OXFORD ENHANCED IRT JOINT WORKING PROJECT WITH BOEHRINGER-INGELHEIM: HEALTH ECONOMIC IMPACT ANALYSIS USING DATA FROM A SMALL PATIENT SAMPLE.

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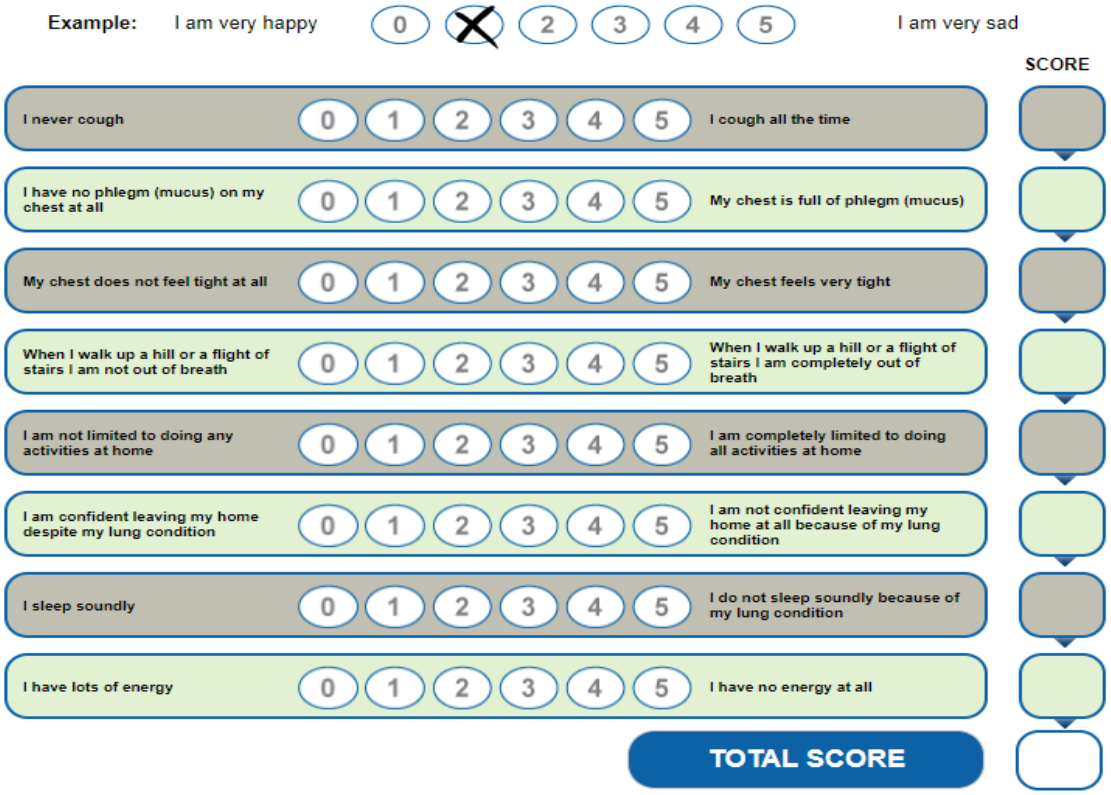
Part A – COPD.

The societal, premature mortality and healthcare resource utilisation implications associated with respiratory diseases are widely reported and recognised by the World Health Organisation [1] and in the Global Burden of Disease Study [2]. More specifically, health resource utilisation in COPD underlines the significant burden of disease in Western health economies, with particular focus on the resource utilisation associated with the exacerbations of COPD [3], especially in those with a history of exacerbations [4].

Studies exploring COPD exacerbations burden, symptom burden and healthcare resource utilisation have been carried out across multiple healthcare settings, amongst them Ding et al [5] who based their analysis on the association between a validated disease scoring scale and resource utilisation. The analysis uses a validation tool recommended by GOLD, namely the COPD Assessment Test™ (CAT; GlaxoSmithKline, Brentford, UK) in routine daily clinical practice. The CAT score reflects a patient assessment system that takes into account both the current impact of a patient's symptoms and their likelihood of having a serious exacerbation, indicative of disease progression in the future. The meaningfulness of the symptomatic appraisal of disease state is outlined by the authors, from a patient perspective, in that the improvement of symptoms and enhancement of ability to engage in the normal activities of daily living (e.g. family routine and, if applicable, work) are desirable goals of COPD management. *Figure 1* *below details the content of the COPD Assessment Test [6]:* *Figure 1: COPD assessment test*



The unique perspective of the study [5], a perspective that is valuable in the context of the potential economic outcomes of the Oxfordshire IRT project, is that healthcare resource utilisation attributable to different disease states, measured by CAT score, are assessed and reported.

Figure 2 below from Ding et al [5] details their findings in respect of CAT score and healthcare and productivity measures:

Figure 2: Healthcare resource utilisation by CAT score

	Overall by CAT score domain							
	0–9		10–19		20–29		30–40	
	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)
Total physician visits in the last 12 months	159	4.4 (3.5)	464	5.6 (4.3)	666	6.9 (5.7)	271	8.7 (6.7)
Primary care physician visits in the last 12 months	161	2.6 (2.6)	481	3.5 (3.6)	792	5.0 (5.2)	300	5.5 (5.5)
Pulmonologist visits in the last 12 months	167	1.4 (1.5)	471	1.5 (1.7)	675	1.7 (2.0)	274	2.0 (2.0)
Unscheduled hospital visits in the last 12 months	164	0.1 (0.3)	478	0.1 (0.5)	757	0.4 (1.3)	265	1.1 (2.2)
Work time missed (absenteeism) in the last 7 days, %	55	0.1 (1.1)	125	3.3 (13.9)	91	9.4 (23.4)	19	8.4 (24.3)
Work time impaired (presenteeism) in the last 7 days, %	55	6.9 (9.2)	122	19.5 (15.7)	87	33.8 (18.8)	18	51.7 (21.8)
Overall work impairment (combination of absenteeism and presenteeism) in the last 7 days, %	55	7.1 (9.2)	122	20.7 (16.8)	86	36.5 (21.1)	18	52.7 (22.6)
Total activity impairment in the last 7 days, %	130	12.8 (14.5)	347	28.5 (18.7)	444	47.2 (20.2)	145	69.4 (19.3)

Abbreviations: CAT, COPD Assessment Test; SD, standard deviation

The particular measures of interest cited in Figure 2 are:

- *Total physician visits in the last 12 months*
- *Primary care physician visits in the last 12 months*
- *Pulmonologist visits in the last 12 months*
- *Unscheduled hospital visits in the last 12 months*

The primary limitation of the analysis is that it is based upon multiple healthcare systems, rather than being specific to the NHS in England. However, the findings appear to be plausible in the context of the outcomes expected as a result of interventions by the IRT; such as reduced disease exacerbations managed in primary care or requiring hospitalisation. The assumption applied in the translation of the findings of Ding et al [5] to this IRT economic analysis is as follows, and based upon a single example from Figure 2*:*

A COPD patient previously with a CAT score in the range of 30-40, is estimated to require an average of 5.5 primary care physician visits per 12 months. Subsequent to IRT intervention, a CAT score of 10-19 might be achieved and thereafter, typically attending 3.6 primary care physician visits per 12 months. The value of the IRT intervention could be expressed in terms of fewer primary care physician visits per 12 months: in the case above, the benefit is 1.9 fewer.

In economic analysis, it is essential to allocate costs to the consumption of healthcare, and this approach has been undertaken in this analysis. Costs of healthcare for the following activities have been estimated as below:

- *Primary care physician visits in the last 12 months – £28 per visit [7]*
- *Pulmonologist visits (Respiratory Physiology) in the last 12 months – £77 per visit [8]*
- *Unscheduled hospital visits in the last 12 months – £1,742 per visit [9]*

The costing approach for each of these activities is detailed in the attached economic model.

Table 1 *below provides an illustration of the results of the economic modelling. For example, if a patient population of ten individuals with COPD and a baseline CAT score of 30-40 were to achieve a stabilised CAT score of 10-19 subsequent to IRT intervention, it could be expected that the savings from reduced healthcare consumption would aggregate to £18,365 per year.*

Table 1: Illustrative results of the economic model

	Number of patients include in the analysis			**10**
	Cost associated with moving from a CAT score of 30 – 40 to a CAT-score of:			
	0 – 9	**10 – 19**	**20 – 29**	**30 – 40**
Total physician visits in the last 12 months	Not included†	Not included†	Not included†	£0
Primary care physician visits in the last 12 months	-£812	-£560	-£140	£0
Pulmonologist visits in the last 12 months	-£462	-£385	-£231	£0
Unscheduled hospital visits in the last 12 months	-£17,420	-£17,420	-£12,194	£0
Total	**-£18,694**	**-£18,365**	**-£12,565**	**£0**

Abbreviations: CAT, COPD Assessment Test. † Not included as discussed

The plausibility of such findings in respect of CAT score improvement is exemplified by the two case narratives cited in Table 2*below.*

Table 2: Example case narratives

Before	**After**	**What was done**
A 77 year old man referred by GP with severe COPD (FEV1 29% predicted), low BMI, stuck on oral prednisolone with steroids side effects, housebound due to breathlessness and getting depressed. **IRT intervention:** received 2 home visits and 1 phone call from IRT nurse. Initial CAT score 23/40. IRT nurse improved inhaler technique, chest clearance advice, breathlessness management, self-management planning, and weaned off oral steroids.	Patient now back to part time work 2 days per week and CAT score 10/40 (low = good, change of 2 is significant)	Holistic care – IRT nurse improved housebound COPD, back to work
Woman with COPD who had previously declined pulmonary rehabilitation twice due to her carer responsibilities for her daughter.	CAT score has reduced from 26/40 to 7/40; she is so much more positive about doing	Pulmonary rehabilitation delivered at home. Prevention through smoking cessation and housing. Medicines

Before	After	What was done
IRT intervention: received one home visit with full assessment of her COPD and home environment. Referrals made to smoking cessation and Better Housing Better Health, changed her inhalers and corrected her technique, and started her on a home exercise programme.	things and mould in her bedroom is sorted.	optimisation through inhaler technique.

IRT Evaluation Findings:

A small sample of IRT clinic persons diagnosed with COPD, for whom pre-intervention and post-intervention CAT score was collected, was made available for economic evaluation. The representativeness of this small sample was questionable in respect of its translation to the entire IRT population, and a decision was made to not try to extrapolate the CAT score improvements shown in this sample to the larger IRT COPD population.

The CAT score data provided from this sample of nine patients demonstrated the severity of patients through the CAT score collected at baseline (mean score 29), suggestive of the high to very high impact their condition has on their life. Four of the sampled patient cohort showed a continuation in the gradual worsening of the condition and subsequently CAT scores rose. All of the remaining five showed numerical improvements in CAT score, whilst three of these showed improvements suggestive of significant reductions in healthcare resource utilisation in line with the evidence presented above, indicating that from our small sample, one in three patients demonstrated improvements in CAT score likely to yield significant economic benefits. This small sample also complements the case narrative examples provided previously, aggregating to plausible evidence that the interventions provided by the IRT, to individuals with COPD which severely limits their life and daily functioning, is likely to yield economic benefits to a notable proportion of those engaged and treated.

References

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Part B – Asthma.

Echoing the World Health Organisation and Global Burden of disease findings in relation to respiratory disease cited above, economic analysis of patients with poorly controlled asthma report increased emergency care utilisation [1] and three to four fold care cost increases [2], as well as increased indirect care costs [3].

The Asthma control test™ (ACT) is a short, simple, self-reporting tool for identifying patients with poorly controlled asthma [4]. It measures the elements of asthma control as defined by the National Heart, Lung, and Blood Institute. ACT is an efficient, reliable and valid method for measuring asthma control [5]. Scores range from 5 to 25, with scores below 20 indicating poor asthma control. Respondents can be assigned to the well-controlled group when their ACT score was ≥20 and to the not well-controlled group when their ACT score was <20.

A cross sectional study undertaken in the UK in 2016 assessed the effect of uncontrolled asthma on healthcare and patient burden among adult patients treated with ICS+LABA [6], including both direct and indirect healthcare cost implications associated with sub-optimal asthma control. The authors identified the cost consequences associated with asthma control either side of the 20 point threshold cited above, presenting their findings as follows:

Figure 3: Healthcare resource utilisation by ACT score derived asthma control category

Yearly costs	Not well-controlled		Well-controlled	
	£ per person	Weighted total (m)	£ per person	Weighted total (m)
Physician visits	551	408 m	375	151 m
A&E department visits	95	71 m	60	24 m
Hospitalisations	708	524 m	322	130 m
Direct costs	1355	1002 m	758	305 m
Absenteeism	2747	2032 m	1012	407 m
Presenteeism	4480	3314 m	2181	877 m
Indirect costs (overall work impairment)	5238	3874 m	2463	991 m
Total costs	6592	4877 m	3220	1295 m

A&E accident & emergency, *ICS* inhaled corticosteroids, *LABA* long-acting β_2-agonist, *m* million

The direct healthcare costs equivalent to the COPD analysis above comprise 'Physician visits', 'A&E department visits' and 'Hospitalisations', and when aggregated indicated a difference in annual costs of £597 per patient (2011 NHS costs).

<u>IRT Evaluation Findings:</u>

The aforementioned small sample of IRT clinic persons also included those diagnosed with asthma, and some of these patients had a pre-intervention and post-intervention ACT score collected, which indicated suitable inclusion in a modelled economic evaluation. The representativeness of this small sample was questionable in respect of its translation to the entire IRT population, and a decision was

made to not try to extrapolate the ACT score improvements shown in this sample to the larger IRT asthma population.

The ACT score data provided from the ten patient sample demonstrated the severity of patients, with nine of the ten having a score illustrative of not well controlled asthma symptoms. Whilst all ten patients recorded a clinically meaningful improvement in asthma control score, we identified eight in total showing an improvement as well as transitioning their score from one side of the threshold to another: ie – previously a score below 20, to a score above 20 post-intervention.

Therefore, from this discrete sample of asthma patients engaged and treated we can observe that the vast majority showed symptom improvement that would likely bring about health resource utilisation implications, and associated cost benefits as outlined by Pavord et al [6].

References

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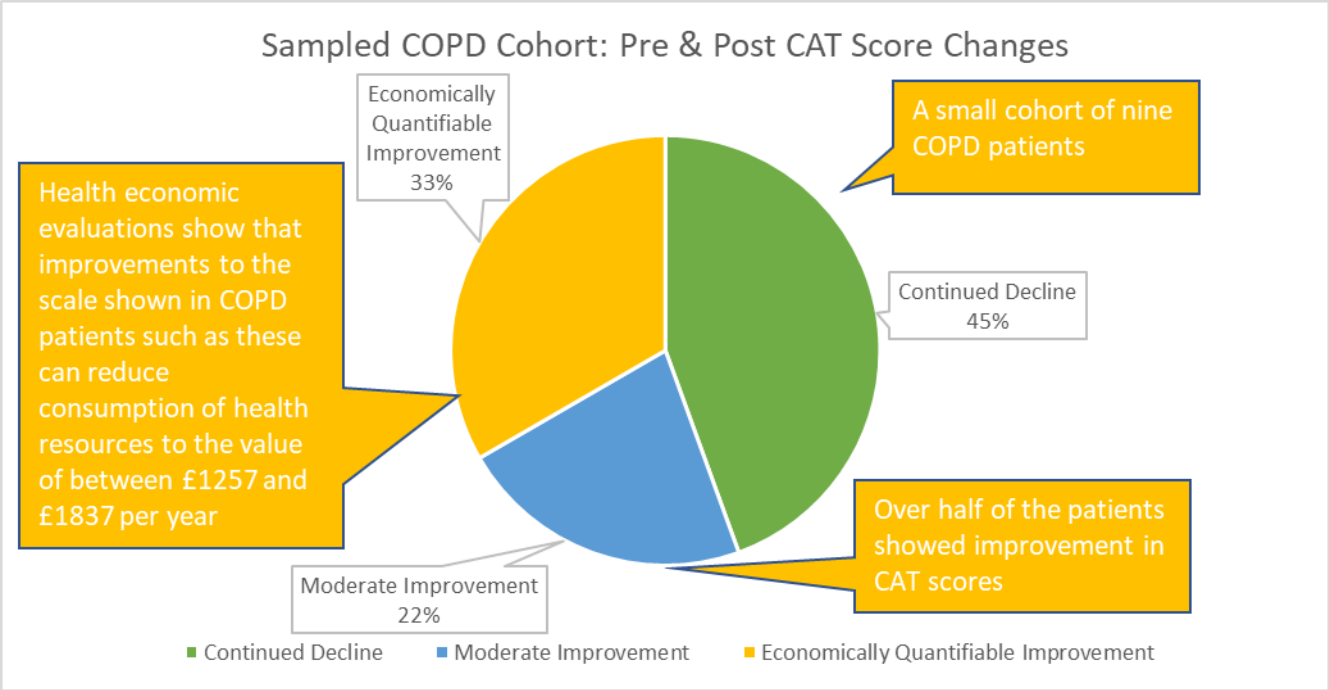
Visual Summary:

COPD



Asthma