Appendix H – Economic evidence tables

Study, Population, Country and Quality	Data Sources	Other Comments	Incremental (EVAR vs. OSR / no repair)			Conclusions	Uncertainty
			Cost (£)	Effect (QALYs)	ICER (£)		
Michaels et al. (2005) Decision tree model comparing EVAR with OSR (and EVAR with no repair). UK. **Partially applicable** [a] **Potentially serious limitations** [b,c,d,e]	Effects: EVAR-1 and DREAM studies for operative outcomes. NICE review of non-RCTs for other EVAR outcomes. Costs: Intervention, monitoring and reintervention. Tariff costs for primary procedure plus £4500 for EVAR. Other resource use from EUROSTAR registry and assumptions. Utilities: Short term recovery decrements (NR), followed by general age-related utility after successful repair.	Cohort: male, 70 years old, 5.5cm AAA. 10-year time horizon. 3.5% discount rates. Price year 2003-04. No long-term CV events. General population life expectancy applied after successful repair.	EVAR vs. OSR 11,449	0.10	110,000	'The results of this analysis suggested that, in patients in whom conventional open repair would be an alternative, EVAR provided a slight additional benefit, but at a cost that would not normally be considered appropriate for funding by the NHS.'	EVAR ICER <£20,000 in ~0% of 1000 PSA model runs, compared with OSR. Base case result robust to scenario analyses (e.g. assuming £0 EVAR device cost: ICER >£50,000).

Key: EVAR, endovascular aneurysm repair; ICER, incremental cost-effectiveness ratio; NR, not reported; OSR, open surgical repair; PSA, probabilistic sensitivity analysis; QALY, quality-adjusted life year.

a. Only considers infrarenal aneurysms.
b. Relative effects only available for operative outcomes for EVAR vs. OSR comparison; no randomised data used for 'unfit for OSR' population.
c. Successful repair effectively considered a 'cure' as patients return to general population life expectancy (long-term data not available at the time of analysis).
d. Reintervention and complications (endoleak) only modelled for EVAR, and no long-term complications modelled.
e. 10-year time horizon (15 in scenario analysis); shorter than lifetime, and current long-term EVAR-1 data suggest long-term survival differences.

Study, Population, Country and Quality	Data Sources	Other Comments	Incremental (EVAR vs. OSR)			Conclusions	Uncertainty
			Cost (£) (95% CI)	Effect (QALYs) (95% CI)	ICER (£)		
Epstein et al. (2008) Markov model comparing EVAR with OSR based on EVAR-1 patients and data. UK. **Partially applicable** [a] **Potentially serious limitations** [b,c,d]	Effects: EVAR-1 study. Costs: EVAR-1 study, NHS reference costs and UK literature. Utilities: UK population norms (Kind et al. 1999), 1-month surgery morbidity (EVAR-1), cardiovascular conditions (UK literature).	2-year convergence of EVAR and OSR overall survival, despite 4-year aneurysm-related survival benefit for EVAR. 'Other cause' EVAR mortality catch-up factor applied in the model. Aneurysm-related readmissions modelled. Cardiovascular conditions were MI and stroke. Lifetime horizon, 3.5% discount rate applied to all outcomes.	3,758 (2,439; 5,183)	-0.02 (-0.189; 0.165)	EVAR dominated	'EVAR is unlikely to be cost-effective for all patients within collectively funded healthcare systems.' 'EVAR may be cost-effective in a subpopulation of elderly patients fit for open surgery … if patients maintain this early survival advantage over open surgery.'	EVAR ICER 1.2% likely to be ≤£20,000 per QALY gained. Various scenario analyses. Probability was 14.7% if OSR perioperative mortality was 8% (from 5%); and was 26.2% if the patient was aged 82 (from 74) and differences in cardiovascular event rates were omitted.

Key: CI, confidence interval; EVAR, endovascular aneurysm repair; ICER, incremental cost-effectiveness ratio; OSR, open surgical repair QALY, quality-adjusted life year; VGNW, Vascular Governance North West; yo, years old.

a. Only considers infrarenal aneurysms.
b. Informed by early results from a single study.
c. Unclear whether difference in aneurysm-related mortality over 4 years is extrapolated to lifetime.
d. Potential conflict of interest.

Study, Population, Country and Quality	Data Sources	Other Comments	Incremental (EVAR vs. OSR)			Conclusions	Uncertainty
			Cost (£)	Effect (QALYs)	ICER (£)		
Chambers et al. (2009) Markov model comparing EVAR with OSR. UK. **Partially applicable** [a] **Potentially serious limitations** [b,c,d]	Effects: Baseline risk equations estimated using IPD from the EUROSTAR study. Relative effects from systematic review (EVAR-1 and DREAM). Costs: Intervention, monitoring and readmission. Resource use from EVAR-1. Costs from EVAR-1 and UK sources. Utilities: UK population norms (Kind et al. 1999), surgery-related decrements for 6 months (EVAR-1).	Lifetime horizon, 3.5% discount rates, Markov model. Price year 2007. Risk equations constructed to predict operative mortality, post-operative mortality, and readmission. Readmissions are AAA-related only. No long-term CV events. Non-AAA mortality converges after ~3 years. AAA-related mortality benefit of EVAR maintained. Rupture fatality rate assumed 100%.	2,002	0.041	48,990	'The base-case decision model found that EVAR is not cost-effective on average for patients who are fit for open surgery 'If patients can be classified into good, average and poor operative risk, then for patients of most ages and aneurysm sizes, EVAR is cost-effective compared with open repair in patients of poor risk but not cost-effective in patients of good risk.'	EVAR ICER 26.1% likely to be ≤£20,000 per QALY gained. ICER is <£30,000 in patients with subjectively poor operative fitness. ICER <£20,000 where (1) EVAR sustained an overall survival benefit over OSR for the patient's lifetime and (2) unit cost of EVAR equal to OSR, follow-up costs lower and reintervention rates lower. ICER £21-22,000 if EVAR operative mortality odds ratio improved (from 0.35 to 0.25), and if overall mortality rates converge at 8 years (vs. 3 years).

Key: CI, confidence interval; EVAR, endovascular aneurysm repair; ICER, incremental cost-effectiveness ratio; IPD, individual patient data; OSR, open surgical repair; QALY, quality-adjusted life year.

a. Only considers infrarenal aneurysms.
b. Relative effects largely drawn from a single study (EVAR-1).
c. Impact of long-term non-aneurysm complications not captured by model.
d. Assumption of maintained AAA-related mortality difference not supported by 15-year EVAR-1 study data.

Study, Population, Country and Quality	Data Sources	Other Comments	Incremental (EVAR vs. OSR / no repair)			Conclusions	Uncertainty
			Cost (£)	Effect (QALYs)	ICER (£)		
Brown et al. (2012) Markov model comparing EVAR with OSR. Trial analysis comparing EVAR with no repair. UK. **Partially applicable** [a] **Potentially serious limitations** [b,c,d]	Effects: EVAR-1 and EVAR-2 studies, including ITT analyses. Costs: Intervention, monitoring and readmission. Resource use from EVAR trials. Costs from trials and UK sources. In EVAR-2 analysis, costs not extrapolated beyond observed 8-year data. Utilities: EVAR-1 analysis: surgery-related decrements for 3 months (EVAR-1 analysis). EVAR-2 analysis: EQ-5D data from trial.	EVAR-1 analysis: Lifetime horizon. EVAR-2 analysis: 8-year analysis and lifetime analysis. 3.5% discount rates. Price year 2008-09. EVAR-1 model: Follow-up divided into first 6 months, 6 months to 4 years, 4 to 8 years, and 8 years onwards. AAA mortality converges after 8 years. Ongoing non-AAA mortality SMR of 1.1 vs. general population (based on EVAR-1 and UKSAT). EVAR-2 analysis: 2 analyses presented, 1 ITT (by randomised group) and 1 per protocol (excludes subjects who crossed over from 'no surgery' to intervention). No long-term CV events.	EVAR-1 3,521 EVAR-2 *8-years* 10,214 *Lifetime* 10,214	 -0.042 0.037 0.350	 EVAR dominated 264,900 30,274	EVAR-1 'For patients with large AAA, who are deemed anatomically suitable for EVAR and anaesthetically fit for open repair, [EVAR] is a more costly treatment option [than OSR] and unlikely to be cost-effective in all patients.' EVAR-2 'For patients deemed anatomically suitable for EVAR but too unfit to for open repair, EVAR offers a long-term benefit in aneurysm mortality … no benefits in quality of life and high rates of adverse events, complications and reinterventions after EVAR contribute to poor cost-effectiveness.'	EVAR-1 EVAR ICER 1% likely to be ≤£20,000 per QALY gained compared with OSR. PSA mean costs: £3,519 (95% CI: 1,919 to 5,053). PSA mean QALYs: -0.032 (-0.117 to 0.096). Robust to univariate sensitivity analysis based on alternative clinical data (OVER) and modelling assumptions (Epstein 2008, NICE 2009). EVAR-2 0% and 3% of 1000 bootstrapped ICERs were ≤£20,000 (ITT analysis). Mean ICER of lifetime 'per protocol' analysis was £17,805 (61% ≤£20,000).

Key: CI, confidence interval; EVAR, endovascular aneurysm repair; ICER, incremental cost-effectiveness ratio; ITT, intention to treat; OSR, open surgical repair; PSA, probabilistic sensitivity analysis; QALY, quality-adjusted life year; SMR, standardised mortality ratio; UKSAT, UK Small Aneurysm Trial.

a. Only considers infrarenal aneurysms.

b. Relative effects largely drawn from a single study for each analysis (EVAR-1 and EVAR-2), though these are the only studies to provide ITT data.

c. Impact of long-term non-aneurysm complications not captured by model.

d. Long-term costs not included in the EVAR-2 lifetime extrapolation.

Study, Population, Country and Quality	Data Sources	Other Comments	Incremental (EVAR vs. OSR)			Conclusions	Uncertainty
			Cost (£) (95% CI)	Effect (QALYs) (95% CI)	ICER (£)		
Epstein et al. (2014) Markov model comparing EVAR with OSR based on 4 RCTs. UK. **Partially applicable [a]** **Potentially serious limitations [b,c]**	Effects: EVAR-1, ACE, DREAM and OVER studies. Costs: EVAR-1 (UK), ACE (France), DREAM (Netherlands) and OVER (US). Converted to 2009 UK pounds using purchasing power parities. Utilities: 3-month surgery morbidity (EVAR-1).	Model based on Epstein el al. (2008) EVAR-1 model. EVAR-1 8-year data used. Cardiovascular complications not modelled. 4 individual models, no synthesis of RCT data. Each analysis applies the relative survival (including convergence of curves), reintervention data and resource us from the relevant RCT. Lifetime horizon, 3.5% discount rate applied to all outcomes.	EVAR-1 4,014 (2,167; 5,942) ACE 2,086 (1,526; 2,869) DREAM 3,181 (1,557; 4,986) OVER -1,852 (-5,581; 2,097)	-0.02 (-0.19, 0.05) -0.01 (-0.07, 0) 0 (-0.07, 0.05) 0.05 (-0.06, 0.13)	EVAR dominated EVAR dominated 2,845,315 Dominant	'This economic analysis does not find that EVAR is cost-effective compared with open repair over the long term based on the EVAR-1, DREAM or ACE trials. EVAR does appear to be cost-effective over the long term based on the OVER trial.'	EVAR ICER 0% likely to be <£20,000 in the base case EVAR-1, ACE and DREAM analyses, rising to 3% in a favourable scenario. EVAR ICER 91% likely to be <£20,000 in the base case OVER analysis, rising to 99% in a favourable scenario.

Key: CI, confidence interval; EVAR, endovascular aneurysm repair; ICER, incremental cost-effectiveness ratio; OSR, open surgical repair QALY, quality-adjusted life year; RCT, randomised controlled trial.

a. Only considers infrarenal aneurysms.
b. Each analysis informed by a single study; no synthesis of data.
c. EVAR-1 analysis is very similar to previous models (Epstein et al. 2008; Chambers et al. 2009; Brown et al. 2012); other analyses use non-UK resource use data.