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Long term conditions

An Evaluation of the Demographics, Characteristics and Healthcare Utilisation of People with Asthma Referred to an Ambulatory Respiratory Hub.

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Abstract

Background

Asthma is the most treated condition in the Ulster Hospital Ambulatory Respiratory Hub (ARH). This multidisciplinary rapid assessment and treatment centre reviews respiratory patients to prevent hospital admission. This service evaluation (SE) may identify improvements for the service and better outcomes for asthma patients.

Aims

The demographics, clinical characteristics including biomarker profile and co-morbidities, alongside subsequent healthcare utilisation of patients with asthma were explored.

Method

Retrospective review of electronic healthcare records identified 151 patients with asthma attending the ARH between 1st July 2019 and 31st Dec 2019. Baseline demographics, clinical characteristics, comorbidities and asthma biomarkers were extracted. Patients were characterised according to their T2-biomarker expression and comparisons made. Healthcare utilisation was assessed by collecting data regarding hospital admissions, emergency department attendances and GP out of hours visits 6 months before and after attending the service.

Results

Most patients with asthma were female (73.5%), T2- biomarker low (74.2%) and had a high prevalence of obesity (49%). Prevalent comorbidities included rhinosinusitis, gastro-oesophageal reflux disease, depression and anxiety. Investigations included spirometry, chest x-ray and asthma biomarkers (fraction of exhaled nitric oxide and blood eosinophil count). Hospital admissions were reduced by 93%, ED attendances by 83.4% and GP OOH visits by 71.4% during the 6-month period following attendance.

Conclusions

The identification and management of common asthma comorbidities is important and should be routinely assessed. The ARH reduces healthcare utilisation for patients attending with asthma. It could provide additional support to the regional service enabling quicker access to biologic therapies.

INTRODUCTION

Asthma is typically a lifelong chronic respiratory disease, affecting around 5.4 million people in the UK and approximately 180, 000 people in Northern Ireland.[1] It is the cause of considerable worldwide morbidity, mortality and substantial healthcare costs.[2]

Exacerbations occur where people experience worsening of their normal day to day symptoms, often requiring increased treatment (e.g. oral corticosteroids, antibiotics, nebulised medication) and unscheduled healthcare utilisation. The latter may include attending a GP surgery, hospital emergency department (ED), Ambulatory Care hub or hospital admission. The primary aim of the Ambulatory Respiratory Hub within the Ulster Hospital (Belfast) is to provide rapid assessment, diagnostics and treatment in an ambulatory setting preventing overnight admission for pa-

Table 1. Service Evaluation Objectives

	Service Evaluation Objectives
1.	Describe the population of patients with asthma referred to the Ambulatory Respiratory Hub in terms of their demographics, clinical characteristics and comorbidity.
2.	Compare demographics, clinical characteristics and co-morbidities between T2 biomarker high and T2 biomarker low patients.
3.	Identify the prevalence of patients attending the Respiratory Hub with Difficult Asthma, their disease expression and subsequently how many of these attend the Regional Difficult Asthma Clinic.
4.	Determine the number of patients who attended with asthma and were given an alternative diagnosis following assessment and map their subsequent management pathway.
5.	Assess the impact on healthcare utilisation (hospital admission, GP OOH visits, ED attendances) for this asthma population 6 months pre and post attendance at the respiratory hub

tients with respiratory conditions (Appendix 1-Summary of Hub Service).

Morbidity, mortality and health care costs are particularly high amongst patients with difficult asthma[2] and it has been suggested by Chung and Wenzel[3] that difficult asthma accounts for approximately 5-10% of the total asthma population. A previous study[4] by Antonicelli *et al.* suggested that this small percentage of the total asthma population accounts for a disproportionately large fraction of the total asthma disease cost. Patients diagnosed with difficult asthma often require specialist out-patient care involving inhaler adherence monitoring and optimisation of oral corticosteroid use, more frequent or continuous courses of oral steroids which can increase the risk of adverse effects related to steroids and progression to expensive biologic immuno- modulatory therapies.

Type 2 (T2) cytokine-driven eosinophilic airway inflammation is the predominant phenotype in difficult asthma. For these patients, T2- biomarkers such as fraction of exhaled nitric oxide (FeNO) and blood eosinophil count (BEC) can be useful as markers for exacerbation risk and predictors of treatment response to corticosteroids.[5] Phenotyping the asthma population attending the ambulatory respiratory hub would allow comparison with other population's in recent studies and provide guidance on the best treatment options.

An important consideration in the management of patients with asthma, is the impact of comorbid diseases on exacerbations. Asthma often occurs with other conditions such as gastro-oesophageal reflux disease (GORD), vocal cord dysfunction (VCD), chronic rhinosinusitis, anxiety and depression which can exacerbate, complicate or simulate asthma symptoms and potentially lead to poor symptom control and increased hospital attendance.[6]

AIM

The primary aim of this service evaluation (SE) was to explore the demographics, clinical characteristics and co-morbidities of patients with asthma who attended the Ambulatory Respiratory Hub Service. It was also to assess the effectiveness of the service at reducing healthcare utilisation. Specific service evaluation objectives are detailed in Table 1.

Table 2. Inclusion/Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
Adults ≥18 years old	Patients with Asthma/ Chronic Obstructive Pulmonary Disease (COPD) overlap
Primary reason for referral of acute exacerbation of asthma or poorly controlled asthma	

METHODS

STUDY DESIGN

Retrospective review of electronic records and quantitative evaluation of data from patients with asthma referred to the Ambulatory Respiratory Hub in the Ulster Hospital, South Eastern Health and Social Care Trust (SEHSCT) over a 6-month period between the 1st July 2019 and 31st Dec 2019. The criteria for patient's data to be included or excluded from the study are described in Table 2.

DATA COLLECTION PROCEDURES

A bespoke excel data base was prepared enabling existing anonymised data to be collated and summarised relating to the aims and objectives of this service evaluation (SE). Outcome measures recorded in this excel database are summarised in Appendix 1. Patients with a diagnosis of asthma following hub assessment were identified using the trust scheduler IT data collection system. The Northern Ireland Electronic Care Record (NIECR) was then used to obtain baseline demographics, clinical characteristics and information regarding the prevalence of 11 common asthma co-morbidities previously reported by Porsbjerg and Menzies-Gow[7] with the addition of diabetes (Appendix 2). NIECR was also used to identify patients who met the BTS /SIGN Asthma Guideline[8] definition of difficult asthma.

BIOMARKER PROFILE

Blood eosinophil count (BEC) was recorded at initial assessment as well as the highest historic BEC available on NIECR. FeNO was only recorded at initial assessment. In the absence of any international consensus for validated

biomarker thresholds, T2 biomarker high patients were defined as having a FeNO level ⩾30ppb and BEC ⩾300cells/μL. These thresholds for biomarker positivity are similar to those used by Busby *et al*.[9] and Denton *et al*.[10] T2 low group for comparison was defined if one of these biomarkers were below these thresholds.

ALTERNATIVE DIAGNOSIS

The Trust's scheduler IT system was used to identify patients diagnosed with dysfunctional breathing or vocal cord dysfunction. Clinical records including the respiratory hub email were then reviewed to determine if they had been referred with asthma but given this alternative diagnosis.

IMPACT ON HEALTHCARE UTILISATION

NIECR was accessed for information relating to healthcare utilisation 6 months before and after assessment at the respiratory hub. This included data on ED attendances, hospital admissions and GP (OOH) attendances (Appendix 2).

DATA ANALYSIS

Descriptive statistics were used to summarise baseline demographics, characteristics, prevalence of difficult asthma, alternative diagnosis, healthcare utilisation and co-morbidity. Results were then tabulated to facilitate comparisons of co-morbidities and clinical characteristics within this asthma population and its subgroups. Categorical variables were summarised using counts and percentages and continuous variables summarised using mean (SD) and/or median (IQR). To determine if healthcare use was affected by the introduction of the hub, we calculated the total number of hospital admissions, A+E attendances, and GP attendances, at each time point (before vs after), presenting any % change. We compared the demographics and clinical characteristics between the independent groups, T2- high vs T2- low patients; for categorical variables we used cross tabs and odds ratios (OR) with 95% confidence intervals (95% CIs), and for the numerical variables (T2- biomarker outcomes (FeNO/BEC)) we used Independent –Samples Mann-Whitney U tests. A Statistical Package for the Social Sciences (SPSS ®) version 28 was used to perform all analyses and statistical significance denoted with a P-value of <0.05.

ETHICAL APPROVAL

Ethical approval was granted by the INHR Filter/Ethics Committee, Ulster University (Reference number FCNUR-21-094). Informed consent was not required as this was a retrospective, anonymised service evaluation and patients will have received normal routine care. Approval was obtained from the physiotherapy professional lead (SEHSCT).

RESULTS

This SE included n=151 patients who attended the Ambulatory Respiratory Hub with a clinical diagnosis of asthma between July 2019 and December 2019. The demographic and clinical characteristics including co-morbidities are summarised in Table 3 below. Within the study population asthma was more prevalent in females (73.5%) than males (26.5%) with the most prevalent age ranges being 36-45years (19.2%) and 46-55 years (19.2%) (Figure 1, Appendix 3). Many patients never smoked (46.4%), while 27.8% were ex-smokers and 25.8% current smokers. Nearly half (49%) of the population were obese (BMI⩾30) with an increased prevalence of obesity among females (71.6%). The most frequently reported comorbidities in the study population were rhinosinusitis (49.7%), obesity (49%), GORD (46.4%), depression (35.8%), anxiety (23.2%). N=14 patients (9.3%) were classified as having difficult asthma according to the BTS /SIGN Asthma Guideline (2019) definition.[8] Three patients required onward referral to the regional difficult asthma service as they required maintenance oral steroids in addition to maximal inhaled therapy to manage their asthma symptoms.

BIOMARKER PROFILE

The median highest recorded BEC was 0.48 (IRQ 0.48) cells/10^9L. This was notably higher than the median BEC at initial assessment 0.15 (IQR 0.43) cells/10^9L which was below the T2-high –biomarker threshold. Similarly, the median FeNO level at initial assessment of 20 (IRQ 30) ppb was below the T2-biomarker positive cut point (Table 3).

COMPARISON OF T2 HIGH VERSUS T2 LOW PATIENTS

Criteria for T2-low asthma were met by 112 (74.2%) patients with 23 (15.2%) classified as T2- high. Compared with the T2-high group, T2-low patients were more likely to be female (75.9% vs 65.2%; OR 1.7; 95% CI 0.6 to 4.4, p=0.29), older (67% ⩽ 55years vs 86.8%; OR 3.2 ; 95% CI 0.9 to 11.7, p=0.06), have anxiety (23.2% vs 4.3%;OR 7.7; 95%CI 0.99 to 59.6, p=0.05) and depression (35.8% vs13% OR 4.2; 95% CI 1.2 to 14.8; p=0.03). The T2-low patients were also more likely to have GORD (47.3% vs30.4%; OR 2.1; 95% CI 0.78 to 5.4, p=.14) (Appendix 4).

Median FeNO values were significantly higher at initial hub assessment in the T2-high group 51: IQR 37.5 ppb vs T2- low group 13: IQR 17.5 ppb with p<0.001).

Similarly, the median BEC at initial assessment was significantly higher in the T2-high group versus T2-low group (0.57: IQR 0.435 vs 0.09: IQR 0.168) with p<0.001. (Figure 2).

It's worth noting that some patients categorised as T2-biomarker low had BEC or FeNO levels above the agreed thresholds. This is due to the thresholds used to categorise the T2-biomarker groups and the fact that if one biomarker was below these thresholds then they were defined as T2-low. There was no statistically significant difference (P>0.05) in the prevalence of co-morbidities, gender, age

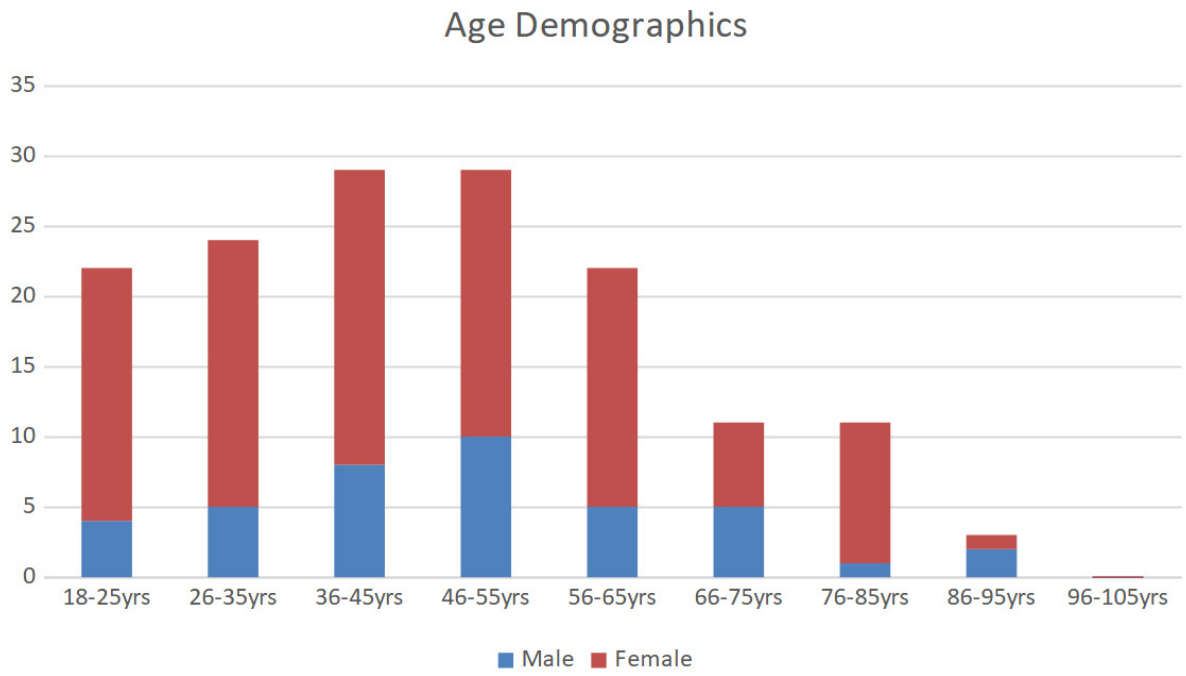

Figure 1. Age ranges and prevalence within the study population (N=151)

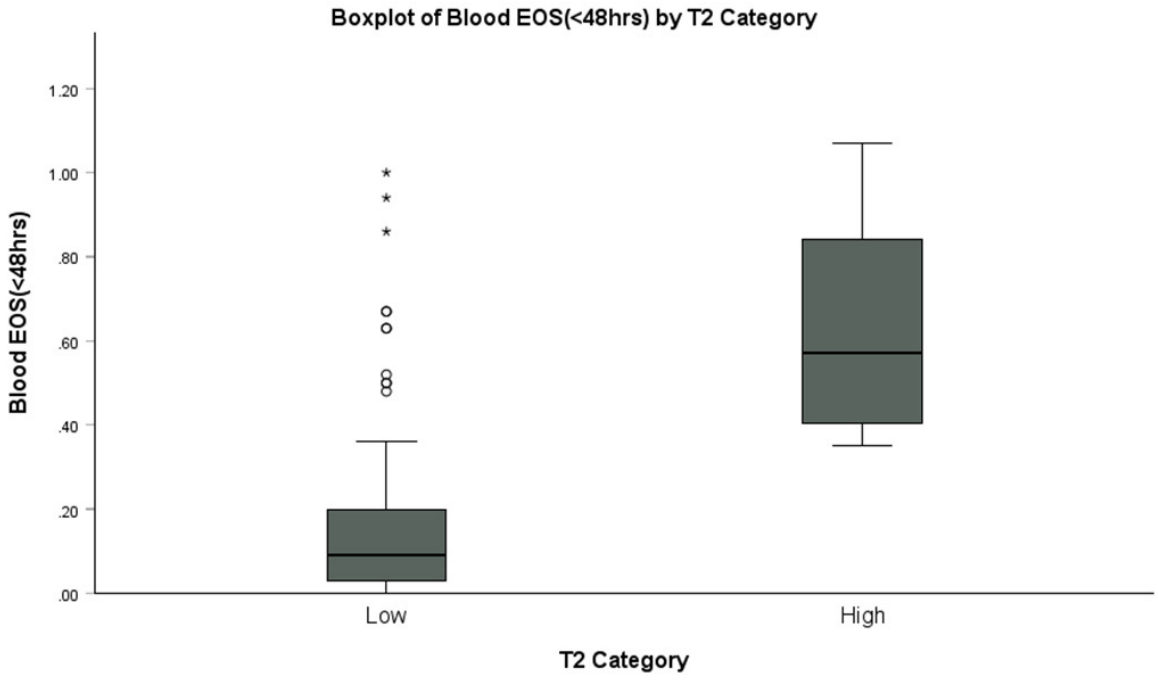

Figure 2. Comparison of Blood EOS between T2 groups at initial assessment

or smoking status between the T2 biomarker high and low groups.

DIFFICULT ASTHMA

Only 14 patients (9.3%) met the criteria for difficult asthma. The median BEC for this group was 0.14 (IRQ: 0.42) N/10^9L and median FeNO 21 (IRQ: 33) ppb, both of which fall short of the T2- biomarker high thresholds.

ALTERNATIVE DIAGNOSIS

Only five patient's referred to the respiratory hub with asthma were given an alternative diagnosis. These patients were subsequently referred to either the SEHSCT Dysfunctional Breathing Clinic or Ear Nose and Throat (ENT) services for follow-up.

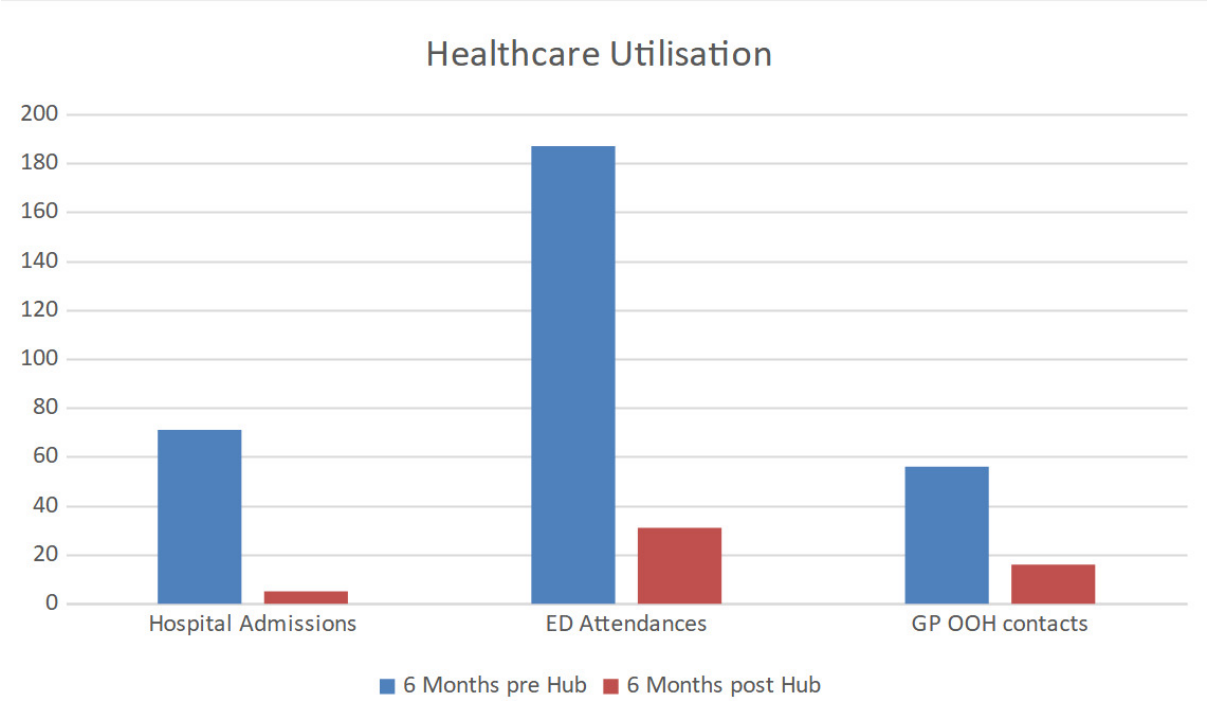

Figure 3. Healthcare Utilisation (contacts) 6 months pre vs post hub attendance.

ED= emergency department, GP OOH= General Practitioner Out of hours

HEALTHCARE UTILISATION

Hospital admissions were significantly reduced ($p<0.001$) by 93%, ED attendances by 83.4% and GP OOH visits by 71.4% (Figure 3). Total combined medical contacts were therefore significantly reduced by 83.4% ($p<0.001$) during the 6-month period after respiratory hub assessment (Figure 2).

DISCUSSION

The majority of the 151 asthma patients in this SE were female , T2- biomarker low and had a high prevalence of obesity . This biomarker low, obese, female phenotype with poor symptom control is similar to that previously highlighted in a UK multicentre randomised controlled trial by Heaney *et al.*[11]

Asthma often co-exists with other conditions[12] and these comorbidities contribute to poor symptom control, perceived exacerbations, reduced quality of life and increased healthcare utilisation.[13] The most prevalent comorbidities reported were rhinosinusitis , GORD , depression and anxiety . This is similar to the findings of a small cohort study assessing adherence and psychological morbidity in 103 asthma patients which found that 30% had a psychiatric disorder (asthma/depression), particularly patients with poor asthma control and adherence.[14] If clinicians including physiotherapists were better able to identify these common comorbidities, then adherence with medication and asthma control may be improved without the need for escalating asthma treatment.

Using the reference criteria, the vast majority of patients in this study (74.2%) met the biomarker definition of T2-low asthma at the point of data collection. However, review of their historic highest BEC revealed a median count fulfilling the T2- high biomarker definition which is similar to findings in a multicentre trial by Jackson *et al.*[15] One possible explanation could be that some patients had already started high dose oral corticosteroids for a potential exacerbation by the time they were assessed in the Respiratory Hub, thus already supressing T2 inflammation. Alternatively, they could have been repeat hub attenders with better inhaled corticosteroid management. It is important that T2-biomarker low patients with poor symptom control can be accurately identified as they are not as steroid responsive and may not benefit from increased ICS or oral corticosteroid treatment to manage exacerbations. Rapid access to an ambulatory respiratory hub or difficult asthma clinic during exacerbation enables these T2 biomarkers such as FeNO and BEC to be checked prior to commencing oral corticosteroids.

This evaluation suggests that healthcare utilisation can be significantly reduced for patients with asthma who attend an ambulatory respiratory hub. Although this evaluation only provides a short window into the service, it suggests that ambulatory care should be considered as an alternative to hospital admission for patients with asthma during exacerbation. It has the potential to reduce the burden on the hospital's ED, primary care services and provide a satellite service to the regional difficult asthma clinic therefore reducing waiting times and more timely access to biologic therapies for difficult asthma patients.

One limitation of this evaluation was that it was retrospective rather than prospective, and as such relied upon accurate data entry, accurate data coding of comorbidities by GPs and other health care professionals (HCPs), there-

fore reducing the validity if there were any inaccuracies in the clinical coding. Furthermore, the improvements in healthcare utilisation may have been influenced by input and treatment from other healthcare professionals during the 6 month follow-up period. This evaluation also lacked objective data on lung function, asthma symptom control and medications to enable classification and comparison of disease severity with T2 phenotype. A future prospective study could provide this data as well as more detailed information on asthma comorbidities. This would help to address any unmet need particularly for patients with severe asthma who may benefit from biologic therapy targeting T2 inflammation.

In conclusion, this study highlights the potential value of an Ambulatory Respiratory Hub to significantly reduce healthcare utilisation for patients who attended with asthma. The majority of patients with asthma attending the respiratory hub were T2-biomarker low. Future research is required to establish what is driving poor control (e.g. poor inhaler technique and/or adherence) and exacerbations for these patients in the absence of steroid responsive T2- inflammation.

Although not measured in this evaluation, there is potential for future impact in terms of reduced ED re-attendance rates, improved hospital patient flow and cost effectiveness due to bed days saved; this should be a focus for any further study.

Key Points

- The SEHSCT Ambulatory Respiratory Hub significantly reduces healthcare utilisation for patients attending with poorly controlled asthma.
- Commonly reported co-morbidities included rhinosinusitis, GORD, depression and anxiety. Physiotherapists and clinicians should routinely screen and treat these to improve asthma control and reduce exacerbation risk.
- The T2- biomarker low obese female, with poor symptom control was the most common phenotype identified in this evaluation.

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DECLARATION OF INTEREST

There are no conflicts of interest to declare.

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SUPPLEMENTARY MATERIALS

Appendices

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