Robotics and Navigation in Hips - What is the Evidence?

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Disclosures/Financial Conflicts of Interest: None

Robotic-assisted THA

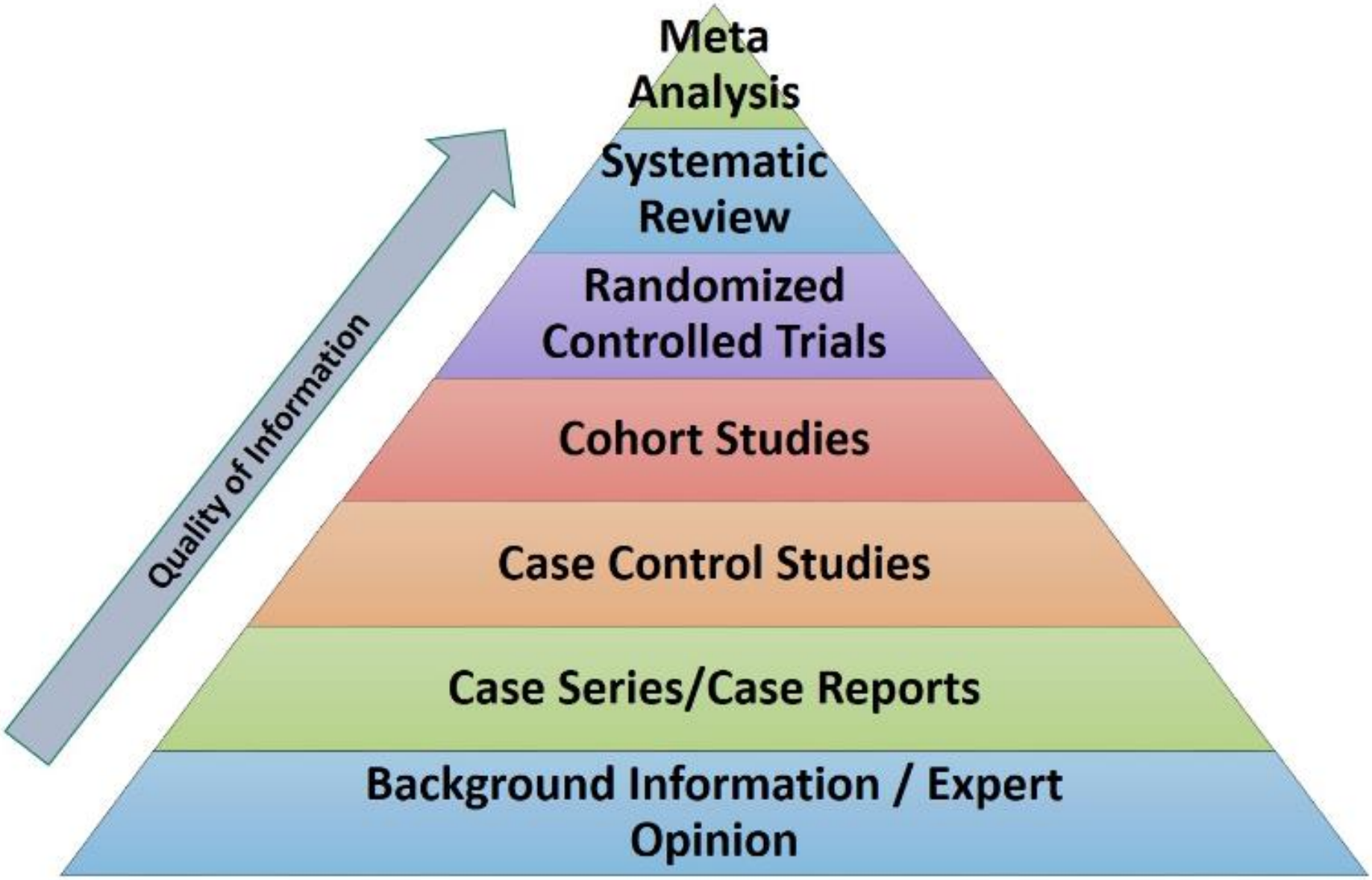
Fully-Active
ROBODOC
(femoral component)

Semi-Active
Robotic-arm Assisted
(acetabular component)

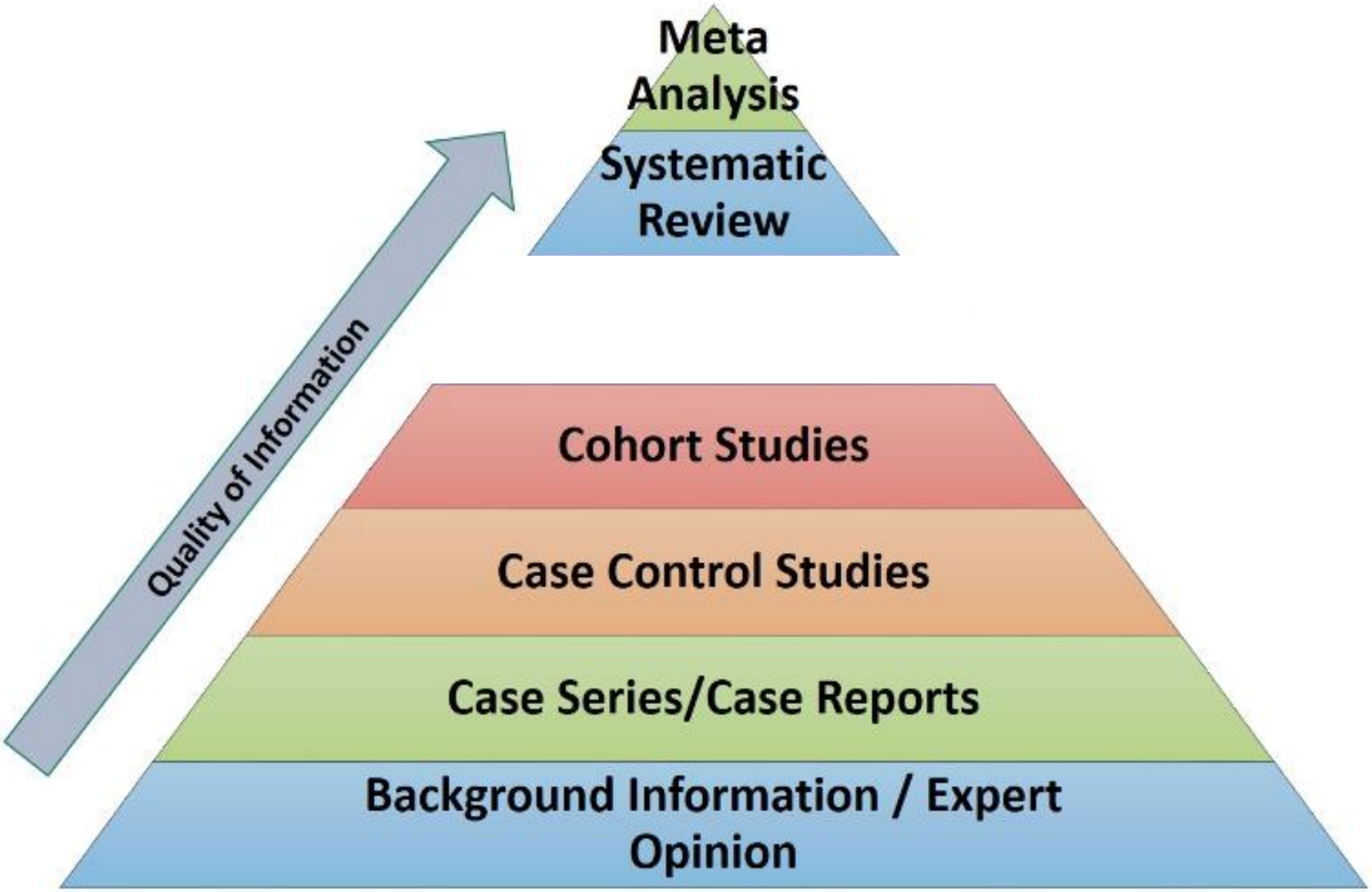
Published claims about robotic-arm assisted THA (rTHA)

- Higher accuracy and precision of implantation
- Increased patient satisfaction
- Increased return to activities of daily living
- Reduced complications such as dislocation
- Reduced utilization of health services
- Reduced payer costs
- Cost effective

Evidence Pyramid



Evidence Pyramid: No RCTs



Comparison of Outcomes After Robotic-Assisted or Conventional Total Hip Arthroplasty at a Minimum 2-Year Follow-up

A Systematic Review

■ SYSTEMATIC REVIEW

Robotic arm-assisted versus manual total hip arthroplasty

A SYSTEMATIC REVIEW AND META-ANALYSIS

OPEN Research Article

Comparison of Surgical Time, Short-term Adverse Events, and Implant Placement Accuracy Between Manual, Robotic-assisted, and Computer-navigated Total Hip Arthroplasty: A Network Meta-analysis of Randomized Controlled Trials

OXFORD

Postgraduate Medical Journal, 2023, 99, 1171, 375–383
https://doi.org/10.1136/postgradmedj-2021-141135
Advance access publication date 17 December 2021
Review

Does robotic-assisted surgery improve outcomes of total hip arthroplasty compared to manual technique? A systematic review and meta-analysis

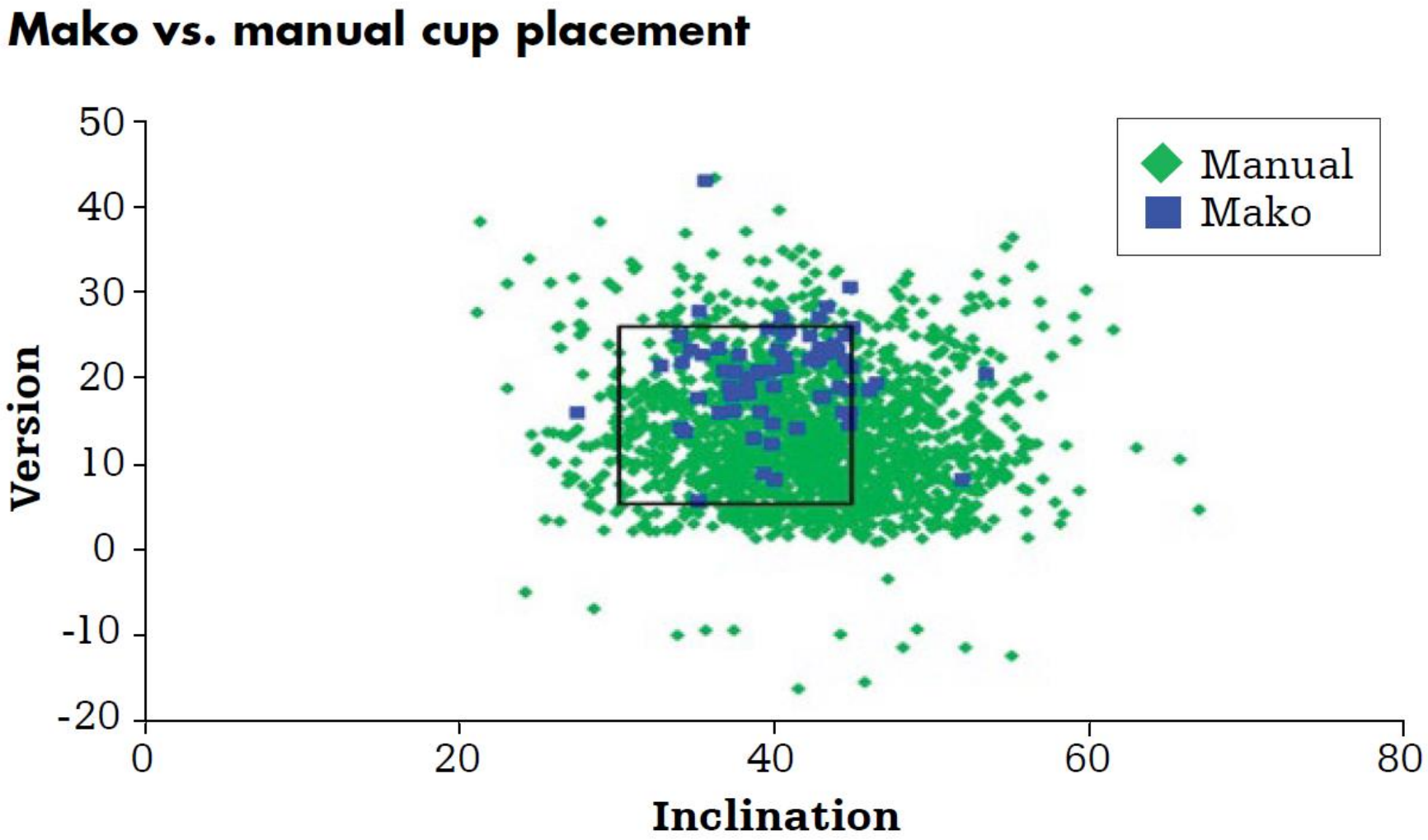
Comparison of Outcomes After Robotic-Assisted or Conventional Total Hip Arthroplasty at a Minimum 2-Year Follow-up

A Systematic Review

"The existing literature comparing robotic THA and manual THA is scarce and low-quality, with findings limited by methodological flaws in study design."

Sweet MC, JBJS Rev. 2021 Jun 16;9(6). doi: 10.2106.

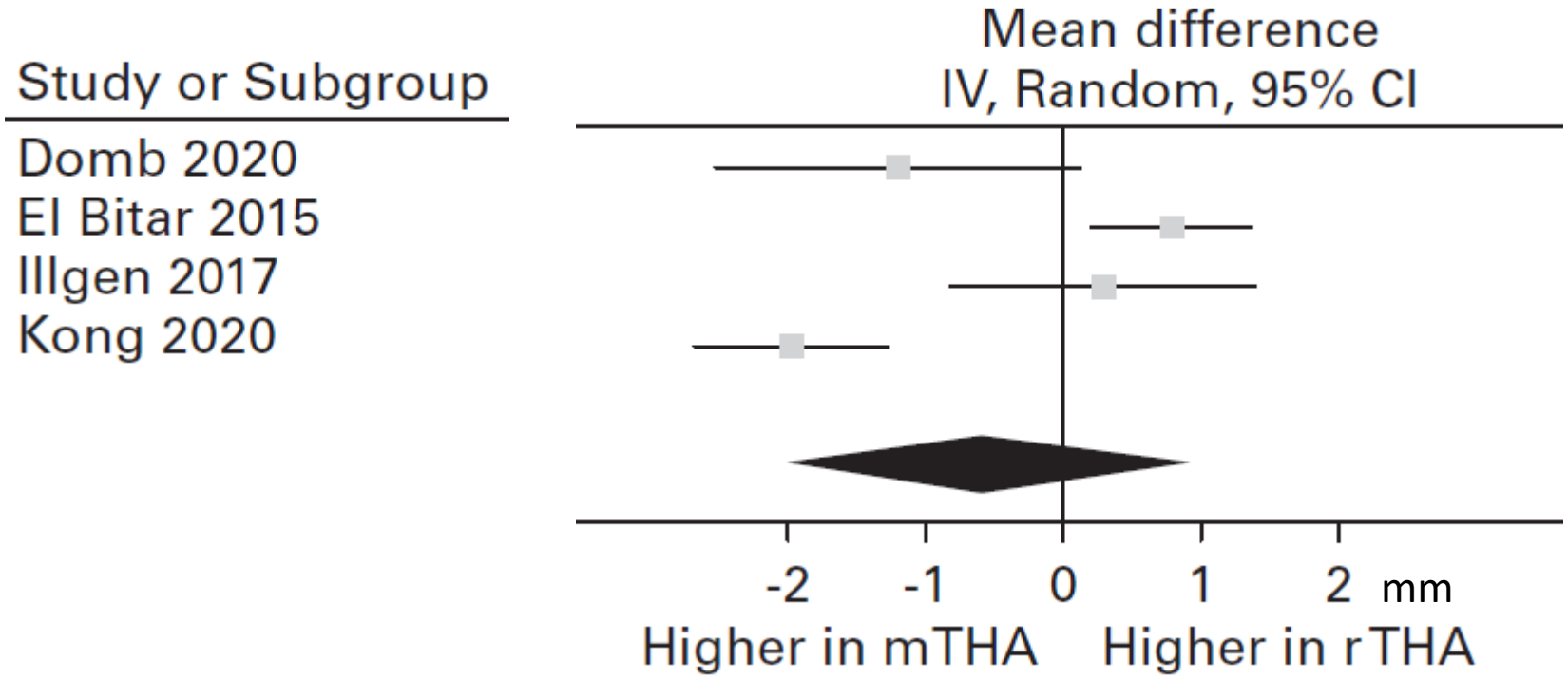
Acetabular Component Positioning



Elson L, Hip Int. 2015 Nov-Dec;25(6):531-6

Stryker: The clinical and economic value of Mako SmartRobotics

Leg-length Difference

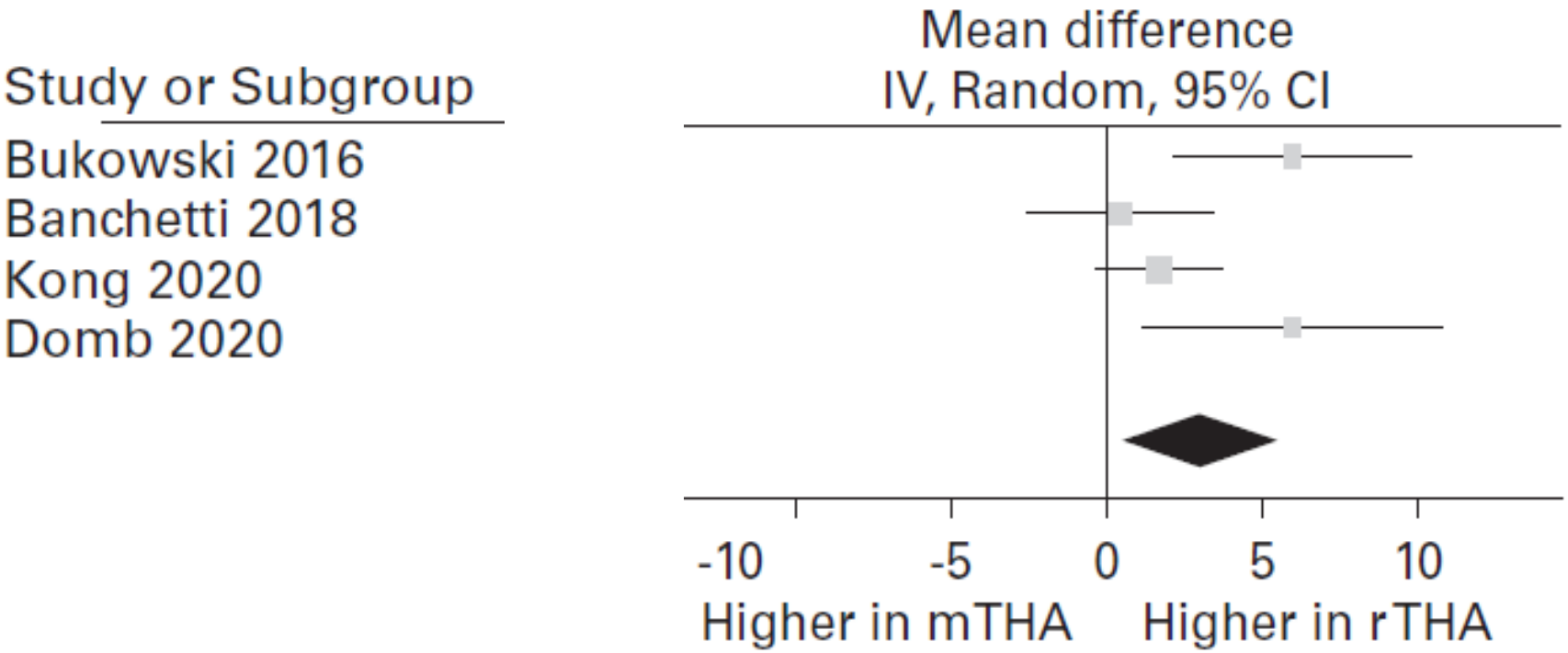


Mean difference in leg-length inequality of 0.5 mm

(Not statistically or clinically significant)

Ng N, Bone Joint J. 2021 Jun;103-B(6):1009-1020.

Patient Reported Outcomes: Postoperative Harris Hip Score



Statistically but not clinically significant (difference less than minimal clinically important difference)

Ng N, Bone Joint J. 2021 Jun;103-B(6):1009-1020.

Systematic Review of Complications: No differences in

- Overall complication rates
- Infection rates
- Dislocation rates
- Revision rates

Ng N, Bone Joint J. 2021 Jun;103-B(6):1009-1020.

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Primary Hip

Patient-Reported Outcome Measures in Conventional Total Hip Arthroplasty Versus Robotic-Arm Assisted Arthroplasty: A Prospective Cohort Study With Minimum 3 Years' Follow-Up

- More accurate acetabular component positioning with rTHA
- No clinically or statistically significant differences in
    - Oxford Hip Score
    - UCLA Hip Score
    - Forgotten Joint Score

Fontalis A, J Arthroplasty. 2023 Jul;38(7S2):S324-S329.

How does rTHA compare to Fluoroscopy?

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Primary Hip

A Comparison of Component Positioning Between Fluoroscopy-Assisted and Robotic-Assisted Total Hip Arthroplasty

Nathaniel J. Stewart, MD [a, *], James L. Stewart, BS [a], Abra Brisbin, PhD [b]

Stewart N, J Arthroplasty. 2022 Aug;37(8):1602-1605.e3

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Primary Hip

A Comparison of Component Positioning Between Fluoroscopy-Assisted and Robotic-Assisted Total Hip Arthroplasty

Nathaniel J. Stewart, MD [a,*], James L. Stewart, BS [a], Abra Brisbin, PhD [b]

- Retrospective comparison of Direct Anterior THA with either robotic assistance or fluoroscopy
- 0.8 degree difference in acetabular inclination error
- No significant difference in anteversion, leg length discrepancy, femoral offset, or global offset

Stewart N, J Arthroplasty. 2022 Aug;37(8):1602-1605.e3

Is rTHA Cost-Effective?

- **Added Costs**
  - Robot: $100,000s to $1M
  - Annual Maintenance/Service Contract
  - Preoperative CT
  - Disposables
- **Cost savings**
  - Improved Quality of life?
  - Decreased length of stay?
  - Decreased SNF utilization?
  - Decreased 90-day episode of care costs?

Is rTHA Cost Effective?

Advantages of robotic arm-assisted total hip arthroplasty: a 90-day episode-of-care clinical utility and cost analysis

Journal of Comparative Effectiveness Research

Wael Barsoum[1,2], David Gregory[3], Keith Needham*[,3], Michael Mont[4], Nipun Sodhi[5], Andrea Coppolecchia[6] & David Jacofsky[1,7]

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[7]The CORE Institute, Phoenix, AZ 85015, USA
*Author for correspondence: Tel.: +1 646 375 3828; Keith.Needham@Bakertilly.com

- Does not take into account costs of
  - Robot
  - Service Contracts
  - Disposables

Barsoum W, J Comp Eff Res. 2023 May 5;12(5):e220208

Conclusions: The best available evidence indicates that

- rTHA increases accuracy and precision of acetabular component positioning
- This has not led to meaningful improvements in function, complications, or revision rates
- Use of fluoroscopy can lead to similar radiographic results
- rTHA increases health-care costs


stryker
Visum Surgical Light
UCSF

Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Systematic Review and Meta Analysis

The Impact of Author Financial Conflicts on Robotic-Assisted Joint Arthroplasty Research

- Review of robotic hip and knee arthroplasty literature
  - --91% of studies had an author financial COI
  - --Conflicted studies more likely to report a favorable robotic outcome
  - --Studies favoring robotic outcomes had a higher number of conflicted authors and a higher mean industry payment per author

DeFrance MJ, J Arthroplasty. 2021 Apr;36(4):1462-1469.