Institute of Medical & Biological Engineering

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The development of a 20-year economic model for the cost-effectiveness analysis of using decellularised bone versus fresh-frozen allograft as an acetabular impaction bone graft during a revision hip arthroplasty

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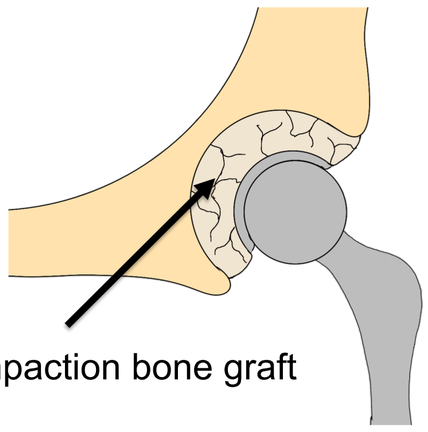
Why is a cost-effectiveness analysis needed?

2240 revision hip replacements in the UK every year require a bone replacement[1,2]

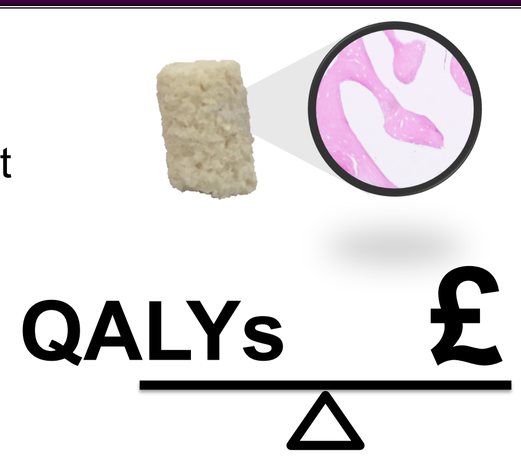
Fresh-frozen allografts are the current gold standard for revision hip arthroplasty[2]



Acetabular impaction bone graft

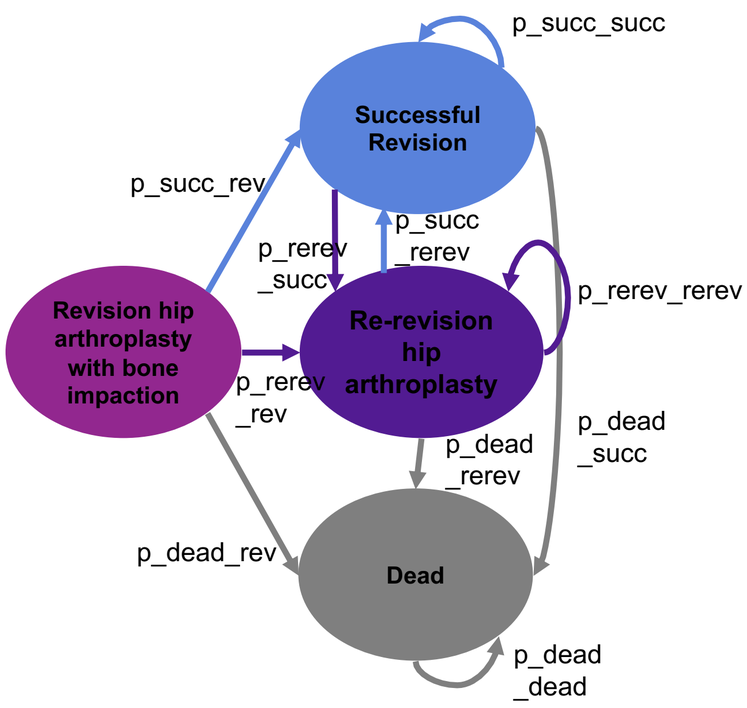
Decellularised bone grafts could reduce immune reaction and increase regenerative potential but processing costs more than fresh-frozen allograft[3]

Economic evaluation to weigh up costs and health benefits



Economic model for cost-effectiveness analysis

Markov model[4]: Health states and transition probabilities *p_to_from*



Economic Model												
	Probabilities				Costs				Quality adjusted life years (QALYs)			
Years	Revision	Success	Rerevision	Dead	Revision	Success	Rerevision	Dead	Revision	Success	Rerevision	Dead
1.0	1.000	0.000	0.000	0.000	18825.18	0.00	0.00	0.00	0.40	0.00	0.00	0.00
2.0	0.000	0.909	0.006	0.085	0.00	44.27	116.41	0.00	0.00	0.60	0.00	0.00
...												
20	0.000	0.246	0.002	0.752	0.00	6.45	16.69	0.00	0.00	0.09	0.00	0.00
Totals	1.000	9.713	0.067	9.220	18825.18	379.11	983.04	0.00	0.40	5.15	0.02	0.00
							Total cost	20187.34			Total QALYs	5.57

The model has yearly cycles that estimate the quality adjusted life years (QALYs) and costs over a time period of 20 years from the first RHA.

At year 1 of the model all patients start in the revision health state, in the following years the patients transition between the re-revision, success and dead health states.

All of the costs and the health benefits (QALYs) are summed for years 1 to 20

Results and Conclusions

Incremental cost effectiveness ratio (ICER): C_1 is the cost and E_1 is the effectiveness of the new intervention with C_0 and E_0 being the cost and effectiveness of the original intervention[5]

$$ICER = \frac{C_1 - C_0}{E_1 - E_0}$$

ICER for decellularised bone graft – fresh-frozen allograft

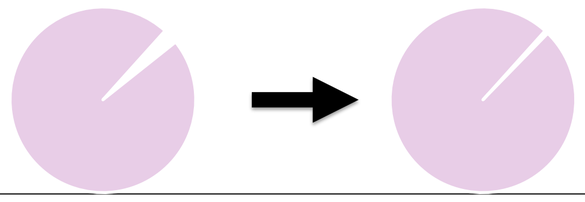
$$£43{,}362.24 = \frac{£20{,}187.34 - £17{,}692.19}{5.571 - 5.514}$$

For decellularised grafts to be cost effective:

Production costs need to be lowered to £4502.78 per graft

~~£5233.51~~ £4502.78

Re-revision rate needs to be lowered to 64 re-revisions per year per 10,000 patients



References

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