Abstract Number: 23070

UNIVERSITY of MARYLAND
SCHOOL OF MEDICINE

MODEMS Preoperative and Postoperative Met Expectations Cluster Analysis Predicts Two-Year Outcomes in Knee Surgery Patients

R. Frank Henn III, M.D.

Evan Honig, B.A.; Brandon Leon, B.S.; Samir Kaveeshwar, M.D.; Leah Henry, M.D.; Andrew Tran, M.D.; Jonathan Packer M.D.; Natalie Leong, M.D.; Sean Meredith, M.D.; R. Frank Henn III, M.D.

Department of Orthopaedics,
University of Maryland School of Medicine, Baltimore, MD

MODEMS Preoperative and Postoperative Met Expectations Cluster Analysis Predicts Two-Year Outcomes in Knee Surgery Patients

Evan Honig, B.A.; Brandon Leon, B.S.; Samir Kaveeshwar, M.D.; Leah Henry, M.D.; Andrew Tran, M.D.; Jonathan Packer M.D.; Natalie Leong, M.D.; Sean Meredith, M.D.; R. Frank Henn III, M.D.

Department of Orthopaedics, University of Maryland School of Medicine, Baltimore, MD

I (and/or my coauthors) have something to disclose

Detailed disclosure information is available at https://www.isakos.com/2023/Disclosures

No disclosures are relevant to the content of this presentation.

MODEMS Preoperative and Postoperative Met Expectations Cluster Analysis Predicts Two-Year Outcomes in Knee Surgery Patients

Evan Honig, B.A.; Brandon Leon, B.S.; Samir Kaveeshwar, M.D.; Leah Henry, M.D.; Andrew Tran, M.D.; Jonathan Packer M.D.; Natalie Leong, M.D.; Sean Meredith, M.D.; R. Frank Henn III, M.D.

Department of Orthopaedics, University of Maryland School of Medicine, Baltimore, MD

INTRODUCTION

- Both Musculoskeletal Outcomes Data Evaluation and Management System (MODEMS) preoperative and postoperative met expectations domains have been demonstrated to be associated with each other as well as better postoperative outcomes for a variety of orthopaedic procedures.
- Previous studies have only examined either preoperative or postoperative met expectations in isolation.
- However, they may be clinical utility in combining both expectations domains.
- Some patients with high preoperative expectations may ultimately have low postoperative met expectations or vice versa.

OBJECTIVES

- Determine the prognostic value of clustering knee surgery patients into groups based on preoperative and postoperative met expectations

HYPOTHESIS

- We hypothesized that, regardless of preoperative expectations, patients grouped into clusters with “high” postoperative met expectations will have better postoperative outcomes compared those grouped into clusters with “low” postoperative met expectations.

MODEMS Preoperative and Postoperative Met Expectations Cluster Analysis Predicts Two-Year Outcomes in Knee Surgery Patients

Evan Honig, B.A.; Brandon Leon, B.S.; Samir Kaveeshwar, M.D.; Leah Henry, M.D.; Andrew Tran, M.D.; Jonathan Packer M.D.; Natalie Leong, M.D.; Sean Meredith, M.D.; R. Frank Henn III, M.D.

Department of Orthopaedics, University of Maryland School of Medicine, Baltimore, MD

METHODS

- Patients undergoing elective knee surgery between June 2015 to April 2018 were prospectively enrolled.
- 401 patients completed both baseline and two-year follow-up surveys.
- Charts were reviewed for relevant demographic/medical information.
- The following questionnaires were collected both preoperatively and two years postoperatively:
    - Patient-Reported Outcomes Measurement Information System (PROMIS) in six domains
    - The International Knee Documentation Committee (IKDC) Subjective Knee Form
    - Knee and whole-body Numeric Pain Scale (NPS)
    - Marx Activity Rating Scale (MARS)
    - Surgical Satisfaction Questionnaire (SSQ8 – only collected postoperatively).

METHODS

- Preoperative and postoperative met expectations were measured with MODEMS domains.
    - Patients were then clustered into four distinct profiles using k-means cluster analysis of preoperative and postoperative met expectations, and difference between the values.
- Chi-square or Kruskal-Wallis tests were conducted for bivariate analyses.
- Multivariate analysis for relevant two-year outcome metrics identified if expectation clusters were independent predictors.

MODEMS Preoperative and Postoperative Met Expectations Cluster Analysis Predicts Two-Year Outcomes in Knee Surgery Patients

Evan Honig, B.A.; Brandon Leon, B.S.; Samir Kaveeshwar, M.D.; Leah Henry, M.D.; Andrew Tran, M.D.; Jonathan Packer M.D.; Natalie Leong, M.D.; Sean Meredith, M.D.; R. Frank Henn III, M.D.

Department of Orthopaedics, University of Maryland School of Medicine, Baltimore, MD

RESULTS

- Cluster analysis revealed four distinct groups (Table 1) based on MODEMS Preoperative Expectations, Postoperative Met Expectations, and Difference between values :
    - High Preoperative to High Postoperative met expectations (HIGH-HIGH)
    - High Preoperative to Low Postoperative met expectations (HIGH-LOW)
    - Low Preoperative to High Postoperative met expectations (LOW-HIGH)
    - Low Preoperative to Low Postoperative met expectations (LOW-LOW)
- HIGH-HIGH was the largest, accounting for 248 patients (62% of all patients; Table 1)
- Multiple sociodemographic/operative factors were associated with cluster profiles including age, number of prior knee surgeries, education level, income, and arthroplasty vs arthroscopy.

Table 1: MODEMS Preoperative Expectations, Postoperative Met Expectations, and Difference between values vs Cluster Profiles

	Cluster Profiles				
MODEMS Domains	**HIGH-HIGH N=248**	**HIGH-LOW N=84**	**LOW-HIGH N=31**	**LOW-LOW N=38**	**P-value**
Preop Expectations	92.8 ± 8.8	94.2 ± 8.3	49.4 ± 21.0	64.5 ± 12.7	**<0.0001**
Postoperative Met Expectations	90.3 ± 11.4	29.8 ± 20.3	84.7 ± 18.6	47.6 ± 21.7	**<0.0001**
Difference between Preop and Postop Met	-2.5 ± 13.9	-64.4 ± 19.2	35.3 ± 18.9	-16.9 ± 18.2	**<0.0001**

MODEMS Preoperative and Postoperative Met Expectations Cluster Analysis Predicts Two-Year Outcomes in Knee Surgery Patients

Evan Honig, B.A.; Brandon Leon, B.S.; Samir Kaveeshwar, M.D.; Leah Henry, M.D.; Andrew Tran, M.D.; Jonathan Packer M.D.; Natalie Leong, M.D.; Sean Meredith, M.D.; R. Frank Henn III, M.D.

Department of Orthopaedics, University of Maryland School of Medicine, Baltimore, MD

RESULTS

- All preoperative PROs were associated with cluster profiles except PROMIS Physical Function.
    - HIGH-HIGH and LOW-HIGH had the best preoperative scores; LOW-LOW and HIGH-LOW had the worst preoperative scores, with no significant difference between the respective groups.

Table 2: Bivariate Analysis of Preoperative PROs by Cluster Profile

PRO	HIGH-HIGH (Mean±SD)	HIGH-LOW (Mean±SD)	LOW-HIGH (Mean±SD)	LOW-LOW (Mean±SD)	P-value
PROMIS PF	41.7 ± 8.8	40.2 ± 7.6	11.5 ± 7.2	39.3 ± 5.4	0.15
PROMIS PI	58.9 ± 7.5	62.7 ± 6.9	58.5 ± 7.2	61.5 ± 6.4	**0.0006**
PROMIS Fatigue	50.0 ± 10.5	54.3 ± 10.6	49.7 ± 10.5	56.1 ± 9.0	**<0.0001**
PROMIS SS	44.1 ± 9.4	41.1 ± 7.4	45.0 ± 8.8	41.6 ± 7.3	**0.03**
PROMIS Anxiety	54.3 ± 9.0	57.2 ± 9.3	56.6 ± 8.5	58.6 ± 8.2	**0.002**
PROMIS Depression	48.4 ± 8.3	50.2 ± 9.0	49.9 ± 9.8	54.1 ±9.7	**0.005**
IKDC	43.1 ± 16.9	36.0 ± 15.4	46.8 ± 18.6	40.0 ± 16.7	**0.004**
NPS op	41.4 ± 29.0	52.0 ± 29.2	41.0 ± 30.0	53.9 ± 30.1	**0.008**
NPS Whole Body	10.4 ± 19.3	17.5 ± 25.2	14.2 ± 23.1	28.2 ± 24.9	**0.0001**
MARS Lower	53.3 ± 37.2	37.3 ± 37.5	34.9 ± 38.0	33.9 ± 37.2	**<0.0001**

MODEMS Preoperative and Postoperative Met Expectations Cluster Analysis Predicts Two-Year Outcomes in Knee Surgery Patients

Evan Honig, B.A.; Brandon Leon, B.S.; Samir Kaveeshwar, M.D.; Leah Henry, M.D.; Andrew Tran, M.D.; Jonathan Packer M.D.; Natalie Leong, M.D.; Sean Meredith, M.D.; R. Frank Henn III, M.D.

Department of Orthopaedics, University of Maryland School of Medicine, Baltimore, MD

RESULTS

- Clusters with high postoperative met expectations (HIGH-HIGH and LOW-HIGH) had better two-year scores and improvement than those with low met expectations (LOW-LOW and HIGH-LOW). See Tables 3 and 4.

- Multivariable analysis demonstrated that clusters were independent predictors of two-year scores and change for all PROs as well as self-reported being "completely better" postoperatively.

- HIGH-HIGH cluster independently predicted the greatest two-year scores and improvements while HIGH-LOW predicted the lowest.

Table 3: Bivariate Analysis of Two-Year Postoperative PROs by Cluster Profile

PRO	HIGH-HIGH (Mean±SD)	HIGH-LOW (Mean±SD)	LOW-HIGH (Mean±SD)	LOW-LOW (Mean±SD)	P-value
PROMIS PF	55.4 ± 9.8	42.0 ± 6.3	52.6 ± 11.7	43.3 ± 8.0	**<0.0001**
PROMIS PI	46.5 ± 8.0	60.3 ± 7.7	49.7 ± 9.5	57.4 ± 8.7	**<0.0001**
PROMIS Fatigue	43.1 ± 9.4	55.6 ± 8.7	46.7 ± 12.1	52.8 ± 8.4	**<0.0001**
PROMIS SS	57.9 ± 9.9	42.9 ± 8.1	55.0 ± 10.9	45.8 ± 8.9	**<0.0001**
PROMIS Anxiety	47.0 ± 9.7	55.7 ± 9.6	50.0 ± 11.6	54.4 ± 9.6	**<0.0001**
PROMIS Depression	45.2 ± 8.7	50.4 ± 10.0	47.8 ± 10.5	50.4 ± 10.0	**<0.0001**
IKDC	78.5 ± 17.8	42.5 ± 17.7	70.5 ± 21.9	51.9 ± 20.4	**<0.0001**
NPS op	12.7 ± 18.1	51.3 ± 26.0	19.7 ± 24.0	35.5 ± 27.4	**<0.0001**
NPS Whole Body	15.4 ± 20.9	33.9 ± 29.3	25.8 ± 23.8	28.4 ± 27.2	**<0.0001**
Tegner	5.8 ± 2.5	2.9 ± 2.2	5.2 ± 2.7	3.2 ± 2.4	**<0.0001**
MARS Lower	45.5 ± 33.7	21.7 ± 29.4	37.3 ± 31.8	19.3 ± 24.0	**<0.0001**
SSQ8	86.7 ± 13.6	53.6 ± 21.6	80.8 ± 15.2	66.4 ± 22.3	**<0.0001**

Table 4: Bivariate Analysis of Two-Year CHANGE in PROs by Cluster Profile

PRO	HIGH-HIGH (Mean±SD)	HIGH-LOW (Mean±SD)	LOW-HIGH (Mean±SD)	LOW-LOW (Mean±SD)	P-value
PROMIS PF	13.7 ± 11.6	1.8 ± 6.8	11.1 ± 13.1	4.0 ± 7.0	**<0.0001**
PROMIS PI	-12.4 ± 8.7	-2.3 ± 7.8	-8.8 ± 9.8	-4.1 ± 6.7	**<0.0001**
PROMIS Fatigue	-6.9 ± 11.6	1.5 ± 10.5	-2.9 ± 11.6	-3.3 ± 8.9	**<0.0001**
PROMIS SS	13.8 ± 12.1	1.8 ± 9.1	10.1 ± 12.9	4.2 ± 9.3	**<0.0001**
PROMIS Anxiety	-7.3 ± 10.1	-1.4 ± 10.9	-6.6 ± 11.8	-4.2 ± 10.1	**<0.0001**
PROMIS Depression	-3.2 ± 9.4	0.2 ± 10.5	-2.2 ± 10.1	-3.7 ± 8.5	0.06
IKDC	35.6 ± 19.8	6.5 ± 16.0	24.1 ± 20.0	12.5 ± 18.5	**<0.0001**
NPS op	-7.4 ± 30.0	-15.3 ± 36.8	2.4 ± 31.1	-15.8 ± 34.1	0.06
NPS Whole Body	5.0 ± 20.9	16.7 ± 26.1	11.6 ± 23.8	0.3 ± 28.5	**0.0003**
MARS Lower	-28.7 ± 31.3	-0.7 ± 36.6	-21.3 ± 29.7	-18.4 ± 37.8	**<0.0001**

MODEMS Preoperative and Postoperative Met Expectations Cluster Analysis Predicts Two-Year Outcomes in Knee Surgery Patients

Evan Honig, B.A.; Brandon Leon, B.S.; Samir Kaveeshwar, M.D.; Leah Henry, M.D.; Andrew Tran, M.D.; Jonathan Packer M.D.; Natalie Leong, M.D.; Sean Meredith, M.D.; R. Frank Henn III, M.D.

Department of Orthopaedics, University of Maryland School of Medicine, Baltimore, MD

DISCUSSION

- Clusters based on MODEMS Preoperative and Postoperative Met Expectations domains are associated with and independently predict two-year postoperative outcomes following knee surgery
- Patients with high postoperative met expectations had better preoperative, two-year, and improvement in most PROs, regardless of preoperative expectations
- However, between patients in clusters with similar postoperative met expectations, there were differences in some postoperative outcomes such as functional status, pain, and surgical satisfaction postoperatively
    - Patients with similar preoperative and postoperative expectation scores (HIGH-HIGH and LOW-LOW) had better two-year and improvement for various PROs compared to patients with similar postoperative met expectations but opposite preoperative expectations scores (HIGH-HIGH vs LOW-HIGH and LOW-LOW vs HIGH-LOW)

CONCLUSION

Although greater preoperative expectations have been shown to predict better outcomes, these results suggest that this is the case if those high preoperative expectations are met postoperatively.

MODEMS Preoperative and Postoperative Met Expectations Cluster Analysis Predicts Two-Year Outcomes in Knee Surgery Patients

Evan Honig, B.A.; Brandon Leon, B.S.; Samir Kaveeshwar, M.D.; Leah Henry, M.D.; Andrew Tran, M.D.; Jonathan Packer M.D.; Natalie Leong, M.D.; Sean Meredith, M.D.; R. Frank Henn III, M.D.

Department of Orthopaedics, University of Maryland School of Medicine, Baltimore, MD

References

- Henn RF, Dubina AG, Jauregui JJ, Smuda MP, Tracy JK. The Maryland Orthopaedic Registry (MOR): Design and baseline characteristics of a prospective registry. J Clin Orthop Trauma. 2017;8(4):301-307. doi:10.1016/j.jcot.2017.04.003
- Henry LE, Aneizi A, Nadarajah V, et al. Preoperative expectations and early postoperative met expectations of extremity orthopaedic surgery. *J Clin Orthop Trauma*. 2020;11(Suppl 5):S829-S836. doi:10.1016/j.jcot.2020.06.027
- Conner-Spady BL, Bohm E, Loucks L, Dunbar MJ, Marshall DA, Noseworthy TW. Patient expectations and satisfaction 6 and 12 months following total hip and knee replacement. *Qual Life Res*. 2020;29(3):705-719. doi:10.1007/s11136-019-02359-7
- Nadarajah V, Stevens KN, Henry L, et al. Patients undergoing shoulder surgery have high preoperative expectations. *Knee Surg Sports Traumatol Arthrosc Off J ESSKA*. 2020;28(7):2377-2385. doi:10.1007/s00167-019-05824-5
- Gandhi R, Davey JR, Mahomed N. Patient expectations predict greater pain relief with joint arthroplasty. *J Arthroplasty*. 2009;24(5):716-721. doi:10.1016/j.arth.2008.05.016
- Henn RF, Kang L, Tashjian RZ, Green A. Patients' preoperative expectations predict the outcome of rotator cuff repair. *J Bone Joint Surg Am*. 2007;89(9):1913-1919. doi:10.2106/JBJS.F.00358
- Jain D, Bendich I, Nguyen LCL, et al. Do Patient Expectations Influence Patient-Reported Outcomes and Satisfaction in Total Hip Arthroplasty? A Prospective, Multicenter Study. *J Arthroplasty*. 2017;32(11):3322-3327. doi:10.1016/j.arth.2017.06.017

Acknowledgements

This work was supported by The James Lawrence Kernan Hospital Endowment Fund, Inc.