

Economic Analysis – WP2

Aims

The aim of the economic analysis in the work package 2 (WP2) pilot was to assess the collection of data for cost-effectiveness analysis in a future full trial/evaluation and to provide a summary of the resource use reported in the pilot trial and health impact in terms of quality-adjusted life years (QALYs), using EQ-5D data collected in the pilot trial.

Methods

Data on resource use in the health service and social care were collected using a standardised questionnaire at baseline (referring to the previous six months), at 4 months (referring to the 4 months since commencement of the pilot) and at 6 months (referring to the 2 months since the last assessment). Data from months 4 and 6 were combined to calculate the total resource use during the 6 months of the pilot. Note that although all resource use was based on self-report, hospital admissions were reconciled against serious adverse events reporting. In addition the questionnaire captured wider societal costs in terms of both patients' time off work and unpaid caring activities carried out by the patient's main caregiver and by other people.

Unit costs per item of resource use were obtained from published estimates and where necessary inflated to 2016 prices (see Appendix 2) using the Healthcare and Community Health Services index (1). These unit costs were then applied to the resource use values to estimate the total costs associated with health and social care before and during the pilot.

Note that the unit cost of a hospitalisation event represents the expected cost of a typical HF or non-HF hospitalisation event in HF patients, rather than the specific cost of the hospitalisation events experienced by patients in the pilot and reported in serious adverse events (SAEs). Unit cost per event was assumed to be the same between groups, despite differences in the length of stay observed in SAE reporting.

Quality of life data were collected by self-report for both patients and their participating caregivers using the standardised EQ5D-5L health questionnaire, and utilities obtained using both the recently-published health state value set for England by Devlin et al (2) and the existing crosswalk values to estimate 3L utilities (3). QALY estimates for the 6 months of the pilot were calculated using baseline, 4- and 6-month 5L values using the area under the curve method. Patients who had not provided a value for all 5 dimensions at a given time-point were excluded. For the purposes of calculating QALYs only complete cases were included (patients with month 4 and month 6 follow-up data).

Results

Table 1 summarises the resources used over the 6 months of the pilot and their estimated costs by treatment group (0=intervention, 1=control).

In both groups the most costly element of resource use was secondary care, with hospital admissions being the biggest driver of cost. In addition, GP and physiotherapist appointments added considerably to the overall costs. Whilst medication costs were not as high as care costs, the relatively high costs of both ivabradine and nitrate prescriptions meant that even though only a small percentage of patients were prescribed these drugs, they tended to dominate the medication costs.

The average estimated cost of resources used during the 6 months of the pilot was over £1880 per person. Over 60% of these costs came from secondary care, with nearly £1,030 being due to hospital admissions, of which there were 11 during the course of the pilot (of which 4 HF-related). The average length of stay for patients admitted during the pilot was 11.4 days. The numbers of admissions reported and length of stay are summarised in Table 2 and details of each event are given in Table 3.

Overall, the mean cost per person was higher in treatment group 1 (£2,135 per person compared with £1,632). This was in part due to higher rates of hospital admission in group 1, but was also affected by the fact that no one in group 0 attended a day care centre, whereas two patients in group 1 had regular day care centre attendance which added to the costs in this group.

During the course of the pilot 30 patients reported receiving support from their main caregiver and 16 reported receiving support from someone else (average 21 hours per week per patient). In addition, patients reported that caregivers and others who supported them took 29 days off during the six months of the pilot. Patients did not report having taken time off work themselves, though the average age of 75 suggests many could be retired. The wider cost to society of the time spent caring for patients is summarised in Table 5.

Note that patients were asked in the resource use questionnaire at months 4 and 6 whether they had attended any cardiac rehabilitation. Out of 50 patients in both arms, 45 responded in both time periods saying they had not attended cardiac rehabilitation and 5 responses were missing. Therefore, there was no evidence of patients attending cardiac rehabilitation sessions.

Table 4 summarises the estimated utility experienced by patients before and during the pilot. As expected, caregivers achieved higher utility than patients (0.84 compared with 0.67 at baseline). Utility measures tended to fluctuate over the course of the pilot, however, patients in group 0 had more QALYs on average during the pilot than at baseline, while group 1 had slightly fewer QALYs on average during the pilot as compared to baseline.

Due to the small numbers in the pilot none of the between-group differences are likely to be statistically different.

Table 1 Summary of resource use and costs experienced in health, social and community care and HF medications during the 6 months of the pilot, by arm.

	Unit Cost	Treatment group 0				Treatment group 1		
		n	Appointments/visits	Cost per person	n	Appointments/visits	Cost per person	
			per person			per person		
		mean (SD) [range]	mean (SD)	mean (SD) [range]	mean (SD)			
Primary Care Appointments:								
GP (surgery)	£31.00	22	5.36 (7.68) [0-36]	£166.16 (£238.08)	23	2.78 (2.04) [0-9]	£86.18 (£63.24)	
GP (home)	£74.98	22	0.45 (0.91) [0-3]	£33.74 (£68.24)	23	0.61 (2.29) [0-11]	£45.74 (£171.71)	
GP (phone)	£22.29	22	0.64 (1.29) [0-4]	£14.27 (£28.76)	23	0.91 (3.36) [0-16]	£20.29 (£74.90)	
Practice nurse (surgery)	£11.11	22	2.77 (2.69) [0-9]	£30.77 (£29.88)	23	2.61 (2.52) [0-10]	£28.99 (£27.99)	
Practice nurse (home)	£18.80	22	0.09 (0.43) [0-2]	£1.69 (£8.08)	23	0.00 (0.00) [0-0]	£0.00 (£0.00)	
Practice nurse (phone)	£4.30	22	0.27 (0.94) [0-4]	£1.16 (£4.04)	23	0.39 (1.88) [0-9]	£1.68 (£8.08)	
Heart failure nurse	£22.11	22	0.00 (0.00) [0-0]	£0.00 (£0.00)	23	0.00 (0.00) [0-0]	£0.00 (£0.00)	
Physiotherapist	£77.52	22	2.73 (12.79) [0-60]	£211.62 (£984.45)	23	1.00 (3.80) [0-18]	£77.52 (£294.56)	
Occupational therapist	£71.40	22	0.00 (0.00) [0-0]	£0.00 (£0.00)	23	0.52 (2.50) [0-12]	£37.13 (£178.50)	
Community/district nurse	£39.51	22	0.05 (0.21) [0-1]	£1.98 (£8.30)	23	0.39 (1.88) [0-9]	£15.41 (£74.27)	
Health visitor	£27.22	22	0.00 (0.00) [0-0]	£0.00 (£0.00)	23	0.00 (0.00) [0-0]	£0.00 (£0.00)	
Primary Care Total			12.36 (17.84) [1-76]	£461.39		9.22 (11.10) [0-45]	£312.93	
Secondary care:								
Hospital admission	£4,282.51	22	0.18 (0.50) [0-2]	£770.85 (£2141.25)	23	0.30 (0.63) [0-2]	£1284.75 (£2697.98)	
A&E attendance	£137.82	22	0.00 (0.00) [0-0]	£0.00 (£0.00)	23	0.09 (0.29) [0-1]	£12.40 (£39.97)	
Day hospital attendance	£319.33	22	0.32 (0.72) [0-3]	£102.18 (£229.92)	23	0.04 (0.21) [0-1]	£12.77 (£67.06)	
Outpatient cardiology appt	£135.68	22	0.41 (0.67) [0-2]	£55.63 (£90.90)	23	0.57 (1.08) [0-5]	£77.34 (£146.53)	
Outpatient cardiac or HF nurse	£102.96	22	0.05 (0.21) [0-1]	£5.15 (£21.62)	23	0.00 (0.00) [0-0]	£0.00 (£0.00)	
Other outpatient appt	£116.54	0	0.00 (0.00) [0-0]	£0.00 (£0.00)	0	0.00 (0.00) [0-0]	£0.00 (£0.00)	
Secondary Care Total			0.95 (1.00) [0-3]	£933.81		1.00 (1.48) [0-6]	£1,387.27	
Social & community care:								
Social worker visit	£79.00	22	0.45 (1.41) [0-6]	£35.55 (£111.39)	23	0.00 (0.00) [0-0]	£0.00 (£0.00)	
Home care /home help visit	£12.00	22	4.41 (20.68) [0-97]	£52.92 (£247.20)	23	3.48 (11.01) [0-48]	£41.76 (£132.00)	
Day care visits	£46.00	22	0.00 (0.00) [0-0]	£0.00 (£0.00)	23	6.26 (20.74) [0-72]	£287.96 (£952.20)	
Drop in club visits	£13.00	22	0.00 (0.00) [0-0]	£0.00 (£0.00)	23	0.00 (0.00) [0-0]	£0.00 (£0.00)	
Other day care service visits	NA	25	0.00 (0.00) [0-0]	NA	25	0.00 (0.00) [0-0]	NA	
Social Care Total			4.86 (20.85) [0-98]	£88.47		9.74 (22.49) [0-72]	£329.72	
Other:								
Voluntary agency visit	£10.00	22	0.00 (0.00) [0-0]	£0.00 (£0.00)	23	0.09 (0.42) [0-2]	£0.90 (£4.20)	
Other primary/community service	£22.11	25	0.00 (0.00) [0-0]	£0.00 (£0.00)	25	0.16 (0.80) [0-4]	£3.54 (£17.69)	
All Health & Social Care Total			18.18	£1,483.67		20.20	£2,034.35	
Medications:								
	6-month Unit Cost	n	% prescribed mean	Cost per person mean	n	% prescribed mean	Cost per person mean	
Angiotensin II receptor antagonist	£15.12	25	29%	£4.38	25	28%	£4.23	
ACE inhibitor	£6.90	25	44%	£3.04	25	48%	£3.31	
Aldosterone receptor antagonist	£63.06	25	16%	£10.09	25	24%	£15.13	
Anti-coagulant	£8.34	25	15%	£1.25	25	53%	£4.42	
Beta-blocker	£6.12	25	56%	£3.43	25	44%	£2.69	
Digoxin	£18.00	25	8%	£1.44	25	12%	£2.16	
Ivabradine	£258.24	25	4%	£10.33	25	4%	£10.33	
Loop diuretic	£7.98	25	77%	£6.14	25	76%	£6.06	
Nitrate	£277.32	25	39%	£108.15	25	19%	£52.69	
Thiazide diuretic	£9.60	25	5%	£0.48	25	1%	£0.10	
All Medications Total				£148.74			£101.13	
All Resource Use Grand Total				£1,632.41			£2,135.49	

Table 2 Summary of numbers of admissions and days hospitalised per admission before and during the pilot, by arm.

		Group 0	Group 1	Total
PRE PILOT	Admissions	4	4	8
	Days per admission	7.3	4.5	5.9
PILOT	Admissions	4	7	11
	Days per admission	9.0	12.7	11.4
	Admissions due to HF*	0	4	4
*taken from SAE reporting as not in questionnaire				

Table 3 Details of individual serious and adverse events involving hospital admission, by arm.

Treatment Group	Date of Onset	Date Recovered or Died	Final Date of Resolution	Assumed Length of Stay	Reason
0	01/12/2015		15/12/2015	14	Non-HF
0	10/11/2015	16/11/2015		6	Non-HF
0	29/12/2015	13/01/2016		15	Non-HF
0	23/02/2016	24/02/2016		1	Non-HF
1	17/12/2015		18/12/2015	1	HF
1	15/02/2016		09/03/2016	23	HF
1	05/02/2016		22/02/2016	17	Non-HF
1	12/03/2016		29/03/2016	17	HF
1	11/06/2016	14/06/2016		3	Non-HF
1	11/10/2016		21/10/2016	10	HF
1	07/11/2016		24/11/2016	17	Non-HF

Table 4 Summary of utility estimates for patients and caregivers over the course of the pilot, along with QALY estimates, by arm. Results are summarised using the newly-available UK tariff for the EQ5D-5L and compared to utility estimated using the published cross-walk for EQ5D-5L to EQ5D-3L values.

	Treatment group 0		Treatment group 1	
	n	mean (SD) [range]	n	mean (SD) [range]
Patient utility				
EQ5D-5L				
Baseline	25	0.67 (0.28) [0.08-1.00]	24	0.66 (0.30) [0.00-1.00]
Month 4	22	0.71 (0.24) [0.26-0.95]	23	0.59 (0.34) [-0.16-1.00]
Month 6	21	0.72 (0.31) [-0.10-1.00]	23	0.63 (0.30) [0.00-1.00]
Estimated QALYs per person (5L)				
6 months of pilot	21	0.36 (0.12) [0.07-0.49]	23	0.31 (0.15) [-0.04-0.50]
EQ5D-3L				
Baseline	25	0.57 (0.29) [-0.05-1.00]	24	0.58 (0.31) [-0.02-1.00]
Month 4	22	0.60 (0.28) [-0.01-0.91]	23	0.52 (0.34) [-0.16-1.00]
Month 6	21	0.65 (0.31) [0.04-1.00]	23	0.55 (0.29) [-0.04-1.00]
Estimated QALYs per person (5L)				
6 months of pilot	21	0.31 (0.12) [0.03-0.48]	23	0.27 (0.16) [-0.02-0.50]
Caregiver utility				
EQ5D-5L				
Baseline	10	0.85 (0.15) [0.50-1.00]	10	0.82 (0.24) [0.21-1.00]
Month 4	8	0.89 (0.07) [0.75-1.00]	10	0.84 (0.14) [0.51-1.00]
Month 6	8	0.86 (0.14) [0.56-1.00]	9	0.77 (0.32) [-0.07-1.00]
Estimated QALYs per person (5L)				
6 months of pilot	8	0.44 (0.04) [0.36-0.50]	9	0.42 (0.10) [0.16-0.48]
EQ5D-3L				
Baseline	10	0.78 (0.19) [0.37-1.00]	10	0.74 (0.28) [0.06-1.00]
Month 4	8	0.81 (0.10) [0.65-1.00]	10	0.75 (0.17) [0.41-1.00]
Month 6	8	0.78 (0.18) [0.44-1.00]	9	0.67 (0.35) [-0.22-1.00]
Estimated QALYs per person (5L)				
6 months of pilot	8	0.40 (0.06) [0.31-0.50]	9	0.37 (0.11) [0.09-0.48]

Table 5 Summary of time spent by main caregivers and others in providing support to patients, by arm. Includes hours spent in support as well as time off work, and patient time off work.

	Unit Cost*	Treatment group 0			Treatment group 1		
		n	Time per patient	Cost per person	n	Time per patient	Cost per person
			mean (SD) [range]	mean (SD)		mean (SD) [range]	mean (SD)
Pilot							
Caregiver hours per week	£24.00	22	3.03 (5.86) [0-20]	£72.72 (£140.64)	23	12.41 (30.30) [0-140]	£297.60 (£727.20)
Non-caregiver hours per week	£24.00	22	4.98 (12.57) [0-57]	£119.52 (£301.68)	23	0.46 (1.31) [0-5]	£11.04 (£31.44)
Total caring hours			8.01	£192.24		12.86	£308.64
Caregiver days off work	£122.31	22	0.14 (0.64) [0-3]	£17.12 (£78.28)	23	1.00 (4.38) [0-21]	£122.31 (£535.71)
Non-caregiver days off work	£122.31	22	0.14 (0.64) [0-3]	£17.12 (£78.28)	23	0.00 (0.00) [0-0]	£0.00 (£0.00)
Total days off work			0.28	£34.25		1.00	£122.31
Patient days off work	£96.15	22	0.00 (0.00) [0-0]	£0.00 (£0.00)	23	0.00 (0.00) [0-0]	£0.00 (£0.00)
Pre-Pilot							
Caregiver hours per week	£24.00	25	5.36 (10.79) [0-42]	£128.64 (£258.96)	25	8.04 (18.72) [0-84]	£192.96 (£448.80)
Non-caregiver hours per week	£24.00	25	4.84 (16.84) [0-84]	£116.16 (£404.16)	25	0.12 (0.44) [0-2]	£2.88 (£10.56)
Total caring hours			10.20	£244.80		8.16	£195.84
Caregiver days off work	£122.31	25	0.16 (0.80) [0-4]	£19.57 (£97.85)	25	0.52 (2.40) [0-12]	£63.60 (£293.54)
Non-caregiver days off work	£122.31	25	0.00 (0.00) [0-0]	£0.00 (£0.00)	25	0.00 (0.00) [0-0]	£0.00 (£0.00)
Total days off work			0.16	£19.57		0.52	£63.60
Patient days off work	£96.15	25	0.00 (0.00) [0-0]	£0.00 (£0.00)	25	0.00 (0.00) [0-0]	£0.00 (£0.00)

*sources of unit costs are given in Appendix 2

Pilot data collection and analysis learning

Note that the EQ5D-5L value set for England is still relatively new (published 2016), and has some important differences from the value set previously used for the EQ5D-3L in the UK, including changes to the methodology for capturing and analysing values. This leads to differences in the distribution of health state values across the population. As a result we have reported the utility values based on self-reported health-related quality of life calculated both using the new 5L value set and using the previously-published cross-walk (3) which provides values equivalent to the old 3L value set.

Most of the resources used were picked up by the named categories in the resource use questionnaire. The only other type of resource use reported in the pilot was for a COPD nurse appointment, which was included and assumed to have the same cost as a specialist HF nurse appointment for the purpose of this analysis.

Patient time traveling for, waiting for and receiving medical care/treatment was not accounted for, so if this changed, e.g. with fewer hospital admissions, there would be no way (from a societal perspective) of quantifying the benefit or cost.

Informal care was measured for both the main caregiver and other individuals, but was not broken down into specific care tasks, nor was any exploration of the type of informal care included in the resource use questionnaire. As a result it is not possible to either report or cost informal care activities at any more than a generic level, e.g. using the proxy good method and the cost of home care.

Serious adverse event reporting collected date of onset, date recovered or died and date of final resolution, but not specifically days hospitalised (from admission to discharge). Therefore, it was possible to reconcile the events against patient self-report but not necessarily the length of stay.

In addition, admissions for HF events can be of a different nature and cost from non-HF admissions in this patient group. It is worth considering whether to ask patients in the survey to separate HF from other admissions. If this is not available in the survey the options are to a) use one generic cost to cover all admissions or b) obtain the split from detailed analysis of individual serious adverse event reports.

In the resource use questionnaire some primary care and social care services are bundled together in the section 'Primary and Community Based Health and Social Care'. Since this section has three fields for 'Other' types of service, it is not possible to determine whether these 'other' services are primary care (NHS costs) or social care (LA costs) without individually analysing and assessing the free text responses. This could be made clearer by separating the questionnaire into 'primary care' appointments, 'secondary care' and 'social care' sections.

Appendix 1

Resource use and cost at baseline (6 months prior to pilot)

	Treatment group 0							Treatment group 1						
	Unit Cost*	n	Appointments/visits	Cost per	n	Appointments/visits	Cost per							
			per person	person		per person	person							
			mean (SD) [range]	mean (SD)				mean (SD) [range]	mean (SD)					
Primary Care Appointments:														
GP (surgery)	£31.00	25	3.08 (3.11) [0-12]	£95.48 (£96.41)	25	3.28 (2.64) [0-12]	£101.68 (£81.84)							
GP (home)	£74.98	25	0.24 (0.83) [0-4]	£18.00 (£62.24)	25	0.60 (2.40) [0-12]	£44.99 (£179.96)							
GP (phone)	£22.29	25	0.20 (0.65) [0-3]	£4.46 (£14.49)	25	0.80 (2.42) [0-12]	£17.83 (£53.95)							
Practice nurse (surgery)	£11.11	25	2.00 (2.38) [0-10]	£22.22 (£26.44)	25	1.96 (2.70) [0-12]	£21.77 (£29.99)							
Practice nurse (home)	£18.80	25	0.16 (0.80) [0-4]	£3.01 (£15.04)	25	0.00 (0.00) [0-0]	£0.00 (£0.00)							
Practice nurse (phone)	£4.30	25	0.00 (0.00) [0-0]	£0.00 (£0.00)	25	0.04 (0.20) [0-1]	£0.17 (£0.86)							
Heart failure nurse	£22.11	25	0.00 (0.00) [0-0]	£0.00 (£0.00)	25	0.00 (0.00) [0-0]	£0.00 (£0.00)							
Physiotherapist	£77.52	25	0.00 (0.00) [0-0]	£0.00 (£0.00)	25	1.00 (4.80) [0-24]	£77.52 (£372.07)							
Occupational therapist	£71.40	25	0.00 (0.00) [0-0]	£0.00 (£0.00)	25	0.00 (0.00) [0-0]	£0.00 (£0.00)							
Community/district nurse	£39.51	25	0.12 (0.60) [0-3]	£4.74 (£23.70)	25	0.00 (0.00) [0-0]	£0.00 (£0.00)							
Health visitor	£27.22	25	0.00 (0.00) [0-0]	£0.00 (£0.00)	25	0.00 (0.00) [0-0]	£0.00 (£0.00)							
Primary Care Total			5.80 (5.63) [0-25]	£147.90		7.68 (9.25) [0-37]	£263.96							
Secondary care:														
Hospital admission	£4,282.51	24	0.17 (0.38) [0-1]	£728.03 (£1627.35)	24	0.17 (0.64) [0-3]	£728.03 (£2740.81)							
A&E attendance	£137.82	25	0.08 (0.28) [0-1]	£11.03 (£38.59)	25	0.08 (0.40) [0-2]	£11.03 (£55.13)							
Day hospital attendance	£319.33	25	0.08 (0.28) [0-1]	£25.55 (£89.41)	25	0.00 (0.00) [0-0]	£0.00 (£0.00)							
Outpatient cardiology appt	£135.68	25	0.64 (0.64) [0-2]	£86.83 (£86.83)	25	0.40 (0.50) [0-1]	£54.27 (£67.84)							
Outpatient cardiac or HF nurse	£102.96	25	0.00 (0.00) [0-0]	£0.00 (£0.00)	25	0.00 (0.00) [0-0]	£0.00 (£0.00)							
Other outpatient appt	£116.54	25	0.00 (0.00) [0-0]	£0.00 (£0.00)	25	0.00 (0.00) [0-0]	£0.00 (£0.00)							
Secondary Care Total			0.96 (0.86) [0-3]	£851.43		0.63 (1.06) [0-5]	£793.32							
Social & community care:														
Social worker visit	£79.00	25	0.00 (0.00) [0-0]	£0.00 (£0.00)	25	0.00 (0.00) [0-0]	£0.00 (£0.00)							
Home care /home help visit	£12.00	25	1.00 (4.08) [0-20]	£12.00 (£48.96)	25	3.36 (10.69) [0-48]	£40.32 (£127.20)							
Day care visits	£46.00	25	0.00 (0.00) [0-0]	£0.00 (£0.00)	25	0.00 (0.00) [0-0]	£0.00 (£0.00)							
Drop in club visits	£13.00	25	0.00 (0.00) [0-0]	£0.00 (£0.00)	25	3.12 (14.40) [0-72]	£40.56 (£187.20)							
Other day care service visits	NA	25	0.00 (0.00) [0-0]	£0.00	25	0.00 (0.00) [0-0]	£0.00							
Social Care Total			1.00 (4.08) [0-20]	£12.00		6.48 (17.31) [0-72]	£80.88							
Other:														
Voluntary agency visit	£10.00	25	0.00 (0.00) [0-0]	£0.00 (£0.00)	25	0.00 (0.00) [0-0]	£0.00 (£0.00)							
Other primary/community service	£22.11	25	0.00 (0.00) [0-0]	£0.00 (£0.00)	25	0.00 (0.00) [0-0]	£0.00 (£0.00)							
All Health & Social Care Total			7.76	£1,011.33		14.79	£1,138.17							
	6-month Unit Cost	n	% prescribed mean	Cost per person mean	n	% prescribed mean	Cost per person mean							
Medications:														
Angiotensin II receptor antagonist	£15.12	25	28%	£4.23	25	28%	£4.23							
ACE inhibitor	£6.90	25	44%	£3.04	25	56%	£3.86							
Aldosterone receptor antagonist	£63.06	25	16%	£10.09	25	24%	£15.13							
Anti-coagulant	£8.34	25	24%	£2.00	25	52%	£4.34							
Beta-blocker	£6.12	25	72%	£4.41	25	52%	£3.18							
Digoxin	£18.00	25	12%	£2.16	25	12%	£2.16							
Ivabradine	£258.24	25	4%	£10.33	25	4%	£10.33							
Loop diuretic	£7.98	25	84%	£6.70	25	92%	£7.34							
Nitrate	£277.32	25	40%	£110.93	25	16%	£44.37							
Thiazide diuretic	£9.60	25	4%	£0.38	25	4%	£0.38							
All Medications Total				£154.27			£95.34							
All Resource Use Grand Total				£1,165.60			£1,233.51							

*sources of all unit costs are provided in Appendix 2

Appendix 2

Unit costs, sources and assumptions

Category	Unit cost (2016 £)	Data Source	Basis/assumptions
Primary Care:			
GP appt (surgery)	£31.00	PSSRU 2016	cost per 9.22 min (ave length) appointment with GP
GP appt (home)	£74.98	PSSRU 2015	cost per 11.4 minute home visit appt plus 12 minutes travel time
GP appt (phone)	£22.29	PSSRU 2015	cost per 7.1 minute telephone appt
Practice nurse appt (surgery)	£11.11	PSSRU 2016, PSSRU 2015	£43 per hour *15.5 minutes contact for surgery appt
Practice nurse appt (home)	£18.80	PSSRU 2016, PSSRU 2015, PSSRU 2010	£43 per hour *25 minutes contact for home visit + 80p per visit travel cost (inflated from 2010)
Practice nurse appt (phone)	£4.30	PSSRU 2016, PSSRU 2015	£43 per hour *6 minutes contact for telephone consultation (nurse advanced)
Heart failure nurse appt	£22.11	PSSRU 2016	assumed Band 6 £44 per hour *15.5 minutes for surgery appt or 25 minutes for home appt + 80p (inflated from 2010) for travel time and applying direct to indirect time multiplier of 1.71
Physiotherapist appt	£77.52	PSSRU 2016, PSSRU 2010	Assumes community physiotherapist. Using the mean basic salary for physiotherapists (33175) to calculate the hourly working time cost (£47.92). The more recent reports do not have info on appt time or ratio of indirect to direct time per appt so we go back to 2010 for these. This gives 83% home visits and 17% clinic based, appt lengths 60 and 30 mins respectively, £2.80 (inflated) in travel costs and ratio of 1:0.67 for indirect to direct contact time.
Occupational therapist appt	£71.40	PSSRU 2016, PSSRU 2010	Assumes community OT. Using the hourly working time cost (£44). The more recent reports do not have info on appt time or ratio of indirect to direct time per appt so we go back to 2010 for these. This gives 83% home visits and 17% clinic based, appt lengths 60 and 30 mins respectively, £2.80 (inflated) in travel costs and ratio of 1:0.67 for indirect to direct contact time.
Community/district nurse appt	£39.51	PSSRU 2016, PSSRU 2010	Using the mean basic salary for community nurses (31902) to calculate the hourly working time cost (£46.14). 43% of time spent in direct patient consultation gives a multiplier of 2.33 to get full cost. , Then from 2010 appt lengths 20 mins, £1.50 (inflated) in travel costs, assuming all appts are home visits
Health visitor appt	£27.22	PSSRU 2015, PSSRU 2010	Not available in 2016 so use 2015 (inflated) cost per hour of patient-related work (£76) and 2010 report for visit length (20 minutes) and travel cost (£1.50 per visit) inflated.
Other primary/community service	£22.11	PSSRU 2016	Only one in WP2 data - COPD nurse so assume same as HF nurse appt since specialist nurse poss with mix of clinics/home appts

Category	Unit cost (2016 £)	Data Source	Basis/assumptions
Secondary care:			
Hospital admission (HF)	£4,668.66	National Schedule of reference costs 2015/16	Weighted average cost of a single spell for the health resource groups (HRGs) EBo3A-D - assuming any cost of follow up included in other sections Length of stay for HF in pilot = 12.6 days, LoS in NHS Ref Costs (NEL and NES) = 9.48 (per spell) therefore 3.12 extra bed days were added at the weighted average excess bed day cost in the same HRG of £276.78
Hospital admission (non-HF)	£3,966.57	Zannad et al, National Schedule of Reference Costs 2015/16	The EMPHASIS HF trial reported a breakdown of types of admissions by HF, other CVD, renal function, hyperkalaemia and other. The rate of admission for each category was then applied to the estimated weighted mean cost of a hospital spell for this category from the national schedule of reference costs 2015/16 (CVD admissions were assumed to be HRGs EB to EY excluding EBo3, renal function was assumed to be HRGs LA08 to 09, hyperkalaemia was assumed to be HRG KC05 and others were based on a weighted mean cost of all other types of admission in the dataset) to give an expected cost per admission. Length of stay for HF in pilot = 10.17 days, LoS in NHS ref costs (NEL and NES) = 4.32 (per spell) therefore 5.85 extra bed days were added at the weighted average excess bed day cost in the same HRG (also weighted by HF patients relative use of each category) of £300.63
Hospital admission (overall)	£4,282.51		Based on 45% of admissions in WP2 being HF-related (from SAE reporting data)
A&E attendance	£137.82	National Schedule of Reference Costs 2015/16	Mean cost of a single A&E attendance taken from the National Schedule of Reference costs 2015/16 for all A&E attendance types excluding dentistry
Day hospital attendance	£319.33	National Schedule of Reference Costs 2015/16	Based on the weighted average cost of hospital day cases for HF (EBo3)
Outpatient cardiology appt	£135.68	National Schedule of Reference Costs 2015/16	Unit cost of cardiology OP attendance from NSRC 2015-16 (consultant led)
Outpatient cardiac or HF nurse	£102.96	National Schedule of Reference Costs 2015/16	Unit cost of cardiology OP attendance from NSRC 2015-16 (non-consultant led)
Other outpatient appt	£116.54	National Schedule of Reference Costs 2015/16	Weighted average unit cost of a non-cardiology OP attendance from NSRC 2015-16 (consultant- and non-consultant led)
Social & community care:			
Social worker visit	£79.00	PSSRU 2016	Unit cost of £79 per hour of client related work for a social worker in adult services and assumed 60 minute appt length
Home care /home help visit	£12.00	PSSRU 2016	Unit cost for one hour of face-to-face time for social service provided home care: £24 per hour weekday and a mean appointment length of 30 minutes (suggested from the distribution reported)
Voluntary agency visit	£10.00	PSSRU 2016	Unit cost for one hour of face-to-face time for independent sector provided home care: £20 per hour weekday and assumed mean appt length 30 mins same as social care provision
Day care visits	£46.00	PSSRU 2016	£46 per client session lasting 3.5 hours.
Drop in club visits	£13.00	PSSRU 2016	Assume same cost as day care but shorter duration - based on day care cost per client hour of £13
Other day care service visits	NA		None of these in WP2

Category	Unit cost (2016 £)	Data Source	Basis/assumptions
MEDICATIONS			
A2 receptor antagonist	£15.12	BNF 2017, OpenPrescribing	Per-person monthly costs of each drug were based on the relevant products in the BNF 2017 (i.e. those with an indication for treatment of HF) assuming recommended dosage, or where dose up-titration was recommended dosing at half the maximum dose. Costs were based on generics where available, and where multiple products fell within a single category (i.e. the four ACE inhibitors Ramipril, Lisinopril, perindopril erbumine and Enalapril maleate) the weighting of each to the average cost was based on item numbers from OpenPrescribing, assuming that prescribing patterns are the same across all relevant conditions including HF. See Appendix 3 for more details.
ACE inhibitor	£6.90	BNF 2017, OpenPrescribing	
Aldosterone receptor antagonist	£63.06	BNF 2017, OpenPrescribing	
Anti-coagulant	£8.34	BNF 2017, OpenPrescribing	
Beta-blocker	£6.12	BNF 2017, OpenPrescribing	
Digoxin	£18.00	BNF 2017, OpenPrescribing	
Ivabradine	£258.24	BNF 2017, OpenPrescribing	
Loop diuretic	£7.98	BNF 2017, OpenPrescribing	
Nitrate	£277.32	BNF 2017, OpenPrescribing	
Thiazide diuretic	£9.60	BNF 2017, OpenPrescribing	
PATIENT & CAREGIVER TIME			
Caregiver hours per week	£24.00	PSSRU 2016	Based on the cost of face to face homecare worker time (weekday daytime) provided to private purchasers
Non-caregiver hours per week	£24.00	PSSRU 2016	Based on the cost of face to face homecare worker time (weekday daytime) provided to private purchasers
Caregiver days off work	£122.31	National Statistics Distribution of median and mean income and tax by age range and gender 2014-15	No info on caregiver age/gender so use mean income before tax for all ages/genders £31,800 per annum, assuming 260 working days per year.
Non-caregiver days off work	£122.31		
Patient days off work	£96.15	National Statistics Distribution of median and mean income and tax by age range and gender 2014-15	Mean age in study = 74.9, mean income in age group (both sexes) before tax = 25,000, assuming 260 working days per year. If any patients had reported working hours per week we could use this to adjust the figure down if mean <36

Appendix 3

Medications costing; assumed usage and dosage

DRUG TYPE	DRUG	DOSE (assumed for costing)	DOSE (BNF guidance)	% prescriptions by type (OpenPrescribing)
ACE inhibitors <i>Dosed by titration, assume half maximum dose</i>	Ramipril	5mg daily	Heart failure (adjunct), initially 1.25 mg once daily under close medical supervision (see notes above), increased gradually at intervals of 1–2 weeks to max. 10 mg daily if tolerated (preferably taken in 2 divided doses)	60%
	Lisinopril	17.5mf daily	Heart failure (adjunct), initially 2.5 mg once daily under close medical supervision (see notes above); increased in steps no greater than 10 mg at intervals of at least 2 weeks up to max. 35 mg once daily if tolerated	23%
	Perindopril erbumine	2mg daily	Heart failure (adjunct), initially 2 mg once daily in the morning under close medical supervision (see notes above), increased after at least 2 weeks to max. 4 mg once daily if tolerated	12%
	Enalapril maleate	10mg daily	Heart failure (adjunct), asymptomatic left ventricular dysfunction, initially 2.5 mg once daily under close medical supervision (see notes above), increased gradually over 2–4 weeks to 10–20 mg twice daily if tolerated	5%
Beta blockers <i>Dosed by titration, assume half maximum dose</i>	Bisoprolol fumarate	5mg daily	Adjunct in heart failure (section 2.5.5), initially 1.25 mg once daily (in the morning) for 1 week then, if well tolerated, increased to 2.5 mg once daily for 1 week, then 3.75 mg once daily for 1 week, then 5 mg once daily for 4 weeks, then 7.5 mg once daily for 4 weeks, then 10 mg once daily; max. 10 mg daily	96%
	Carvedilol	12.5g twice daily	Adjunct in heart failure (section 2.5.5) initially 3.125 mg twice daily (with food), dose increased at intervals of at least 2 weeks to 6.25 mg twice daily, then to 12.5 mg twice daily, then to 25 mg twice daily; increase to highest dose tolerated, max. 25 mg twice daily in patients with severe heart failure or body-weight less than 85 kg and 50 mg twice daily in patients over 85 kg	2%
	Nebivolol	5mg daily	Adjunct in heart failure (section 2.5.5), initially 1.25 mg once daily, then if tolerated increased at intervals of 1–2 weeks to 2.5 mg once daily, then to 5 mg once daily, then to max. 10 mg once daily	2%
Aldosterone antagonists <i>Dosed by titration, assume half maximum dose</i>	Eplerenone	25mg daily	Initially 25 mg once daily, increased within 4 weeks to 50 mg once daily;	20%
	Sprinolactone	25mg daily	Oedema in congestive heart failure, initially 100 mg (range 25–200 mg) daily in single or divided doses; maintenance dose adjusted according to response Moderate to severe heart failure (adjunct), initially 25 mg once daily, increased according to response to max. 50 mg once daily (see section 2.5.5)	80%
Angiotensin II receptor antagonists <i>Dosed by titration, assume half maximum dose</i>	Candesartan cilexetil	16mg daily	Heart failure, initially 4 mg once daily, increased at intervals of at least 2 weeks to 'target' dose of 32 mg once daily or to max. tolerated dose	41%
	Losartan potassium	75 mg daily	Chronic heart failure, initially 12.5 mg once daily, increased at weekly intervals to max. 150 mg once daily if tolerated	55%
	Valsartan	80 mg daily	Heart failure, initially 40 mg twice daily increased at intervals of at least 2 weeks up to max. 160 mg twice daily	3%
Digoxin <i>Assume halfway between two recommended doses</i>	Digoxin	93.75mg daily	Heart failure (for patients in sinus rhythm), by mouth, 62.5–125 micrograms once daily	
Diuretics <i>Assume halfway between two recommended doses</i>	Bendroflumethiazide	7.5mg 3x week	Oedema, initially 5–10 mg daily in the morning or on alternate days; maintenance 5–10 mg 1–3 times weekly	6%
	Indapamide	2.5 daily	2.5 mg daily in the morning	25%
	Bumetanide	3mg daily	By mouth, 1 mg in the morning, repeated after 6–8 hours if necessary; severe cases, 5 mg daily increased by 5 mg every 12–24 hours according to response; ELDERLY, 500 micrograms daily may be sufficient	8%
	Furosemide	30mg daily	By mouth, oedema, initially 40 mg in the morning; maintenance 20–40 mg daily;	61%
Ivabradine <i>Assume halfway between two recommended doses</i>	Ivabradine	5mg twice daily	Heart failure, initially 5 mg twice daily, increased if necessary after 2 weeks to 7.5 mg twice daily (if not tolerated reduce dose to 2.5 mg twice daily)	
Calcium channel blockers <i>Assume halfway between two recommended doses</i>	Amlodipine	7.5mg daily	Hypertension or angina, initially 5 mg once daily; max. 10 mg once daily	
Anti-arrhythmic <i>Assume maintenance amount</i>	Amiodarone	200mg daily	By mouth, 200 mg 3 times daily for 1 week reduced to 200 mg twice daily for a further week; maintenance, usually 200 mg daily or the minimum required to control the arrhythmia	
Anticoagulants	Warfarin	<i>dosage is personalised so used a simple average of all pack prices >=1mg (all similar), assuming one tablet per day of either 500 micrograms, 1mg, 3mg or 5mg.</i>		

Hydralazine + nitrate <i>Dosed by titration, assume half maximum dose or halfway between two recommended doses</i>	Isosorbide dinitrate	120mg daily	By mouth, daily in divided doses, angina 30–120 mg, left ventricular failure 40–160 mg, up to 240 mg if required
	Hydralazine hydrochloride	250mg daily	Heart failure (initiated in hospital) 25 mg 3–4 times daily, increased every 2 days if necessary; usual maintenance dose 50–75 mg 4 times daily

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