

Quantifying the relationship between time to diagnosis and potential system level burden in obstructive hypertrophic cardiomyopathy (HCM)

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Introduction

- Hypertrophic cardiomyopathy (HCM) is a chronic cardiovascular disease in which hypercontractility results in left ventricular hypertrophy and cardiac dysfunction^{1,2}
- HCM is one of the most common cardiomyopathies, with an estimated prevalence rate of 1 in 500; however, expert consensus assumes a significant undiagnosed patient population, owing to non-specific symptom burden³
- Patients with a left ventricular outflow tract obstruction (LVOTO)⁴ are categorized as living with obstructive HCM, with approximately two-thirds of patients living with the obstructive subtype⁵
- Prior studies have identified a strong relationship between increased symptomatic burden (denoted by increases in New York Heart Association [NYHA] class) and increases in system level burden and associated costs⁶⁻⁸
- The aim of this study is to explore the association between time to diagnosis and healthcare resource utilization (HRU) and the associated economic burden to understand potential savings that can be achieved through earlier diagnosis and improved clinical management

Methods

- A retrospective observational study was undertaken utilizing linked primary and secondary care data in the UK from the Clinical Practice Research Datalink (CPRD) and Hospital Episode Statistics (HES), respectively (ISAC protocol 21_000342 on March 4, 2022)
- Adult patients (aged >18 years) were included if they were eligible for HES linkage and had a diagnosis of obstructive HCM (defined as an International Classification of Diseases, Tenth Revision [ICD-10], Read, and/or Systematized Nomenclature of Medicine [SNOMED] code for obstructive HCM or a code for HCM with an additional code for LVOTO and/or septal reduction therapies [SRT]) between 2007 and 2019 with at least 1 year of continuous registration prior to index date (date of diagnosis)
- Patient records were extracted for all eligible patients, with a pre-index period starting from the date a patient started contributing data to CPRD (from April 1, 1997 onwards)
- When investigating HRU, the pre-index period was stratified into three distinct periods (Figure 1)
 - Period A, between date patient contributed to CPRD and 2 years prior to diagnosis
 - Period B, in the second year prior to diagnosis
 - Period C, in the year prior to diagnosis
- Event rates were summarized as mean per patient-year (PY)

Table 1. Baseline demographics and clinical characteristics

	Obstructive HCM population (N = 3,988)
Baseline demographics at index date	
Age, years	62.3 (16.0)
Gender: male	2,295 (57.5)
Ethnicity: White	3,071 (77.0)
Smoking status: current smoker	798 (20.0)
Region in England	
London	931 (23.3)
South-East	907 (22.7)
North-West	645 (16.2)
West Midlands	578 (14.5)
South-West	459 (11.5)
Other	468 (11.7)
Duration of pre-index registration, years	12.3 (6.1)
Clinical characteristics	
Clinical measurements (latest measurement in year prior to index)	
SBP, mm Hg	133.2 (18.4)
DBP, mm Hg	90.7 (22.7)
BMI, kg/m ²	29.3 (6.2)
Total cholesterol, mmol/L	4.7 (1.2)
HDL cholesterol, mmol/L	1.4 (0.4)
LDL cholesterol, mmol/L	2.7 (1.0)
Triglycerides, mmol/L	1.6 (1.1)
Family history (entire pre-index period)	
Obstructive HCM diagnosis	70 (1.8)
MI, HF, sudden death, or unexplained death	186 (4.7)
Diagnosis history (entire pre-index period) ^a	
Hypertension	2,600 (65.2)
Cardiac dysrhythmias	1,391 (34.9)
Coronary heart disease	1,359 (34.1)
Non-obstructive HCM diagnosis	1,259 (31.6)
Hypercholesterolemia	1,218 (30.5)

BMI, body mass index; DBP, diastolic blood pressure; HDL, high-density lipoprotein; HF, heart failure; LDL, low-density lipoprotein; MI, myocardial infarction; SBP, systolic blood pressure; SD, standard deviation.

^aShown when experienced by more than 30% of patients.

Note: Mean (SD) for continuous variables; n (%) for categorical variables.

Figure 1. Pre-index period

^aFrom April 1, 1997 onwards.

Figure 2. Healthcare resource utilization, stratified by intervals within the pre-index period and setting

Figure 3. Healthcare resource utilization, stratified by intervals within the pre-index period and resources within secondary care

Table 2. Healthcare resource utilization, stratified by intervals within the pre-index period

	All pre-index period (PYs: 48,988)	Period A (PYs: 41,124)	Period B (PYs: 3,876)	Period C (PYs: 3,899)
Primary care (all-cause)				
Primary care physician visits	6.40 (6.38-6.42)	5.52 (5.49-5.54)	9.57 (9.48-9.67)	12.42 (12.31-12.53)
Nurse visits	1.59 (1.58-1.60)	1.37 (1.36-1.39)	2.57 (2.52-2.62)	2.88 (2.82-2.93)
Secondary care (all-cause)				
Outpatient visits	3.75 (3.73-3.76)	3.09 (3.07-3.11)	6.06 (5.98-6.14)	8.27 (8.18-8.36)
Day case visits	0.43 (0.43-0.44)	0.36 (0.35-0.36)	0.64 (0.61-0.66)	1.03 (1.00-1.06)
Inpatient visits	0.31 (0.30-0.31)	0.23 (0.23-0.24)	0.44 (0.42-0.46)	0.93 (0.90-0.96)
Emergency visits	0.81 (0.80-0.82)	0.66 (0.65-0.66)	1.30 (1.27-1.34)	1.95 (1.90-1.99)
Cardiovascular-related tests and visits				
ECG visits	0.16 (0.15-0.16)	0.08 (0.08-0.08)	0.29 (0.27-0.30)	0.82 (0.79-0.85)
Pacemaker-related visits	0.04 (0.04-0.04)	0.02 (0.02-0.02)	0.08 (0.07-0.09)	0.20 (0.18-0.21)
CMR visits	0.02 (0.02-0.03)	0.01 (0.01-0.01)	0.04 (0.03-0.05)	0.20 (0.19-0.22)
Urea/electrolytes tests	0.69 (0.68-0.70)	0.59 (0.58-0.60)	1.07 (1.04-1.11)	1.36 (1.33-1.40)
LFTs	0.61 (0.60-0.62)	0.52 (0.52-0.53)	0.96 (0.93-0.99)	1.18 (1.14-1.21)
Cardiac monitoring visits	0.02 (0.02-0.02)	0.01 (0.01-0.01)	0.03 (0.02-0.03)	0.06 (0.05-0.07)
CPET visits	0.02 (0.01-0.02)	0.01 (0.01-0.01)	0.02 (0.01-0.02)	0.06 (0.06-0.07)
Biomarker ^c testing	0.02 (0.01-0.02)	0.01 (0.01-0.01)	0.03 (0.03-0.04)	0.08 (0.07-0.09)
Cardiac rehabilitation visits	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.00)	0.00 (0.00-0.01)

BNP, B-type natriuretic peptide; CI, confidence interval; CMR, cardiovascular magnetic resonance; CPET, cardiopulmonary exercise test; ECG, electrocardiogram; LFT, liver function tests.

^aIncludes BNP and troponin T tests.

Note: Results presented as mean burden (95% Poisson CI) per PY.

Table 3. Costs associated with healthcare resource utilization, stratified by intervals within the pre-index period

	Unit costs (NHS [2021/22] and PSSRU [2022])	All pre-index period (PYs: 48,988)	Period A (PYs: 41,124)	Period B (PYs: 3,876)	Period C (PYs: 3,899)
Primary care (all-cause)		275 (274-276)	237 (236-238)	413 (409-417)	532 (527-537)
Primary care physician visits	41.00 ^a	262 (262-263)	226 (225-227)	392 (389-396)	509 (505-514)
Nurse visits	7.99 ^a	13 (13-13)	11 (11-11)	21 (20-21)	23 (23-23)
Secondary care (all-cause)		4,026 (3,945-4,045)	3,140 (3,118-3,216)	6,002 (5,789-6,208)	10,807 (10,510-11,098)
Outpatient visits	235.00 ^a	881 (877-884)	726 (721-731)	1,424 (1,405-1,443)	1,943 (1,922-1,965)
Day case visits	1,224.00 ^a	526 (526-539)	441 (428-441)	783 (747-808)	1,261 (1,224-1,297)
Inpatient visits	7,076.00 ^a	2,194 (2,123-2,194)	1,627 (1,627-1,698)	3,113 (2,972-3,255)	6,581 (6,368-6,793)
Emergency visits	523.99 ^a	424 (419-430)	346 (341-346)	681 (665-702)	1,022 (996-1,043)
Cardiovascular-related tests and visits		267 (257-277)	147 (138-155)	502 (453-555)	1,277 (1,198-1,360)
ECG visits	351.36 ¹⁰	55 (54-56)	28 (27-29)	100 (95-106)	287 (278-298)
Pacemaker-related visits	3,989.97 ¹⁰	160 (153-168)	85 (79-91)	323 (288-361)	779 (726-836)
CMR visits	553.96 ¹⁰	14 (13-15)	3 (3-4)	22 (19-26)	112 (105-120)
Urea/electrolytes tests	20.00 ^{11,b}	14 (14-14)	12 (12-12)	21 (21-22)	27 (27-28)
LFTs	20.00 ^{11,b}	12 (12-12)	10 (10-11)	19 (19-20)	24 (23-24)
Cardiac monitoring visits	192.29 ¹⁰	3 (3-3)	2 (2-2)	5 (4-6)	12 (10-13)
CPET visits	487.05 ¹⁰	8 (7-8)	5 (5-6)	9 (7-11)	31 (28-35)
Biomarker ^c testing	20.00 ¹¹	0 (0-0)	1 (1-1)	1 (1-1)	2 (1-2)
Cardiac rehabilitation visits	483.98 ¹⁰	1 (1-1)	0 (0-1)	1 (0-2)	2 (1-4)
Total costs		4,567 (4,476-4,599)	3,524 (3,492-3,609)	6,917 (6,652-7,180)	12,616 (12,236-12,995)

NHS, National Health Service; PSSRU, Personal Social Services Research Unit.

^aIncludes BNP and troponin T tests. ^bUnit cost assumed equivalent to BNP testing.

Note: Results presented as £ (95% Poisson CI) per PY.