

Cost-Effectiveness of Argus II Retinal Prosthesis System for Retinitis Pigmentosa Patients

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Tu HA, Xie S, C Holubowich, Weir M, Ng V, Dahlla I, Sikich N

Background

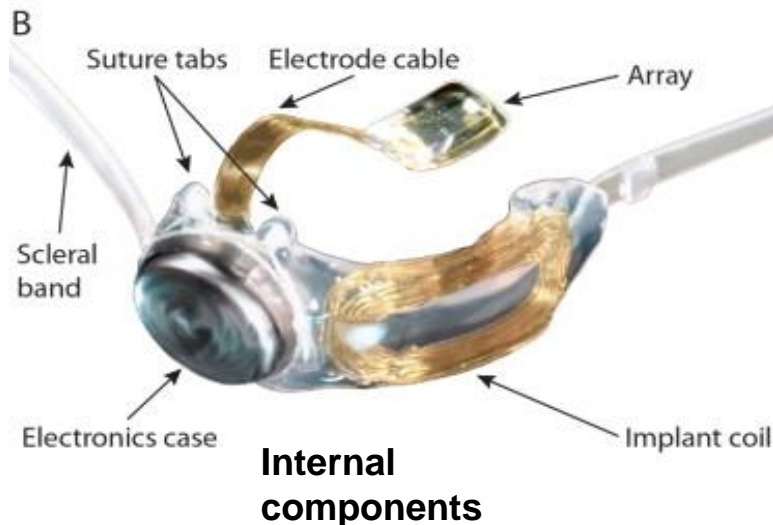
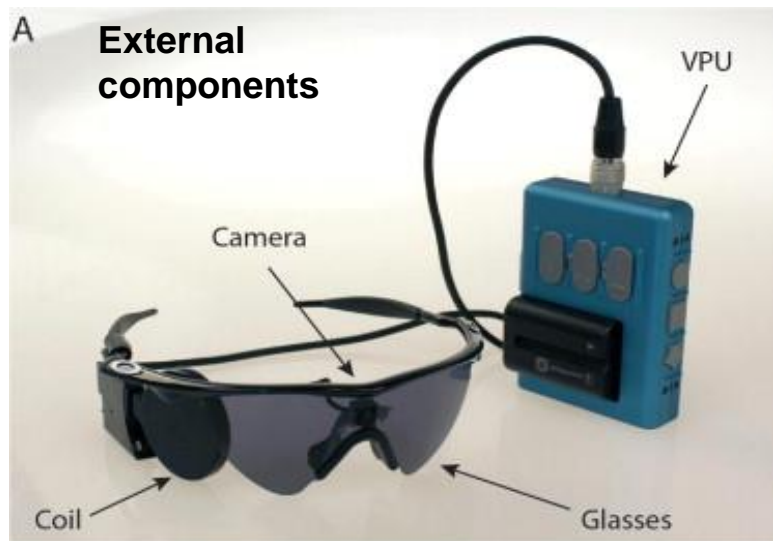
Retinitis Pigmentosa

- A group of genetic disorders that involve the progressive breakdown and loss of photoreceptors in the retina
- Result in progressive retinal degeneration and blindness
- Affect 1:3500 Canadians with a prevalence of ~10,000 in Canada and ~4,000 in Ontario having some form of retinitis pigmentosa

Argus II Retinal Prosthesis System

- Implanted device to bypass damaged photoreceptors on retina to stimulate preserved inner retinal cells to induce visual perceptions
- Only currently available surgical implantable device that has been shown to improve visual function in patients with severe visual loss from advanced retinal degenerative disease, such as retinitis pigmentosa

How Argus II works?



- A video camera attached on the glasses to capture visual image
- Visual image being converted to electrical signals by VPU
- Electrical signals being sent wirelessly to electrode array on Argus II implant
- Electrical signals from Argus II bypass damaged photoreceptors to stimulate preserved inner retinal cells
- Stimulated retinal cells transmit visual information to brain via optic nerve to induce vision

Objective

To assess the cost-effectiveness of Argus II Retinal Prosthesis System (Argus II) compared to Usual Care (rehabilitation, nursing care, treatment of RP, etc) in individuals with advanced retinitis pigmentosa (RP)?

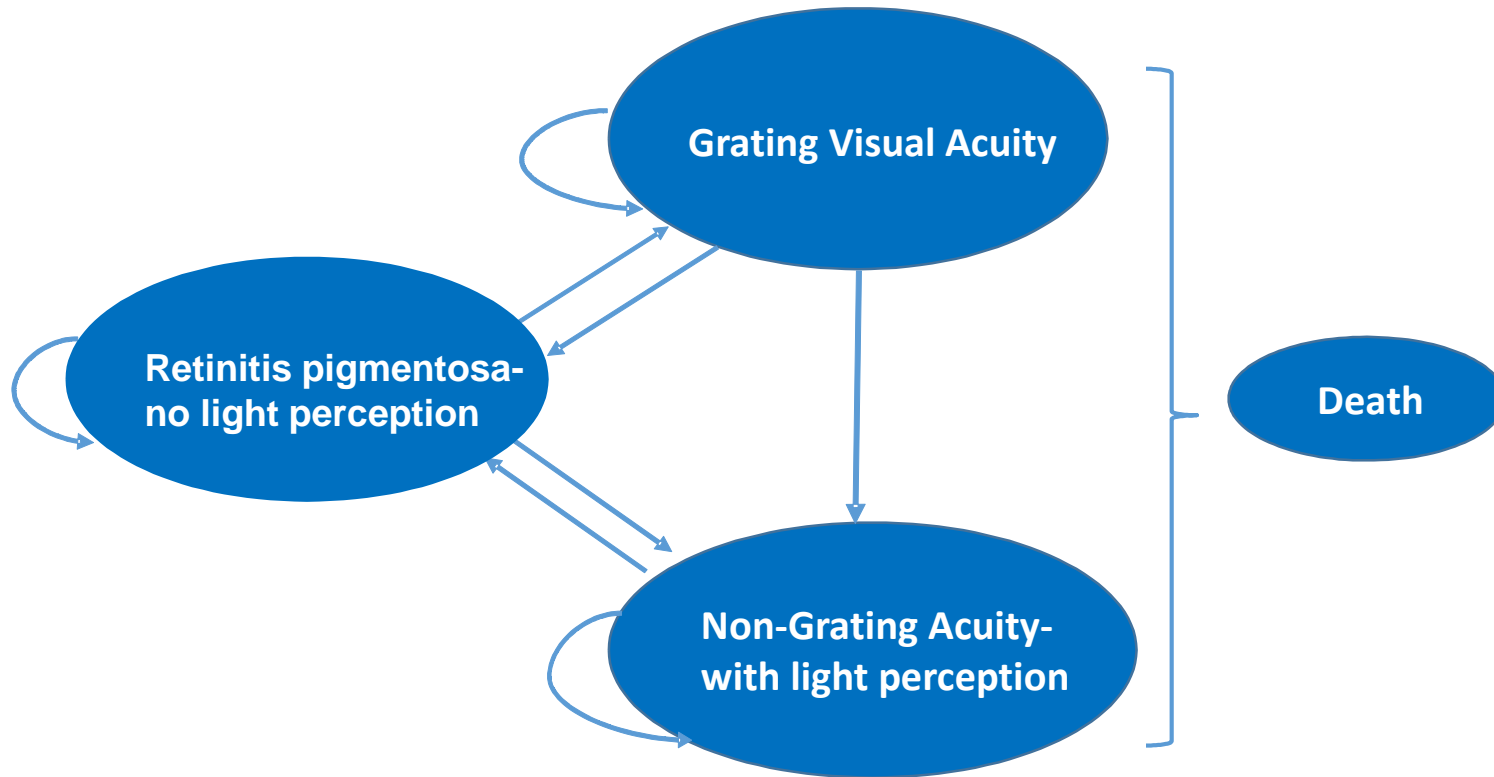
Methods

- **Analysis type:**
 - Cost-utility analysis (CUA), Markov model followed RP individuals for 10 years, 5% discount rate
- **Target population:**
 - RP individual aged 50 years
- **Interventions:**
 - Argus II versus Usual Care
- **Clinical outcomes of interest:**
 - Visual function (Grating Visual Acuity)

Methods (cont.)

- **Outcomes:**
 - Quality-adjusted-life-years (QALYs), Costs, Incremental cost-effectiveness ratios (ICER)
- **Perspective:**
 - MOHLTC
- **Sensitivity analyses:**
 - One-way, probabilistic sensitivity analyses (PSA)

Markov Model



Model Assumptions

- After Argus II implantation, Non-GVA would not progress to GVA
- All RP patients achieved light perception after Argus II implants
- Patients achieved GVA could count fingers (communication and opinions from expert opinions & manufacturer and published literature)
- One-time Argus II explantation

Model Clinical Parameters

Parameters		Parameter values (min-max)
Effectiveness	Probability of RP patients achieving GVA – First Year	0.4820 ^{1,2}
	Annual transition probability from GVA to Non-GVA in subsequent years	0.1688 ^{1,2}
Safety	Probability of SAEs – First Year	0.3333 ^{1,2}
	Annual probability of SAEs in subsequent years	0.0465 ^{1,2}
	One-time explantation due to SAEs	0.0330 ^{1,2}
Utility	RP – No light perception	0.26 (0.19-0.33) ³
	Non-GVA – light perception	0.35 (0.33-0.60) ³
	GVA	0.52 (0.36-0.68) ³
	Dead	0

¹ Humayun et al. Ophthalmology 2012 ² Ho et al. Ophthalmology 2015 ³ Brown et al. Br J Ophthalmol 2001

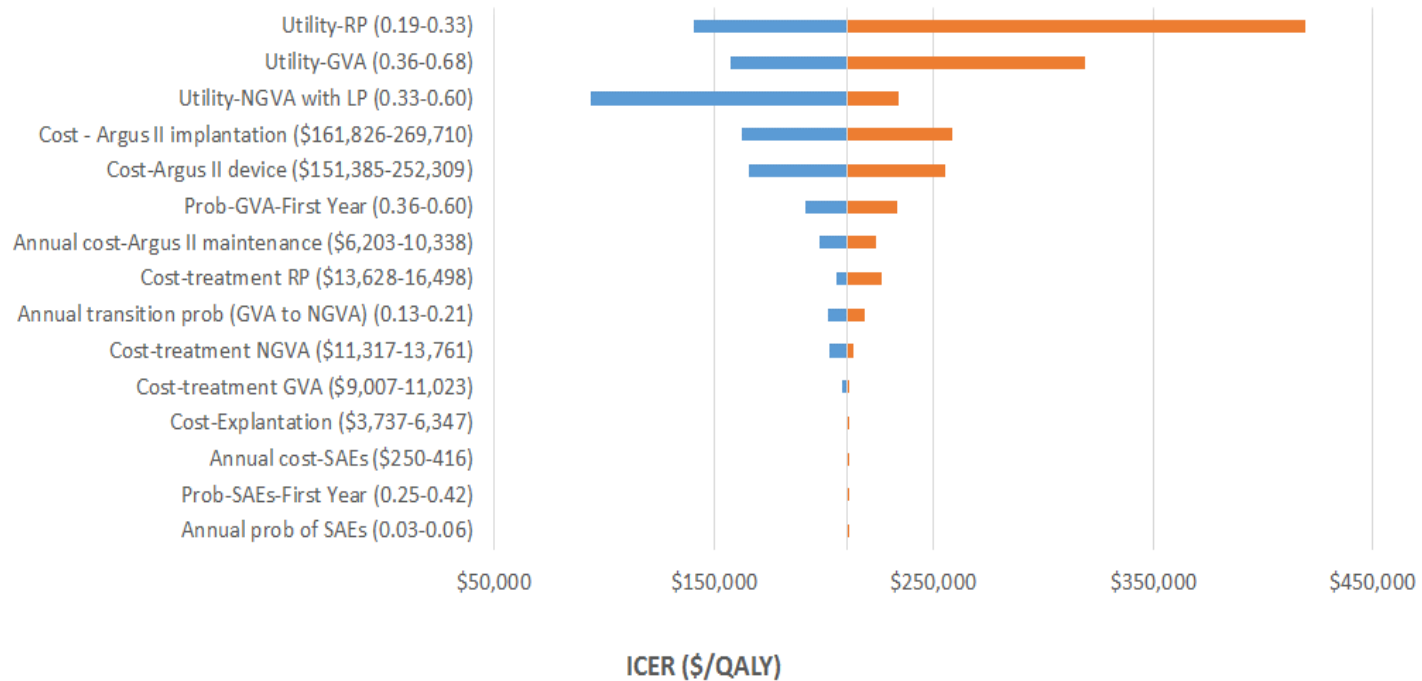
Model Costing Parameters

Healthcare Resource Utilization (CAD)		Parameter values (CAD, min/max)	References
Argus II - total cost of device and implantation	215,768	161,826-269,710	UHN & Calculation
Argus II - annual maintenance cost	8,271	6,203-10,752	UHN
Argus II- explantation cost	5,042	3,737-6,347	UHN
Annual treatment cost of RP	15,777	13,628-16,498	Frick et al
Annual treatment cost of GVA	10,490	9,007-11,023	Frick et al & Assumption
Annual treatment cost of NGVA	13,133	11,317-13,761	Frick et al & Assumption
Annual treatment cost of SAEs	333	250-416	UHN

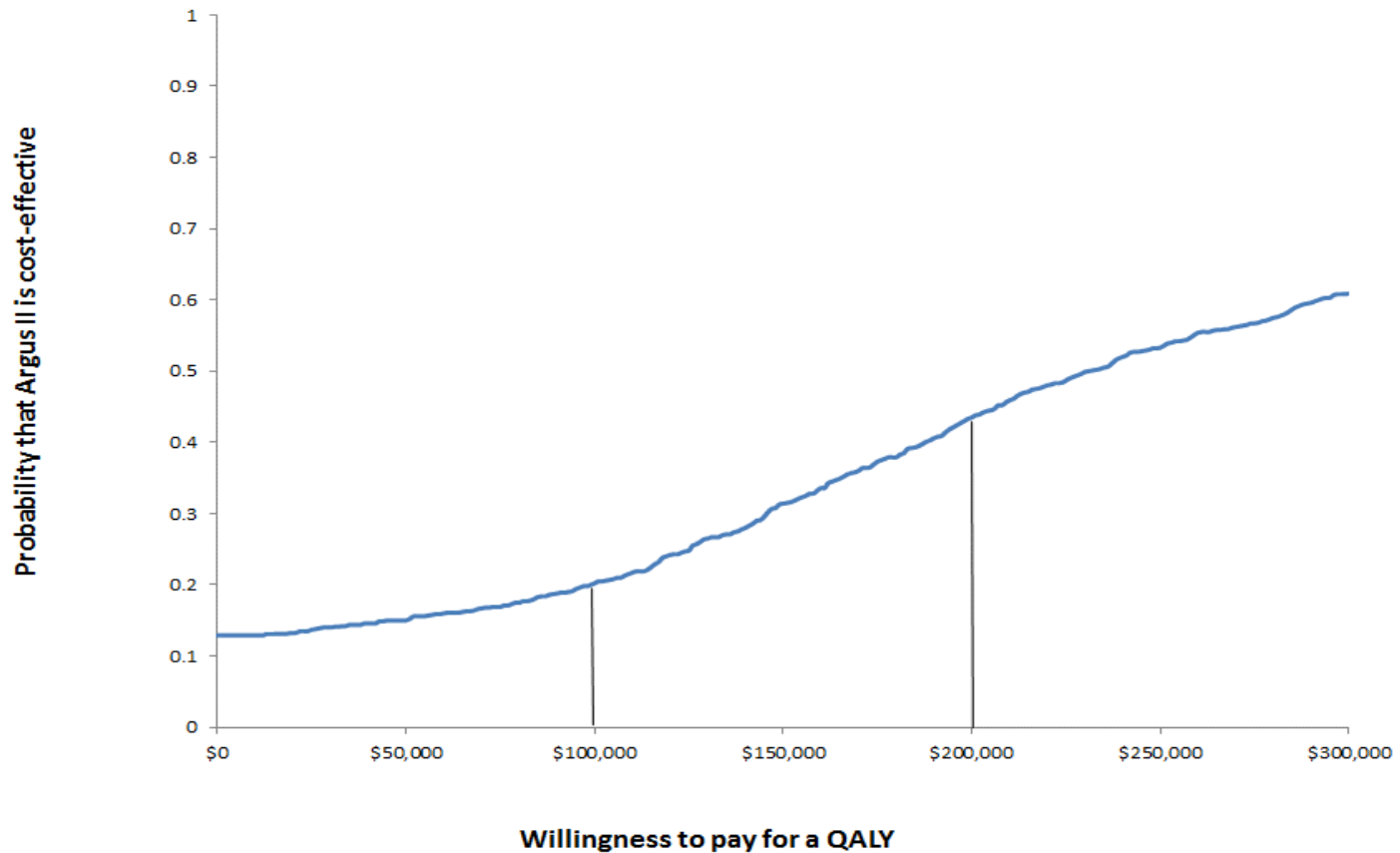
Base-Case Results

Interventions	Costs	QALYs	ICER (\$/QALY)
Argus II	361,034	2.08	
Usual Care	126,428	3.21	
Incremental	234,606	1.13	207,616

Tornado Diagram



Cost-Effectiveness Acceptability Curve (Argus II)



Limitations

- No utility data on RP was available
- No treatment cost of RP based on Canadian context was available
- No disutility associated with Argus II implants was included

Conclusions

- Implementation of the Argus II system could improve the quality of life of RP patients who are legally blind, and no other treatment option is available for this disease
- Argus II Retinal Prosthesis System would not be cost-effective if the willingness to pay is less than C\$ 207,616 per QALY



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