – sensitivity analysis

Conclusions

Modest investments to embed capture of adherence data in routine practice and to use these data to support behaviour change has the potential to improve CF care and reduce costs. An NIHR funded RCT to test CFHealthHub is planned in the UK.[2] Given the uncertainty surrounding the current evidence base, it is important to re-assess the cost-effectiveness of the adherence intervention upon completion of the full RCT in order to ascertain whether the additional value of this intervention outweighs the opportunity costs associated with its use.

References

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