AN EARLY COST-EFFECTIVENESS ANALYSIS OF MINIMALLY INVASIVE PADDLE-TYPE SPINAL CORD STIMULATION FOR THE TREATMENT OF CHRONIC NEUROPATHIC PAIN

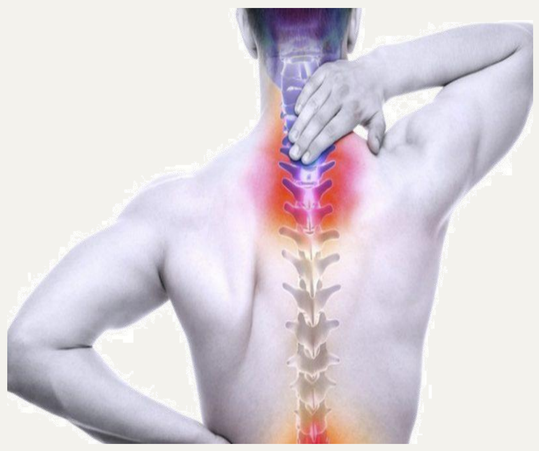
Tahir W[1], Barker-Yip J[1], Buchanan V[1], Proctor CM[2], Malliaras GG[2] and Barone DG[2]

[1]Cogentia, Cambridge, UK; [2]University of Cambridge, Cambridge
Contact email: warda.tahir@cogentia.co.uk

WWW.COGENTIA.CO.UK

BACKGROUND

- Spinal cord stimulation (SCS) is a well-established neuromodulation therapy used for the treatment of chronic pain conditions. Chronic pain is a debilitating condition which causes physical and emotional suffering. SCS works by modifying the perception of pain experienced by stimulating the dorsal columns of the spinal cord, which may relieve neuropathic or ischaemic pain.
- SCS devices are commonly separated into two categories: percutaneous linear-type probes and paddle-type probes.
  I. The cylindrical, linear design can be implanted percutaneously in a relatively low-risk and simple day surgery procedure. Unfortunately, the benefit of simple implantation is negated by its decreased capability to manage pain because of its limited spatial range and likelihood of migration compared to a paddle-type probe.
  II. Paddle SCS exhibits greater efficacy however a more invasive, higher-risk surgical procedure is required to implant the device.



- Minimally invasive paddle-type SCS (MI-SCS) harnesses ideas from the fields of bioelectronics and soft robotics and combines the spatial coverage of paddle-SCS with the ease of percutaneous implantation.

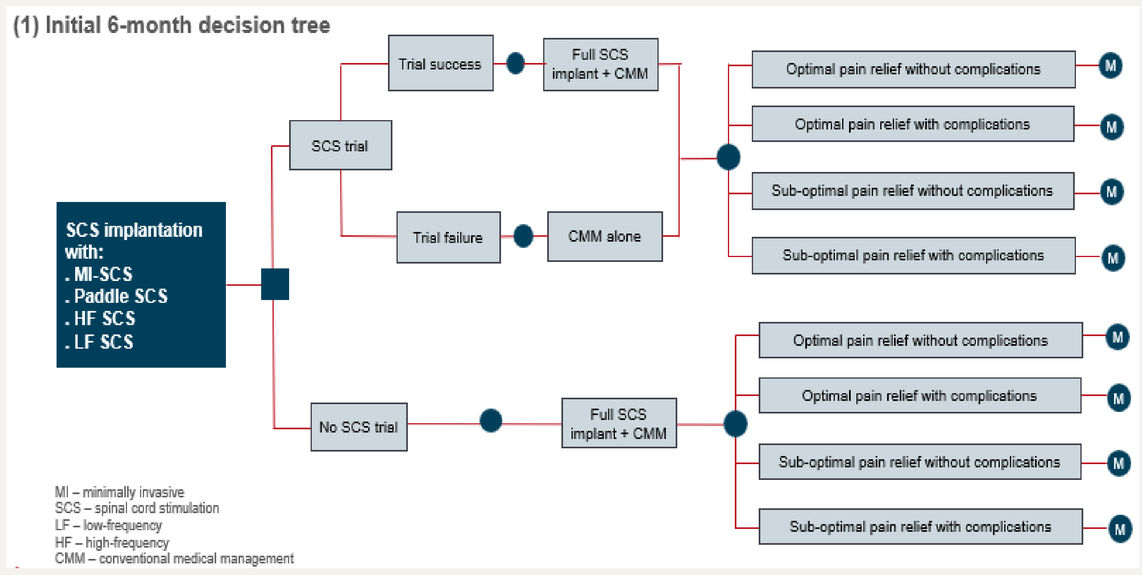
OBJECTIVES

- To develop an early economic model exploring the cost-effectiveness of MI-SCS vs. paddle SCS and percutaneous SCS from the perspective of the UK NHS.
- To develop a model that will identify key value drivers for the cost-effectiveness of MI-SCS in the target population and is indicative of further research requirements.

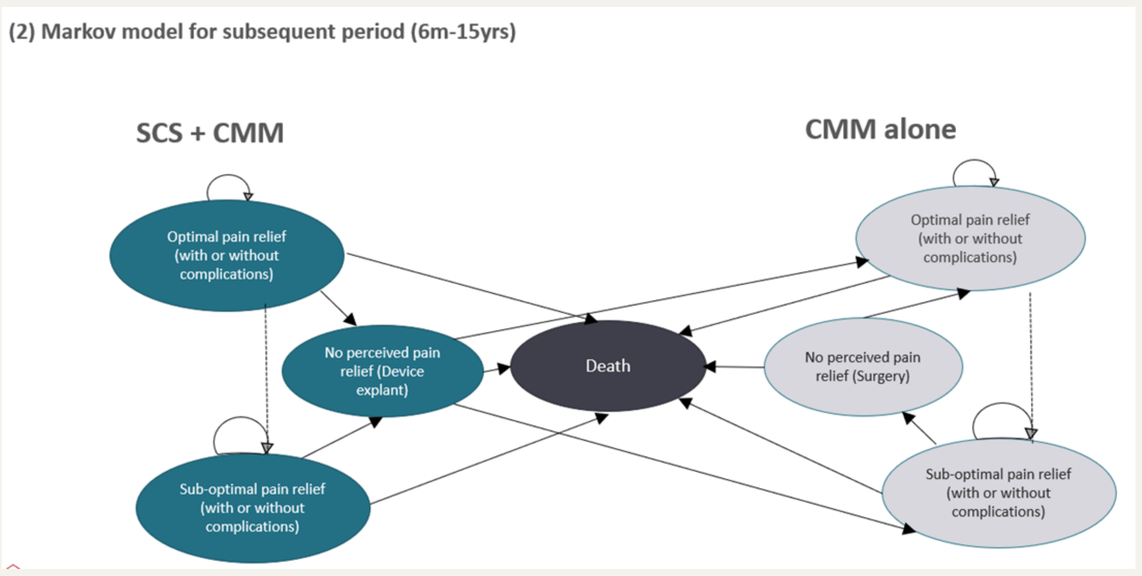
METHODS

- A targeted literature review was conducted to identify suitable model structures and data sources to develop a conceptual model that was validated by clinical experts.
- The model structure was in line with NICE TA159: Spinal cord stimulation for chronic pain of neuropathic or ischaemic origin.
- An early economic model was developed in Microsoft Excel comprising a 6-month decision tree leading into a longer-term Markov, with a total time horizon of 15 years. The comparators included in the model were paddle SCS, and Low Flow (LF) and High Flow (HF) percutaneous SCS.

(1) Initial 6-month decision tree



(2) Markov model for subsequent period (6m-15yrs)



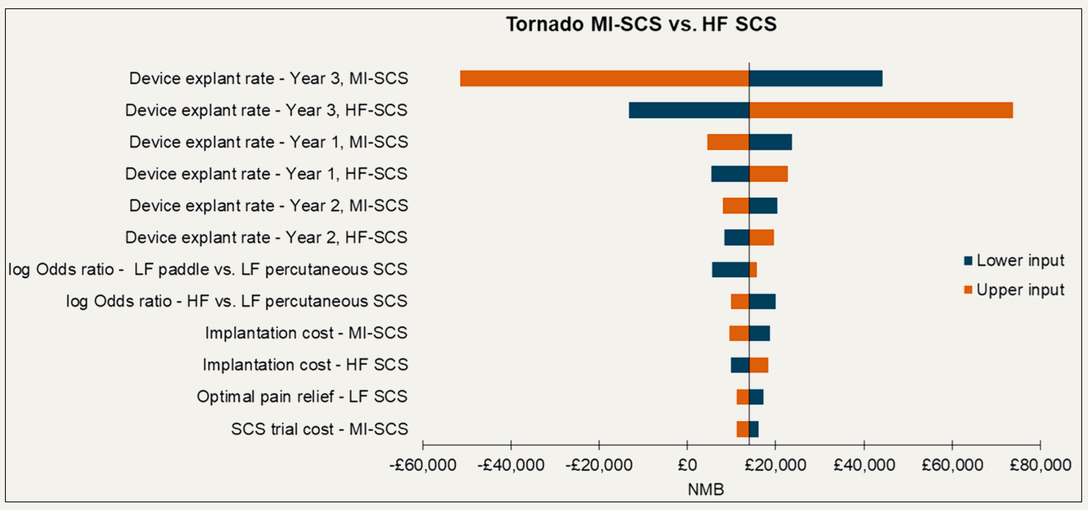
- Due to a lack of comparative data available for all comparators, a Bucher indirect comparison was conducted to derive clinical efficacy parameters.
  - Odds ratios (ORs) were calculated for available comparative data (paddle vs. LF SCS and LF SCS vs. HF SCS).
  - The efficacy of paddle and HF SCS vs. LF SCS was then recalculated using the ORs derived from the indirect comparison.
- The model base-case assumed equal efficacy of MI-SCS to paddle SCS.
- Cost and utility data were sourced from TA159, due to a lack of recently-published data.

RESULTS

- MI-SCS dominated all comparators, accruing greater QALYs whilst incurring lower costs.

Technology	Total costs	Total QALYs	Incremental costs	Incremental QALYs	ICER vs. MI-SCS	NMB vs. MI-SCS
MI-SCS	£89,725	5.60	-	-	-	-
Paddle SCS	£111,112	4.51	-£21,387	1.08	MI-SCS dominates	£48,501
HF SCS	£92,594	5.15	-£2,870	0.45	MI-SCS dominates	£14,089
LF SCS	£109,169	3.92	-£19,445	1.67	MI-SCS dominates	£61,312

- The most sensitive model parameter was the explant rate, followed by the odds ratios for optimal pain relief



EVIDENCE GAPS

- The majority of parameters which were large drivers of value for MI-SCS will be available once data is available for patients who have been implanted e.g. device explant rates and proportion of patients achieving trial success.
- The targeted literature review highlighted several key areas where further research is needed:
  - Quality of life – the health state utility values applied in the model were the same values that have consistently been used across SCS cost-utility analyses since TA159 and were also used in the ScHARR Evidence Review Group appraisal of TA159. However, the validity or appropriateness of some of these values is questionable, as the values for the suboptimal and no perceived pain relief health states were considerably low.
  - Complications – the rate of complications for paddle SCS in particular is not well-reported in the literature. Key opinion leaders stated that the rate of complications is typically low and that most complications would occur in the short-term, in the period just after surgery.

CONCLUSIONS

- MI-SCS has the potential to be a highly cost-effective treatment for the treatment of chronic neuropathic pain.
- There is a scarcity of evidence regarding the HRQoL experienced by patients with chronic pain of neuropathic origin who experience suboptimal pain relief after undergoing SCS