

Quantifying the economic burden of obstructive hypertrophic cardiomyopathy (HCM) in the UK

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Introduction

- Hypertrophic cardiomyopathy (HCM) is a chronic disease that is distinguished by hypercontractility and hypertrophy of the heart.^{1,2}
- It is estimated that the majority of patients with HCM have left ventricular outflow tract obstruction, referred to as obstructive HCM.^{1,3}
- Obstructive HCM presents with a substantial symptomatic burden, most notably fatigue, arrhythmias, and syncope, which can result in a burden on a patient’s quality of life.^{1,4}
- Symptomatic burden is typically assessed using the New York Heart Association (NYHA) classification, with higher classes representing greater disease severity.
- There is a general paucity of evidence demonstrating the relationship between obstructive HCM disease severity and economic burden to health systems.

Objective

- The objective of this study was to quantify the relationship between disease severity and economic burden in the UK, gathering inputs through an elicitation exercise from practicing cardiologists who treat patients with HCM.

Methods

- Invitations to participate in the elicitation exercise were sent to leading practicing cardiologists across all of the secondary care centers in the UK where patients with obstructive HCM are actively treated and monitored (n = 24). Criteria for selected participants included the following:
 - only one HCM expert per center
 - participant must be a practicing cardiologist who currently treats patients with HCM
 - participant could not be involved in any other ongoing sponsored research studies on the economic burden of HCM.
- Ten cardiologists who responded to the invitation and met the inclusion criteria participated in the study. Selection was based on achieving a mix of cardiology subspecialties and geographic representation (Table 1).

Center	Country	Cardiovascular subspecialty of expert
Queen Elizabeth Hospital, University Hospitals Birmingham NHS Foundation Trust	England, West Midlands	Cardiomyopathy and cardiac imaging
University Hospital Southampton NHS Foundation Trust	England, South East	Complex coronary and trans catheter valve intervention/ cardiomyopathy (structural interventionalist)
Oxford University Hospitals	England, South East	Heart failure, multimodality imaging, acquired and inherited cardiac conditions
The University of Manchester	England, North West	Inherited cardiac conditions
Liverpool Heart and Chest Hospital NHS Foundation Trust	England, North West	Cardiomyopathy and cardiac imaging (structural interventionalist)
Norfolk and Norwich University Hospitals NHS Foundation Trust	England, East	Cardiomyopathy and cardiac imaging
Belfast City Hospital	Northern Ireland	Cardiomyopathy and cardiac imaging
Wansbeck General Hospital, Northumbria Healthcare NHS Foundation Trust	England, North East	Heart failure and advanced rhythm management/complex device implantation
Royal Brompton and Harefield Clinical Group, London	England, London	Inherited cardiac conditions, valvular disorders, and advanced echocardiography
The Leeds Teaching Hospitals NHS Trust	England, Yorkshire and Humber	Heart failure, complex device implantation, inherited cardiovascular conditions, and women with heart disease in pregnancy

NHS, National Health Service.

- A modified Delphi expert elicitation methodology was implemented to collect continuous estimates. It conformed to the good practice principles as set out by Bojke *et al.*⁵
- The study was undertaken in 3 phases.
 - Phase 1.** Experts were invited to complete a survey tool encompassing resource use by NYHA class across primary care, secondary care, and tests and procedures. Questions were quantitative in nature but experts were encouraged to provide rationale for their answers.
 - Phase 2.** Responses were then, based on aggregated results, summarized, and presented to the experts in a virtual panel discussion, moderated by an independent market access consultancy. To reduce bias, no employees of the study funder actively participated in the virtual panel. Participants were encouraged to discuss their responses as a panel, specifically with respect to the variability between experts and the reasons for this.
 - Phase 3.** Experts were then re-sent their previously completed survey and were asked to re-rate their assessments. The experts were informed that changes were optional.
- To ensure that results were representative of the HCM patient population, results were assessed in the base case without structural interventionalists being considered. A scenario analysis was also undertaken, including structural interventionalists, given that they specifically treat patients with advanced disease who are eligible for septal reduction therapies such as septal myectomy or alcohol septal ablation.
- Economic burden was obtained by calculating costs from the Personal Social Services Research Unit and National Health Service (NHS) reference costs tables applied to health resource unit counts by NYHA class.⁶

Results

- A positive association between increasing NYHA class (indicative of worsening symptoms) and economic burden was observed (Figure 1).
- Mean costs per patient-year in the base case were £637, £1242, £9550, and £14,240 for classes I-IV, respectively.
- In the sensitivity analysis, the mean costs per patient-year were £771, £1326, £9323, and £14,483 for classes I-IV, respectively.
- Secondary care resources accounted for the majority of costs across both the base case and scenario analyses, especially in higher NYHA classes (class III and class IV) (Table 2).
- In class IV patients, secondary care resource utilization was driven primarily by inpatient visits in the base case, accounting for £3001 and £4813 for elective visits, and £3065 and £5032 for non-elective visits for classes III and IV, respectively. Coronary care unit costs were also substantial (£1065 and £1034, respectively).
- The results of the scenario analyses including structural interventionalists were broadly similar compared to the base case indicating representativeness of the HCM population, with a slight uplift observed in all primary care categories and in the majority of NYHA classes in secondary care and tests/procedures.

Figure 1. Mean cost (£) of obstructive HCM per patient-year, by NYHA class, by scenario

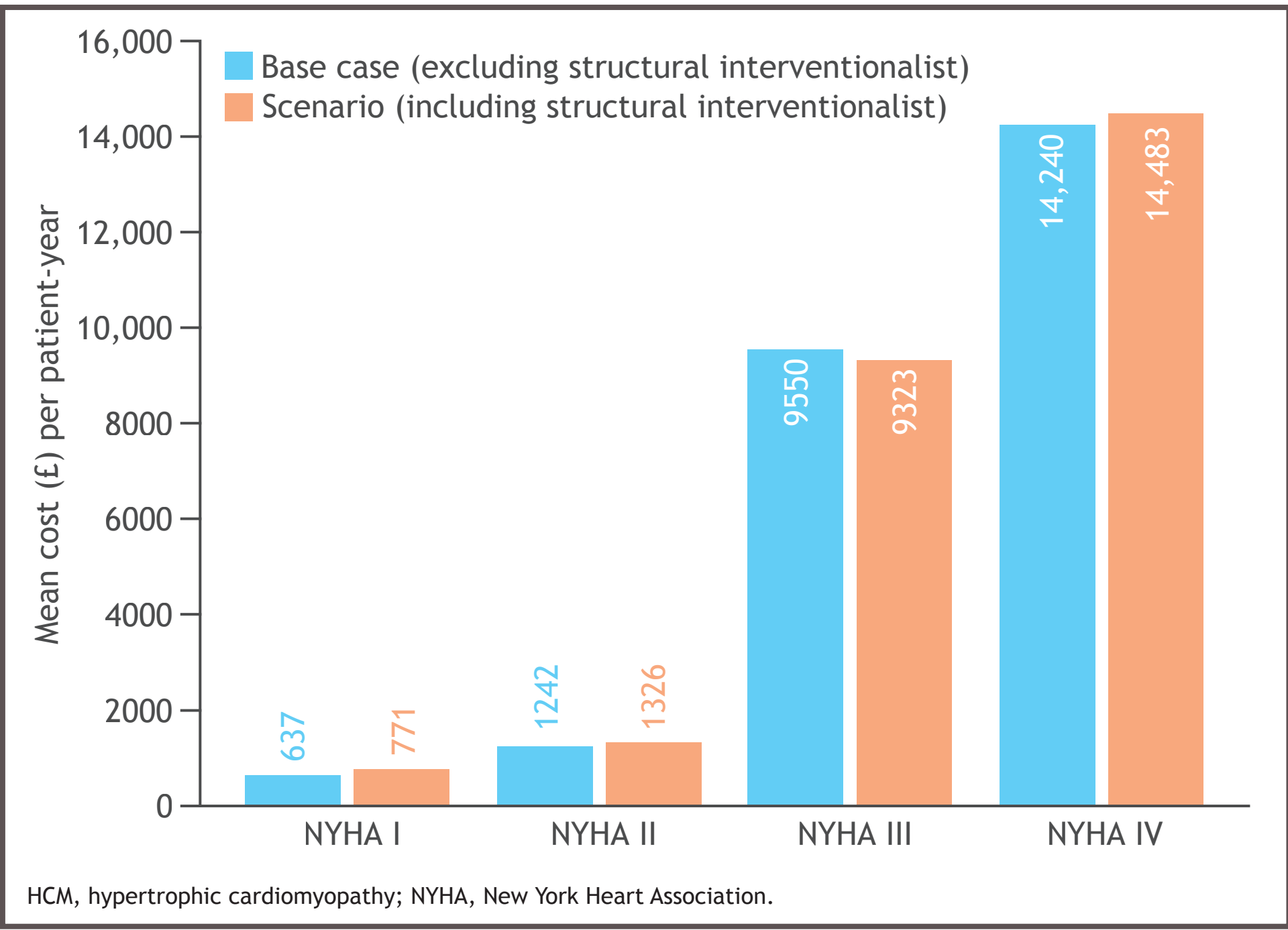


Table 2. Disaggregated event counts and associated economic burden of obstructive HCM by NYHA class, by subgroup, per patient-year

		Unit cost, £ ^a	Base case: excluding structural interventionalists (N = 8)				Scenario analyses: including structural interventionalists (N = 10)			
			NYHA I ^b	NYHA II ^b	NYHA III ^b	NYHA IV ^b	NYHA I ^b	NYHA II ^b	NYHA III ^b	NYHA IV ^b
Primary care; total cost, £			22.73	42.06	183.45	407.98	27.96	64.11	209.83	425.09
Nurse consultation	14.06	0.32 ± 0.35	0.50 ± 0.37	1.71 ± 1.02	3.57 ± 2.38	0.36 ± 0.32	0.61 ± 0.46	1.78 ± 1.02	3.44 ± 2.07	
GP consultation	39.23	0.46 ± 0.38	0.89 ± 0.21	1.57 ± 0.40	3.14 ± 1.31	0.58 ± 0.33	1.03 ± 0.29	2.00 ± 0.65	3.50 ± 1.34	
Out of hours	136.77	0.00 ± N/A ^c	0.00 ± N/A ^c	0.71 ± 0.36	1.71 ± 0.70	0.00 ± N/A ^c	0.11 ± 0.22	0.78 ± 0.44	1.75 ± 0.61	
Secondary care; total cost, £			301.24	801.21	8492.57	12,870.72	376.33	821.08	8177.72	13,117.86
Day visit	840.00	0.13 ± 0.24	0.18 ± 0.24	0.72 ± 0.46	0.94 ± 0.91	0.20 ± 0.26	0.24 ± 0.26	0.78 ± 0.47	0.96 ± 0.77	
Outpatient (CV-related) visits	137.00	0.69 ± 0.26	0.88 ± 0.24	2.13 ± 0.78	3.25 ± 1.42	0.70 ± 0.22	0.95 ± 0.31	2.15 ± 0.65	3.03 ± 1.28	
Outpatient (non-CV-related) visits	137.00	0.31 ± 0.34	0.63 ± 0.69	1.25 ± 0.69	2.00 ± 1.01	0.50 ± 0.43	0.89 ± 0.77	1.56 ± 0.83	2.33 ± 1.07	
Inpatient (elective) unique visit	4754.00	0.00 ± N/A ^c	0.04 ± 0.07	0.63 ± 0.51	1.01 ± 0.54	0.00 ± N/A ^c	0.03 ± 0.07	0.56 ± 0.47	0.91 ± 0.47	
Inpatient (non-elective) unique visit	3627.00	0.00 ± 0.00	0.00 ± 0.01	0.85 ± 0.42	1.39 ± 0.70	0.00 ± 0.00	0.00 ± 0.00	0.86 ± 0.37	1.51 ± 0.57	
Accident and emergency (A&E)	188.28	0.26 ± 0.32	0.41 ± 0.34	1.56 ± 0.77	2.56 ± 0.97	0.21 ± 0.26	0.33 ± 0.29	1.45 ± 0.63	2.45 ± 0.78	
Coronary care unit	1215.90	0.00 ± 0.00	0.14 ± 0.28	0.88 ± 0.44	0.85 ± 0.42	0.00 ± 0.00	0.11 ± 0.22	0.78 ± 0.43	1.08 ± 0.44	
Tests/procedures; total cost, £			312.65	399.13	873.48	961.39	366.34	441.19	934.99	939.68
Echo procedures	191.27	0.64 ± 0.26	0.78 ± 0.32	1.69 ± 0.72	1.31 ± 0.45	0.66 ± 0.22	0.77 ± 0.26	1.75 ± 0.57	1.40 ± 0.38	
12-lead ECG procedures	130.26	0.73 ± 0.25	0.94 ± 0.39	2.13 ± 1.01	3.13 ± 2.01	0.73 ± 0.21	0.90 ± 0.32	2.10 ± 0.80	3.10 ± 1.61	
Cardiac MRI procedures	451.49	0.10 ± 0.12	0.13 ± 0.12	0.34 ± 0.29	0.29 ± 0.31	0.18 ± 0.20	0.20 ± 0.20	0.43 ± 0.26	0.24 ± 0.25	
CPET procedures	174.60	0.19 ± 0.26	0.21 ± 0.25	0.25 ± 0.24	0.14 ± 0.24	0.25 ± 0.26	0.27 ± 0.26	0.35 ± 0.24	0.11 ± 0.19	
BNP and NT-proBNP tests	20.00	0.26 ± 0.32	0.36 ± 0.30	0.91 ± 0.55	1.63 ± 1.06	0.21 ± 0.26	0.39 ± 0.28	0.93 ± 0.44	1.60 ± 0.85	
Troponin T and I tests	20.00	0.13 ± 0.24	0.25 ± 0.32	0.61 ± 0.48	1.26 ± 1.15	0.10 ± 0.20	0.20 ± 0.26	0.49 ± 0.41	1.11 ± 0.94	
Defibrillator ^d	3191.62	0.00 ± N/A ^e	0.01 ± N/A ^e	0.01 ± N/A ^e	0.02 ± N/A ^e	0.00 ± N/A ^e	0.01 ± N/A ^e	0.01 ± N/A ^e	0.02 ± N/A ^e	
Pacemaker ^d	3068.66	0.00 ± N/A ^e	0.00 ± N/A ^e	0.00 ± N/A ^e	0.01 ± N/A ^e	0.00 ± N/A ^e	0.00 ± N/A ^e	0.00 ± N/A ^e	0.01 ± N/A ^e	
Total cost, £			636.63	1242.39	9549.50	14,240.08	770.64	1326.38	9322.54	14,482.62

^aUnit costs sourced from NHS reference costs and Personal Social Services Research Unit. ^bMean ± 95% CI unless otherwise specified. ^cCI could not be calculated because variance was 0. ^dExperts asked to provide a snapshot of prevalence. Event rates calculated based on mean survival by NYHA class. ^eCI could not be calculated.

BNP, B-type natriuretic peptide; CI, confidence interval; CPET, cardiopulmonary exercise testing; CV, cardiovascular; ECG, electrocardiogram; GP, general practitioner; HCM, hypertrophic cardiomyopathy; MRI, magnetic resonance imaging; N/A, not applicable; NHS, National Health Service; NT-proBNP, N-terminal proBNP; NYHA, New York Heart Association.

Limitations

- Although every effort was made to include a large population of experts, those experts who participated may not accurately reflect the broader population of those who are practicing cardiologists who care for patients with obstructive HCM in the UK.
- The Delphi methodology is opinion-based and, as such, the answers provided are an estimate and should not be considered as a definitive answer to the questions.
- Additional research utilizing real-world data is needed to validate the expert opinions.

Conclusions

- The management of symptomatic obstructive HCM is associated with a significant economic burden in the UK, and patients with a higher symptomatic burden and in higher NYHA classes incur substantially higher costs to the system than patients in lower NYHA classes.
- A reduction in the symptomatic burden for these patients may have a substantial impact on healthcare system resource use.

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