Ottobock MPKs – 12 years of health economics

Summary of 10 health economic studies from 2008 to 2020

Major Findings

Cost-effectiveness was demonstrated from payer perspective

- ➔ When comparing C-Leg with NMPKs, the value of the incremental cost-effectiveness ratio (ICER) per quality adjusted life year (QALY) was **16,123 Euros** in amputees without diabetes mellitus (DM) and **20,332 Euros** in amputees with DM in a German study [1], **40,155 Euros** in a recent Italian study from 2016 [3], **35,971 Euros** in an earlier Italian study from 2008 [4], and **3,128 Euros** based on data gathered from a Swedish study [5].
- ➔ One study compared Genium with C-Leg and obtained an ICER per QALY between **6,000 and 11,957 USD** based on an US cohort [7].

Cost-effectiveness was demonstrated from societal perspective

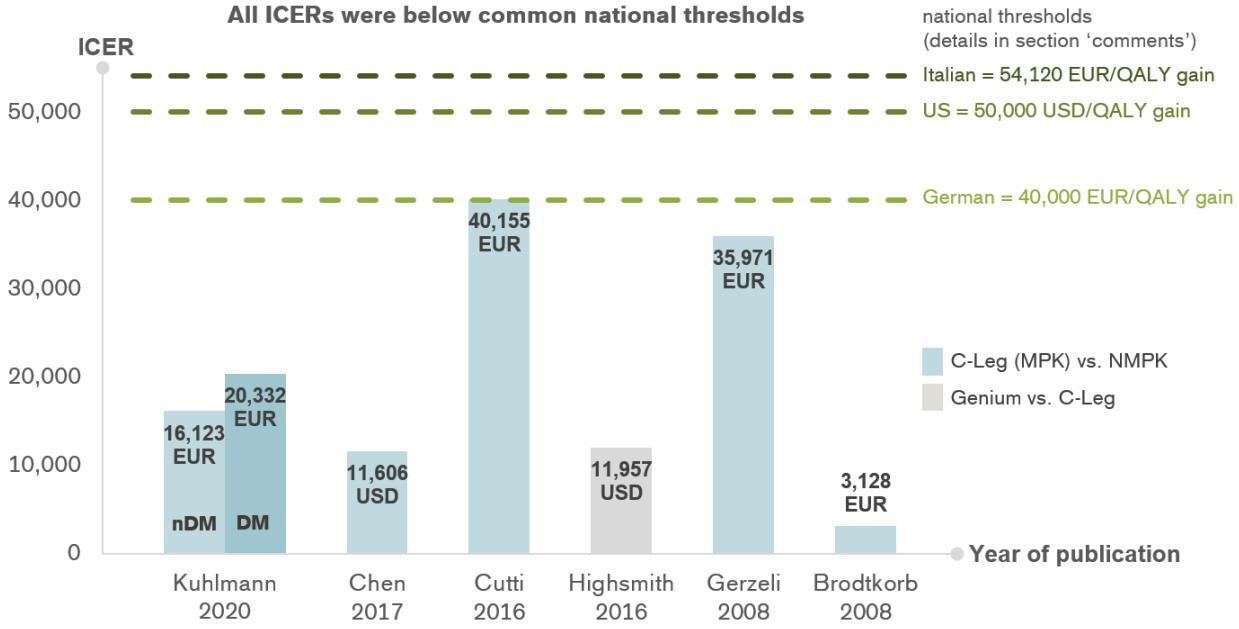
- ➔ An **ICER of 11,606 USD** for comparing C-Leg (MPKs) with NMPKs from the societal perspective was obtained in a US study [2].

A marginal budget impact of C-Leg in comparison to NMPKs was demonstrated in 1 study

- ➔ Over the period of 5 years, a **diminishing effect** in the size of the annual budget impact of C-Leg in comparison to NMPKs was observed [1].

Further important health economics findings were obtained

- ➔ A **favourable cost-benefit ratio** between C-Leg (MPKs) and NMPKs was demonstrated in a Dutch population from the societal perspective (total **costs** were **lower**, and mean **quality of life (QoL)** was **higher**)
- ➔ In 2017, for the first time, **direct medical costs of falls** were determined for adult transfemoral amputees [8].
- ➔ Studies before 2012 were summarized for the evaluation of past health economics finding as part of 2 review articles [9,10].



Clinical relevant outcomes

C-leg (MPK) compared to NMPK improved QoL in 4 studies

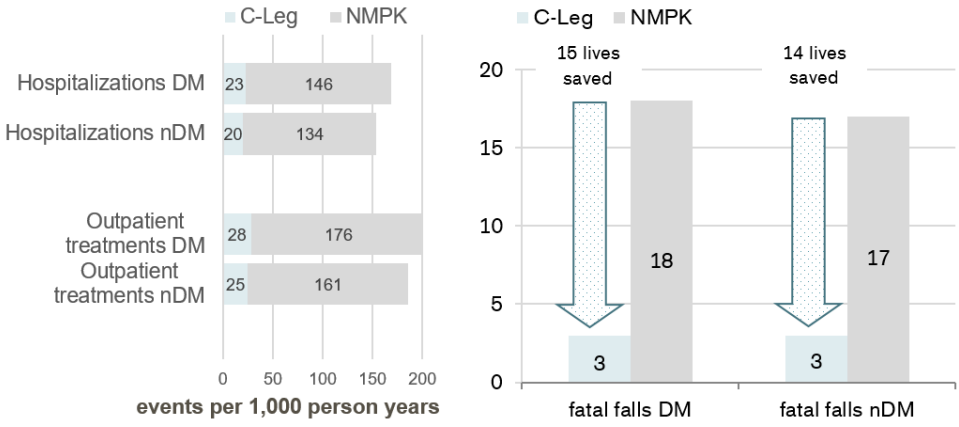
➔ With an **increase of 13-14 %** [3,4] based on EQ-5D measures in the Italian studies, **of 57 %** based on the EuroQoL VAS measure in the Swedish study [5] and of **18 %** based on the SF-6D measure in the Dutch study [6].

C-leg (MPK) compared to NMPK increased QALY in 5 studies

➔ With a **QALY gain of 1.74** for the non-DM and **0.92** for the DM cohort [1], of **0.91** within the US study [2], of **0.42** and **0.46** within the Italian cohorts in 2008 and 2016 [4,3] and of **2.38** within the Swedish study [5].

C-Leg (MPK) compared to NMPK improved safety - falls reduction in 2 studies

➔ With a **reduced rate of fall-related hospitalizations** by approximately **85 %** and **reduced rate of outpatient treatments** by approximately **84 %** [1].
➔ The **rate of fatal falls** was reduced by approximately **83 %**[1].



based on Germany study by Kuhlmann et.al [1]

➔ Similar results were demonstrated as part of the US study that evaluated safety within transfemoral amputees without consideration of DM as comorbidity [2].
➔ The German study showed that C-Leg users without DM **gain 1.96 life years (LYs)** and C-Leg users with DM **0.55 LYs** [1].
➔ The US study expressed this effect as lives saved, **11 lives** would **be saved** by C-leg (MPK) if 1,000 amputees would be observed for one year [2].

Further clinical relevant outcomes were demonstrated in 2 studies

➔ C-Leg (MPKs) resulted in **16 fewer incidences of osteoarthritis** per 100 persons [2].
➔ **Improved physical functionality of activities of daily living** of Genium compared to C-Leg was observed in one study [7].

Costs

➔ National (DRG statistics [1]), health insurance (Medicare [2], INAIL[3,4]) and medical (Dutch rehabilitation centre[6]) databases, literature reviews, expert panels as well as interviews with health specialists and patients were used to inform costs.
➔ Direct medical costs included: device acquisition, fall-related injury (hospital, inpatient, outpatient treatments e.g. for hip/femur/ankle/wrist fractures) and rehabilitation costs.
➔ Indirect medical costs included: lost wages, caregiving and transportation expenses (used for social perspective of studies).

Summary

➔ Health economics of MPKs were extensively evaluated over the last 12 years.
➔ Cost-effectiveness of MPKs compared to NMPKs was demonstrated.
➔ Individuals using an MPK benefit from improved physical functionality of activities in daily living, QoL, QALY gain, reduced number of falls and fall-related injuries.
➔ A negligible marginal budget impact of MPKs compared to NMPKs was demonstrated.
➔ These results strengthen the argumentation to provide MPKs as standard of care.

References of summarized studies

[1] **Kuhlmann**, A., Krüger, H., Seidinger, S. et al. Cost-effectiveness and budget impact of the microprocessor-controlled knee C-Leg in transfemoral amputees with and without diabetes mellitus. Eur J Health Econ (2020). https://doi.org/10.1007/s10198-019-01138-y

[2] **Chen**, C., Hanson, M., Chaturvedi, R., Mattke, S., Hillestad, R., Liu, H.H.: Economic benefits of microprocessor controlled prosthetic knees. A modeling study. J. Neuroeng. Rehabil. 15(Suppl 1), 62 (2018). https ://doi.org/10.1186/s1298 4-018-0405-8, // full study report: RAND Corporation, RR-2096-AOPA, 2017: https://www.rand.org/pubs/research_reports/RR2096.html

[3] **Cutti,** A.G., Lettieri, E., Del Maestro, M., Radaelli, G., Luchetti, M., Verni, G., Masella, C.: Stratified cost-utility analysis of C-Leg versus mechanical knees. Findings from an Italian sample of transfemoral amputees. Prosthet. Orthot. Int. 41(3), 227–236 (2017). https ://doi.org/10.1177/03093 64616 63795 5

[4] **Gerzeli**, S., Torbica, A., Fattore, G.: Cost utility analysis of knee prosthesis with complete microprocessor control (C-leg) compared with mechanical technology in trans-femoral amputees. Eur. J. Health Econ. 10(1), 47–55 (2009). https ://doi. org/10.1007/s1019 8-008-0102-9

[5] **Brodtkorb,** T.-H., Henriksson, M., Johannesen-Munk, K., Thidell, F.: Cost-effectiveness of C-Leg compared with nonmicroprocessor-controlled knees. A modeling approach. Arch. Phys. Med. Rehabil. 89(1), 24–30 (2008). https ://doi.org/10.1016/j.apmr.2007.07.049

[6] **Seelen,** H.A.M., Hemmen, B., Schmeets, A.J., Ament, A.J.H.A., Evers, S.M.A.A.: Costs and consequences of a prosthesis with an electronically stance and swing phase controlled knee joint. Technol Disabil 21(1,2), 25–34 (2009)

[7] **Highsmith,** M., Wernke, M., Carey, S., Miro, R., Lura, D., Sutton, B., Kahle, J.: Effects of the Genium Knee System on Functional Level, Stair Ambulation, Perceptive and Economic Outcomes In Transfemoral Amputees. Technology and Innovation. 18. 139-150. (2016). 10.21300/18.2-3.2016.139.

[8] **Mundell**, B.F., Kremers, H.M., Visscher, S., Hoppe, K.M., Kaufman, K.R.: Predictors of receiving a prosthesis for adults with above-knee amputations in a well-defined population. PM R 8(8), 730–737 (2016). https ://doi.org/10.1016/j.pmrj.2015.11.012

[9] **Samuelsson**, K. A., Töytäri, O., Salminen, A.-L., & Brandt, Å. (2012). Effects of lower limb prosthesis on activity, participation, and quality of life: a systematic review. Prosthet. Orthot. Int., 36(2), 145–158. https://doi.org/10.1177/0309364611432794

[10] **Highsmith**, M.J., Kahle, J.T., Bongiorni, D.R., Sutton, B.S., Groer, S., Kaufman, K.R.: Safety, energy efficiency, and cost efficacy of the C-Leg for transfemoral amputees. A review of the literature. Prosthet. Orthot. Int. 34(4), 362–377 (2010). https ://doi.org/10.3109/03093 646.2010.52005 4

Comments

National thresholds

- ➔ **German threshold**: is equal to the German GDP per capita in 2018, which is a threshold proposed by the WHO [1]
- ➔ **US threshold:** corresponds to the commonly accepted threshold according to the Institute for Clinical and Economic Review in the US [2]
- ➔ **Italian threshold**: is equivalent to the converted upper threshold of 44,000 GBP that was reported as NICE practical acceptability threshold in the UK [3]