Thirteen years of health economic evaluations for microprocessor-controlled knee joints - a review (2008 to 2021)

Susanne Seidinger[1], Anne-Katrin Kurrat [1], Andreas Kannenberg[2] ; [1]Ottobock Health Care Product Gmbh, Vienna, [2]Ottobock Health care LP USA, Austin Texas

Background

Since health-economics research was introduced in prosthetics and orthotics by assessing microprocessor-controlled knees (MPKs), the quality of methodology, models and input data has steadily evolved. Today, with considerably improved evidence on the clinical effectiveness of MPKs, it is warranted to corroborate previous preliminary health-economic findings that have supported the assumption that MPKs may be considered standard of care in individuals with transfemoral amputations by high-quality health-economic research.

Aim

The aim of this review is to evaluate the relevant health-economic effectiveness and affordability of MPKs in various patient cohorts.

Method

A literature review and analysis of publications on MPK interventions and comparators, patient cohorts, methodology, model inputs (databases used), and relevance of health-economic results was performed using the search terms microprocessor-controlled knee, C-Leg/Kenevo/Genium, cost-effectiveness / utility, (health)-economic, budget impact, transfemoral/above knee amputation in Pubmed, Cochrane Library and Google Scholar from the year 2008 – 2021 in March 2021. 20 publications were identified and 12 were excluded. All 8 health-economic studies that evaluated the economics of MPKs (study intervention: 4 C-Leg[2,4,5,6], 2 MPK based on C-Leg data[3,7], 1 Genium[8] , and 1 Kenevo [1] , comparator NMPK) were analyzed using the CHEER-checklist[9] for this review.

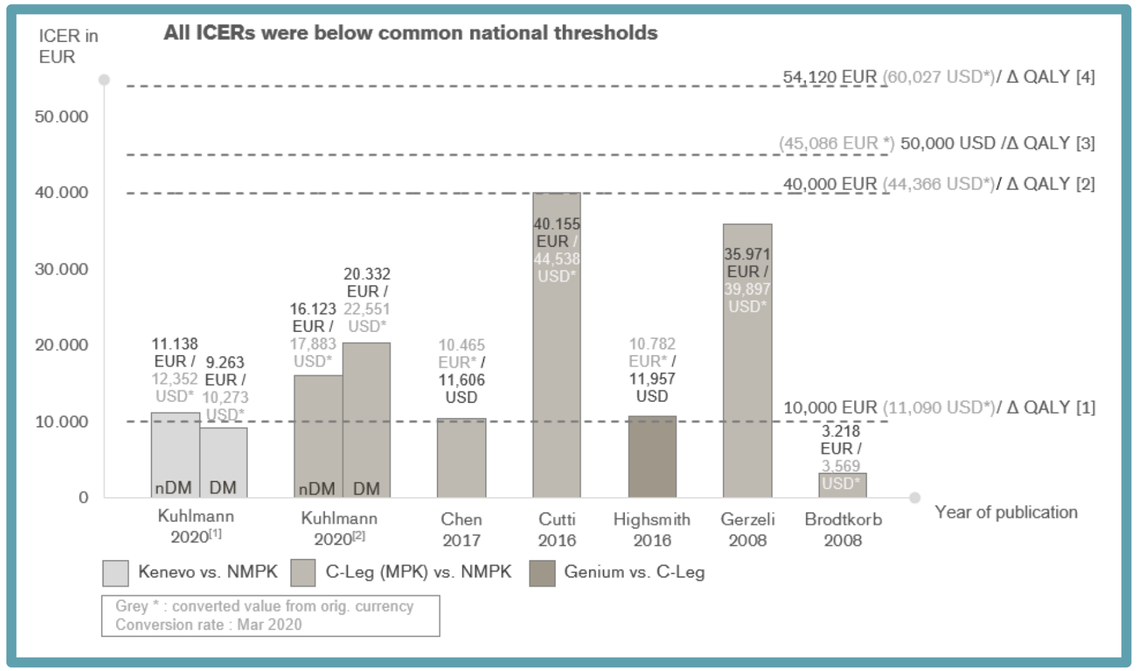

Figure 1: Icremental Cost – Effectiveness Ratio (ICER) results and national thresholds; * exchange calculated Feb 2021 without inflation DM: Diabetes Mellitus

Results

Four studies used a cohort-level Markov model [1,2,3,6], 5 studies assumed the payer perspective[1,2,4,6,8], 2 studies[3,7] the societal perspective and one study both perspectives[5]. Data sources were study cohorts[4,5,6,7,8], health insurance and other official national databases[1,2,3] and actual data input for health care costs [1,2,3].

			Kuhlmann [1] 2020	Kuhlmann [2] 2020	Chen [3] 2017	Cutti [4] 2016	Gerzeli [5] 2008	Brodtkorb [6] 2008	Seelen [7] 2009	Highsmith [8] 2016
General Information	Patient population	Stratification amputation etiology	✓	✓	×	×	×	×	×	×
		country	Sweden	Germany	USA	Italy	Italy	Sweden	Netherlands	USA
		age (years)	≥65	≥ 40	38-62	≥ 35	18-65	Ø 41	18-65	Ø 46.5
	Intervention		Kenevo	C-Leg	MPK (C-Leg)	C-Leg	C-Leg	C-Leg	MPK (C-Leg)	Genium
	Comparator		NMPK	NMPK	NMPK	NMPK	NMPK	NMPK	NMPK	C-Leg
Data	calculation cohort / cost	National data base	✓	✓	×	×	×	×	×	×
		Health insurance	✓	✓	✓	✓	✓	×	×	×
		Study cohort	×	×	×	✓	✓	✓	✓	✓
		Literature review	✓	✓	✓	×	×	×	×	×
	Clinical relevant outcomes	falls	✓	✓	✓	×	×	×	×	×
		Quality of life instruments	EQ-5D-3L	EQ-5D-3L	EQ-5D-3L SF-36, PEQ	EQ-5D-3L	EQ-5D	EuroQol VAS	SF-6D	×
		QALY calculation based on EQ-5D	✓	✓	✓	✓	✓	×	×	×
Model-design	Modell type	Markov	✓	✓	✓	×	×	✓	×	×
	Time horizon (years)		25	25	10	5	5	8	1	5
	Perspective	payer	✓	✓	×	✓	✓	✓	×	✓
		Societal	×	×	✓	×	✓	×	✓	×
	Budget Impact Model		✓	✓	×	×	×	×	×	×
	Sensitivity analysis	PSA	✓	✓	✓	×	×	×	×	×
		DSA	✓	✓	✓	×	✓	✓	✓	×

Table 1: Overview of population, intervention and comparators assessed, databases and outcomes used, and model design applied in 8 studies

The incremental cost-effectiveness ratios (ICER) per QALY gained ranged from USD 3,469 to USD 40,538* (figure 1). Cost-effectiveness compared to NMPKs was demonstrated in 3 studies (deterministic and probabilistic sensitivity analysis) [1,2,3], with 2 of them also performing a budget impact analysis [1,2].
Over a 5-year observation period, use of the C-Leg would incur additional expenditures of USD 58.5m* for patients without DM and USD 49.7m* for those with DM in Germany [2].
If all new prosthesis users ≥ 65 years in Sweden received a MPK (Kenevo) and 50 % of prevalent NMPK users were re-fitted with a MPK, additional expenditures of USD 1.9m* would incur [1].

Discussion & Conclusion

Individuals using C-Leg / MPKs do benefit from improved QoL, QALY gain and safety. This benefit was also demonstrated for individuals >65 years of age and ≥6 months post-amputation using Kenevo.
Cost-effectiveness of MPKs along with affordability has been clearly demonstrated and supports the clinical relevance for the consideration as standard of care.

References

[1] Kuhlmann et al., Value in Health December 2020 Vol. 23 Abstract S576 https://doi.org/10.1016/j.jval.2020.08.1036
[2] Kuhlmann et al., Eur J Health Econ (2020).
[3] Chen et al., J. Neuroeng. Rehabil. 15 (Suppl 1) : 62 (2018).
[4] Cutti et al., Prosthet. Orthot. Int. 41 (3) : 227–236 (2017).
[5] Gerzeli et al., Eur. J. Health Econ. 10 (1) : 47–55 (2009).
[6] Brodtkorb et al., Arch. Phys. Med. Rehabil. 89 (1) : 24–30 (2008).
[7] Seelen et al., Technol Disabil 21 (1,2) : 25–34 (2009)
[8] Highsmith et al., Technology and Innovation. 18, 139-150 (2016)
[9] Huserau et al., BMJ 346(f1049): 1-6 (2013)

The authors are full-time employees of Otto Bock HealthCare LP, Austin, TX, USA/ GmbH Vienna, Austria Susanne.Seidinger@ottobock.at · www.ottobock.com ISPO 5.21.