

### E.1.3 Both admission avoidance and early discharge

Study	Bakerly 2009 <sup>23</sup>			
Study details	Population & interventions	Costs	Health outcomes	Cost effectiveness
<p><b>Economic analysis:</b> CC (health outcome: N/A )</p> <p><b>Study design:</b> matched case-control, with retrospective controls matched on age, sex and post code</p> <p><b>Approach to analysis:</b> Means and mean differences, with bias-corrected bootstrap analysis used to calculate 95% CIs around the mean estimates.</p> <p><b>Perspective:</b> UK NHS</p> <p><b>Follow-up</b> 12 months</p> <p><b>Treatment effect duration<sup>(a)</sup>:</b> 12 months</p> <p><b>Discounting:</b> Costs: NR; Outcomes NR:</p>	<p><b>Population:</b> Patients admitted to a university hospital with acute exacerbation of COPD (AECOPD)</p> <p><b>Cohort settings: (n=225)</b> Mean age: Intervention 1: 68 years Intervention 2: 70 years Male: Intervention 1: 56% Intervention 2: 55%</p> <p><b>Intervention 1: (n=95)</b> Usual inpatient care for AECOPD, where patients stayed in hospital for the whole length of the admission.</p> <p><b>Intervention 2: (n=130)</b> Care delivered by an acute COPD assessment service (ACAS), which provided an integrated care model. *</p>	<p><b>Total costs (mean per patient):</b> Intervention 1: £2,256 Intervention 2: £1,653 Incremental (2–1): -£600 (95% CI: NR; p&lt;0.001)</p> <p><b>Currency &amp; cost year:</b> 2007 UK pounds</p> <p><b>Cost components incorporated:</b> Specialist nurse visits Emergency department visits Emergency home visits Contacts with other health care professionals (GP, district nurse, occupational therapist) Emergency ambulance transfers Hospital admissions and length of stay Outpatient clinic visits</p>	<p>N/A (3-month readmission rate was assumed equal)</p>	<p><b>ICER (Intervention 2 versus Intervention 1):</b> N/A 95% CI: N/A Probability Intervention 2 cost-effective (£20K/30K threshold): N/A</p> <p><b>Analysis of uncertainty:</b> Bootstrapping was used to calculate 95% CI around the mean cost estimates. Total costs: Intervention 1: 95% CI: £2,126 to £2,407 Intervention 2: 95% CI: £1,521 to £1,802</p>
<b>Data sources</b>				
<b>Health outcomes:</b> N/A (3-month readmission rate was assumed equal). <b>Quality-of-life weights:</b> N/A. <b>Cost sources:</b> the unit costs were derived from national sources (NHS reference costs and PSSRU)				

**Comments**

**Source of funding:** Local, non-commercial funding (local respiratory research fund). **Applicability and limitations:** The model evaluated in the study is an integrated care model, with hospital at home representing one component of the model. Some uncertainty exists regarding the applicability of resource use and costs from 2007 to the current NHS context. QALYs were not used as an outcome measure as the study compares costs only. Observational, matched case control study with no adjustment for possible confounders other than the matching variables. So, so does not reflect all the evidence available for this comparison. One year follow-up; so may not capture the long-term consequences of the intervention. The study compares costs only and no health outcomes are considered. No sensitivity analysis is reported.

**Overall applicability<sup>(b)</sup>:** partially applicable **Overall quality<sup>(c)</sup>:** potentially serious limitations

\* The ACAS team comprised 3 full-time specialist respiratory nurses and middle-grade physician (0.4 whole time equivalent) assessing AECOPD admissions daily. Suitable patients received the following interventions: early discharge (with support at home, available 7-days a week from 9:00 am to 5:00 pm.), patient's education and clinic assessment 60 days from the index episode, where a clinical management plan is agreed and communicated to the patient's GP. Patients' could also refer themselves or be referred by their GP to the ACAS service (avoiding admissions)

Abbreviations: CC: comparative costing; COPD: Chronic obstructive pulmonary disease; 95% CI: 95% confidence interval; ICER: incremental cost-effectiveness ratio; NR: not reported; QALYs: quality-adjusted life years.

(a) For studies where the time horizon is longer than the treatment duration, an assumption needs to be made about the continuation of the study effect. For example, does a difference in utility between groups during treatment continue beyond the end of treatment and if so for how long.

(b) Directly applicable/Partially applicable/Not applicable.

(c) Minor limitations/Potentially serious limitations/Very serious limitations.

Study	Patel 2008 <sup>229</sup>			
Study details	Population & interventions	Costs	Health outcomes	Cost effectiveness
<p><b>Economic analysis:</b> CUA (health outcome: QALYs)</p> <p><b>Study design:</b> Within –trial analysis (RCT)</p> <p><b>Approach to analysis:</b> Analysis of individual level data for resource use. Unit costs applied.</p> <p><b>Perspective:</b> Not reported (appears to be Swedish healthcare system)</p> <p><b>Follow-up:</b> 12 months</p>	<p><b>Population:</b> Patients seeking care for deterioration of chronic heart failure identified within 24-48 hours after admission from three medical facilities: ED, Heart failure outpatient clinic and a medical ward.</p> <p><b>Cohort settings: (n=31)</b> Start age: Intervention 1: 78 years (SD=8)</p>	<p><b>Total costs (mean per patient):</b> Intervention 1: £3,671 Intervention 2: £1,711 Incremental (2–1):- £1,960 (95% CI: NR; p=0.05)</p> <p><b>Currency &amp; cost year:</b> Assumed to be 2006 Euros[(presented here as 2006 UK pounds<sup>(a)</sup>)]</p> <p><b>Cost components incorporated:</b> Specialist nurses' time</p>	<p><b>QALYs (mean per patient):</b> EQ-5D visual analogue scale: Intervention 1: 0.43 Intervention 2: 0.44 Incremental (2–1): 0.01 (95% CI: NR; p=NR)</p> <p>SG utilities: Intervention 1: 0.64 Intervention 2: 0.71 Incremental (2–1): 0.01 (95% CI: NR; p=NR)</p>	<p><b>ICER (Intervention 2 versus Intervention 1):</b> 2 dominates 1</p> <p><b>Analysis of uncertainty:</b> SA using last value carried forward for people lost to follow-up: EQ-5D QALYs for the intervention 1 group 0.5 SG QALYs for the intervention 1 group: 0.75 QALYs calculation using the following alternative assumptions (Not clear which one is base case): Any change in HRQoL between two measurement points occurred immediately after the first measurement point</p>

Study	Patel 2008 <sup>229</sup>			
Study details	Population & interventions	Costs	Health outcomes	Cost effectiveness
<b>Discounting:</b> Costs: n/a; Outcomes: n/a	Intervention 2: 77 years (SD=10)  Male: Intervention 1: 83% Intervention 2: 46% <b>Intervention 1: (n=18)</b> Hospital admission/conventional care (CC)  <b>Intervention 2: (n=13)</b> Home care under the direction of a specialist nurse (HC)	(including home visits, administration, transportation)  Physicians' time (including consultations, prescriptions, referrals)  Laboratory tests IV diuretics Emergency visits Hospitalisations due to HF Telephone contacts with HF clinic Visits to HF clinic		Any change in HRQoL occurred immediately before the second measurement point Any change occurred in HRQoL exactly half-way between the two measurement points No differences were observed <b>Costs:</b> Difference in the cost of initial intervention was significant (p<0.001) Difference in total costs was significant (p=0.04) Differences in total costs including HF clinic was significant (p=0.05)  <b>Outcomes:</b> No significant difference in QALYs gained
Data sources				
<b>Health outcomes:</b> patients completed four follow-up sets of questionnaires at 1, 4, 8 and 12 months. Patients' clinical status was documented and information about clinical events was elicited through patient interviews and complemented by the patients' medical records. <b>Quality-of-life weights:</b> EQ-5D visual analogue scale values rather than tariff utilities were used. SG utilities were also measured. <b>Cost sources:</b> resource use data was recorded using patient interviews and patients' medical records. Costs were based on the hospital's financial department records.				
Comments				
<b>Source of funding:</b> NR. <b>Applicability and limitations:</b> Some uncertainty about the applicability of resource use and costs (2004-2006) from Sweden. QALYs are calculated using the VAS values. RCT-based analysis so from one study by definition therefore not reflecting all evidence in area. Local costs are used; some uncertainty as to whether these reflect national costs. Some uncertainty regarding whether time horizon is sufficient (12 months follow-up). Limited number of deterministic sensitivity analyses presented.				
<b>Overall applicability<sup>(b)</sup>:</b> Partially applicable <b>Overall quality<sup>(c)</sup>:</b> potentially serious limitations				

*Abbreviations: 95% CI: 95% confidence interval; CUA: cost–utility analysis; ED: Emergency department; EQ-5D: Euroqol 5 dimensions (scale: 0.0 [death] to 1.0 [full health], negative values mean worse than death); HF: heart failure; ICER: incremental cost-effectiveness ratio; NR: not reported; pa: probabilistic analysis; QALYs: quality-adjusted life years; SA: sensitivity analysis; SG: Standard gamble; VAS: Visual analogue scale.*

*(a) Converted using 2006 purchasing power parities.<sup>223</sup>*

*(b) Directly applicable/Partially applicable/Not applicable.*

*(c) Minor limitations/Potentially serious limitations/Very serious limitations.*

Study	Puig-Junoy 2007 <sup>235</sup>			
Study details	Population & interventions	Costs	Health outcomes	Cost effectiveness
<p><b>Economic analysis:</b> CC (health outcome: n/a)</p> <p><b>Study design:</b> RCT (linked to Hernandez 2003<sup>141</sup> (see clinical review))</p> <p><b>Approach to analysis:</b> Resource use data collected from patient medical records and using resource use instruments. Cost data collected within-trial were analysed using multiple regression analysis with log transformation and bias correction</p> <p><b>Perspective:</b> Spanish public health insurer (third party payer)</p> <p><b>Follow-up</b> 8 weeks</p> <p><b>Discounting:</b> Costs: n/a; Outcomes: n/a</p>	<p><b>Population:</b> Patients presenting to ED with acute exacerbation of COPD.</p> <p><b>Cohort settings: (n=180)</b> Mean age: 70.8 years Male:97.8%</p> <p><b>Intervention 1: (n=77)</b> Conventional care in hospital (CC)</p> <p><b>Intervention 2: (n=103)</b> Nurse-led hospital-at-home involving up to 5 visits from specialist respiratory nurse and phone consultation whenever needed. Patients were followed up for 8 weeks then discharged.</p>	<p><b>Total costs (mean per patient, adjusted):</b> Intervention 1: £1,560 Intervention 2: £1,000 Incremental (2–1): -£560 (95% CI: NR; p&lt; 0.01)</p> <p><b>For patients with low severity COPD:</b> Incremental (2–1): -£397 (95% CI: NR; p=NR)</p> <p><b>For patients with moderate severity COPD:</b> Incremental (2–1): -£671 (95% CI: NR; p=NR)</p> <p><b>For patients with severe COPD:</b> Incremental (2–1): -£1229 (95% CI: NR; p=NR)</p> <p><b>Currency &amp; cost year:</b> 2000 Euros (presented here as 2000 UK pounds<sup>(a)</sup>)</p> <p><b>Cost components incorporated:</b> Hospital stays (initial hospitalisation and readmission), ED visits, Outpatient visits Primary care physician visits, Visits for social support, Nurse visits at home, Ambulatory treatment prescriptions, Phone calls, Transportation services</p>	n/a (CC)	<p><b>ICER (Intervention 2 versus Intervention 1):</b> NA</p> <p><b>Analysis of uncertainty:</b> No sensitivity analysis reported</p>
<b>Data sources</b>				
<b>Health outcomes:</b> n/a (data on health outcomes from this RCT were reported in another paper (Hernandez 2003 <sup>141</sup> ); however, the analysis set for the cost analysis is				

different from that in Hernandez 2003<sup>141</sup>. **Quality-of-life weights:** n/a **Cost sources:** Labour cost market prices including value added taxes and overheads were used to calculate costs of nurse visits at home, phone calls and transportation services. Hospital unit costs per in-hospital stay and visits were calculated as average observed tariffs for COPD patients in a public insurance company covering the civil servants of the City Council of Barcelona (PAMEM).

### Comments

**Source of funding:** NR. **Applicability and limitations:** Uncertainty regarding the applicability of resource use (1999-2000) and unit costs (2000) from Spain to the UK NHS context. Comparative cost analysis, assuming equivalent outcomes, so QALYs are not used as an outcome measure. Short time horizon (8 weeks) which might not capture all the differences in costs. Within-trial comparative costing analysis so does not reflect all the evidence in this area. The authors assumed equivalent health outcomes despite a previous publication from the same trial reporting favourable outcomes for hospital-at-home. Uncertainty was not appropriately addressed and no sensitivity analysis undertaken.

**Overall applicability<sup>(b)</sup>:** partially applicable **Overall quality<sup>(c)</sup>:** potentially serious limitations

*Abbreviations: 95% CI: 95% confidence interval; CC: comparative costing; COPD: chronic obstructive pulmonary disease; CUA: cost-utility analysis; ED: emergency department; ICER: incremental cost-effectiveness ratio; NR: not reported; QALYs: quality-adjusted life years.*

*(a) Converted using 2000 purchasing power parities.<sup>223</sup>*

*(b) Directly applicable/Partially applicable/Not applicable.*

*(c) Minor limitations/Potentially serious limitations/Very serious limitations.*

Study	Teuffel 2011 <sup>288</sup>																							
Study details	Population & interventions	Costs	Health outcomes	Cost effectiveness																				
<p><b>Economic analysis:</b> CUA (health outcome: quality-adjusted febrile neutropenia episodes [QAFNE] )</p> <p><b>Study design:</b> Probabilistic decision analytic model</p> <p><b>Approach to analysis:</b> The analysis was based on a decision-tree model</p> <p><b>Perspective:</b></p> <p><b>Time horizon<sup>(a)</sup>:</b> One FN episode (maximum follow-up of 30 days)</p>	<p><b>Population:</b> Adult cancer patients low risk FN receiving antibiotic treatment</p> <p><b>Cohort settings:</b> hypothetical cohort Start age: NR Male: NR</p> <p><b>Intervention 1:</b> treatment in hospital with intravenous antibiotics (combination of piperacillin and tazobactam, plus tobramycin) (HospIV)</p>	<p><b>Total costs (mean per patient):</b></p> <p>Intervention 1: £7,366 Intervention 2: £3,322 Intervention 3: £2,273 Intervention 4: £1,885</p> <p><i>For incremental analysis see cost effectiveness column</i></p> <p><b>Currency &amp; cost year:</b> 2009 Canadian dollars (presented here as 2009 UK</p>	<p><b>Quality-adjusted FN episodes (QAFNE):</b></p> <p>Intervention 1: 0.62 Intervention 2: 0.66 Intervention 3: 0.72 Intervention 4: 0.65</p> <p><i>For incremental analysis see cost effectiveness column</i></p>	<p><b>ICER:</b></p> <table border="1"> <thead> <tr> <th>Int</th> <th>Inc cost</th> <th>Inc QAFNE</th> <th>ICER</th> </tr> </thead> <tbody> <tr> <td>1</td> <td colspan="3">Dominated</td> </tr> <tr> <td>2</td> <td colspan="3">Dominated</td> </tr> <tr> <td>3</td> <td>£387</td> <td>0.07</td> <td>£5,534</td> </tr> <tr> <td>4</td> <td colspan="3">Baseline reference</td> </tr> </tbody> </table> <p>Early discharge and with hospital intravenous treatment were dominated, as they were more expensive and less effective than another strategy.</p> <p>At a threshold of ~ £2000 per QAFNE (calculated to be corresponding to a cost-effectiveness threshold of £27,000 per QALY:</p>	Int	Inc cost	Inc QAFNE	ICER	1	Dominated			2	Dominated			3	£387	0.07	£5,534	4	Baseline reference		
Int	Inc cost	Inc QAFNE	ICER																					
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4	Baseline reference																							

Study	Teuffel 2011 <sup>288</sup>			
Study details	Population & interventions	Costs	Health outcomes	Cost effectiveness
<p><b>Discounting:</b> Costs: n/a; Outcomes: n/a</p>	<p><b>Intervention 2:</b> Early discharge after 48 hours in-patient observation with IV antibiotics (combination of piperacillin and tazobactam, plus tobramycin), followed by oral out-patient treatment (EarlyDC)</p> <p><b>Intervention 3:</b> Entire out-patient management with intravenous antibiotics (combination of piperacillin and tazobactam, plus tobramycin) (HomeIV)</p> <p><b>Intervention 4:</b> Out-patient management with oral antibiotics (ciprofloxacin plus the combination of amoxicillin and clavulanate)(HomePO)</p> <p>Treatment duration was 6 days for all strategies</p>	<p>pounds<sup>(b)</sup>]</p> <p><b>Cost components incorporated:</b> Hospitalisations, initial consultation, out-patient visits, home nursing, and medications.</p>		<p>Intervention 4 (HomePO) was cost-effective in 54% of simulations, while intervention 3 (HomeIV) was cost-effective in 38% of simulations. Intervention 2 (EarlyDC) was cost-effective in 8% of simulations and intervention 1 was cost-effective in less than 1% of simulations.</p> <p><b>Analysis of uncertainty:</b> PSA was used. The results were sensitive to variations in the costs of in-patient stay, out-patient visits, and home nurse visits. The duration of treatment and some utility assumptions were also key inputs. In some scenarios, home intravenous treatment was the preferred strategy, but the in-patient treatments were never cost-effective.</p>
Data sources				
<p><b>Health outcomes:</b> Systematic review of effectiveness evidence was conducted as part of the study and only RCTs were included. Further data were from observational studies. <b>Quality-of-life weights:</b> preference elicitation study conducted with 77 adult cancer patients receiving treatment in hospital using VAS and the values transformed into SG utilities using power function. <b>Cost sources:</b> The resource quantities were mostly from published studies. Unit costs were from the Ontario Health Insurance Schedule of Benefits and Fees, the local finance offices, and the Department of Pharmacy at Princess Margaret Hospital.</p>				
Comments				

Study	Teuffel 2011 <sup>288</sup>			
Study details	Population & interventions	Costs	Health outcomes	Cost effectiveness
<p><b>Source of funding:</b> Institutional funding. <b>Applicability and limitations:</b> Some uncertainty regarding the applicability of resource use and unit costs from Canada (2009). The outcome used is not QALYs, but rather a quality adjusted FN episode. The short time horizon used (30 days) might not reflect all differences between strategies in terms of costs and outcomes. Some local costs were used to calculate the costs of hospital fees/charges and home care nurse visits. The baseline probability of health care-associated infection was based on data from observational studies. It was not reported how these studies were identified. The cost-effectiveness threshold used in the PSA was arbitrary and may not have a meaningful interpretation.</p>				
<p><b>Overall applicability<sup>(c)</sup>:</b> Partially applicable <b>Overall quality<sup>(d)</sup>:</b> Potentially serious limitations</p>				

*Abbreviations: CCA: cost–consequence analysis; CEA: cost-effectiveness analysis; 95% CI: 95% confidence interval; CUA: cost–utility analysis; da: deterministic analysis; EQ-5D: Euroqol 5 dimensions (scale: 0.0 [death] to 1.0 [full health], negative values mean worse than death); ICER: incremental cost-effectiveness ratio; IV: intravenous; NR: not reported; pa: probabilistic analysis; QALYs: quality-adjusted life year; SA: sensitivity analysis; SG: standard gamble; VAS: visual analogue scale.*

*(a) It is not clear if an assumption of continuous treatment effect beyond initial treatment duration is used in the analysis.*

*(b) Converted using 2009 purchasing power parities.<sup>223</sup>*

*(c) Directly applicable/Partially applicable/Not applicable.*

*(d) Minor limitations/Potentially serious limitations/Very serious limitations.*