# Electronic Patient-Reported Outcome Monitoring to Improve Quality of Life After Joint Replacement

## Secondary Analysis of a Randomized Clinical Trial

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## BACKGROUND

Although remote patient-reported outcome measure (PROM) monitoring has shown promising results in cancer care, there is a lack of research on post-surgery PROM monitoring in orthopedics.

## OBJECTIVE

**To determine whether post-surgery PROM monitoring can improve health outcomes for patients with joint replacement** compared with the standard of care.

## INTERVENTION

PROM-Monitoring critical recovery alerts in month:

1 3 6

post-surgery

Intervention and control groups received the standard of care and PROMs at hospital admission, discharge, and 12 months after surgery.

**Step 1:** In addition, the intervention group received PROMs at 1, 3, and 6 months after surgery.

**Step 2:** An automated alert signaled critical recovery paths to hospital study nurses either when a pre-determined PROM threshold was surpassed or when a 10% relative patient individual PROM-score worsening was detected.

**Step 3:** On notification, study nurses contacted patients.

**Step 4:** Study nurses referred patients to their physicians if necessary.

## METHOD

**Exploratory analyses**

- **2-sided t-tests were performed** to assess for significant differences between the intervention and control groups for all outcomes using $P < .05$ as the statistical significance threshold.

**Main analyses**

- **a linear mixed-effect model was used in the intention-to-treat study population.** This model controls for age, gender, mobilization, and pre-surgery PROM score as fixed covariates and hospital as the random intercept to account for a potential clustering effect at the hospital level.
- As sensitivity analyses, the primary outcomes were assessed in a compliance-corrected sample

## OUTCOMES

The prespecified outcomes were the mean change in PROM scores from baseline to 12 months after surgery

- **EQ-5D-5L**; range, −0.661 to 1.0, with higher values indicating higher levels of health-related quality of life (HRQOL)
- **EQ-VAS**; range, 0-100, with higher values indicating higher levels of HRQOL
- **HOOS-PS or KOOS-PS**; range, 0-100, with lower values indicating lower physical impairment
- **PROMIS–fatigue**; range, 33.7-75.8, with lower values indicating lower levels of fatigue,
- **PROMIS-depression**; range, 41-79.4, with lower values indicating lower levels of depression

## RESULTS

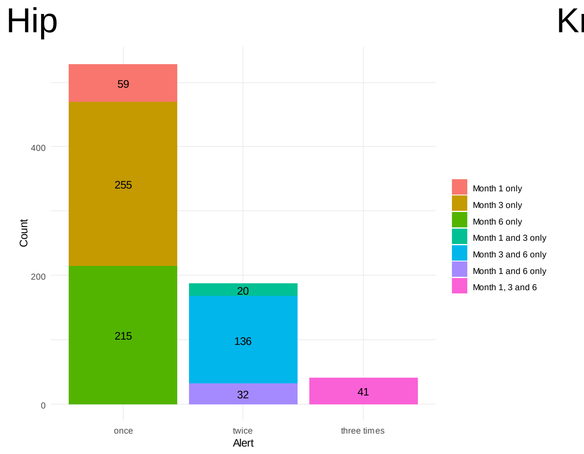
The study included 3697 patients with hip replacement (mean [SD] age, 65.8 [10.6] years; 2065 women [55.9%]) and 3110 patients with knee replacement (mean [SD] age, 66.0 [9.2] years; 1669 women [53.7%]).

**Exploratory analyses**

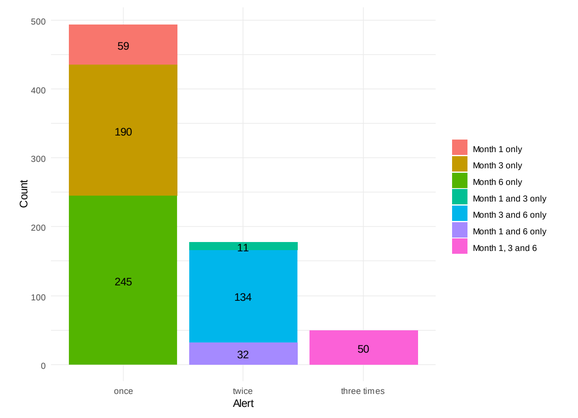
**showed significantly better health outcomes in the intervention group on all PROMs except the EQ-5D-5L** among patients with hip replacement, with a 2.10-point increase on the EQ-VAS in the intervention group compared with the control group (HOOS-PS, −1.86 points; PROMIS-fatigue, −0.69 points; PROMIS-depression, −0.57 points). Patients in the intervention group with knee replacement had a 1.24-point increase on the EQ-VAS, as well as significantly better scores on the KOOS-PS (−0.99 points) and PROMIS-fatigue (−0.84 points) compared with the control group.

**Count of patients whose PROM-scores initiated alerts**

Hip



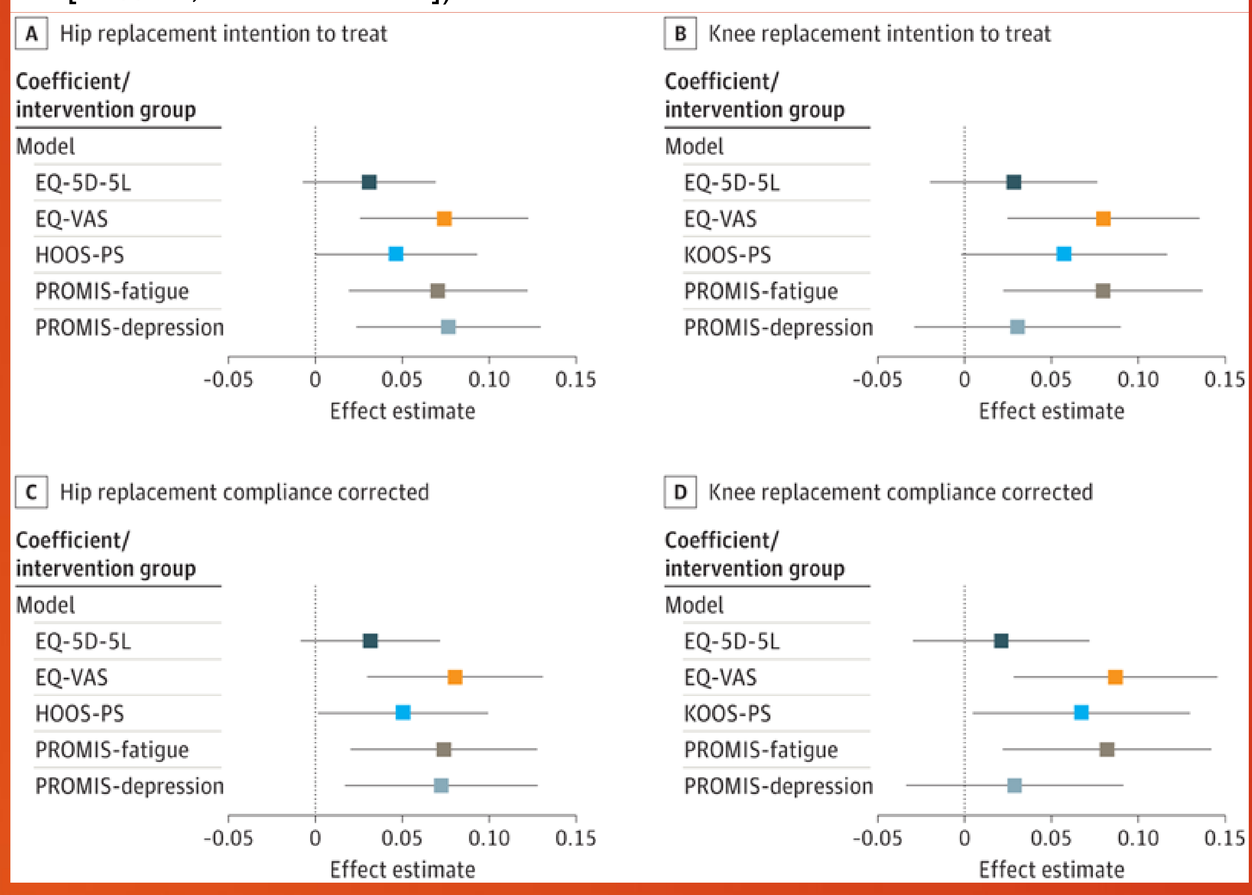

Knee




**Mixed-effect models (main analyses)**

**showed a significant difference in improvement on**

- **the EQ-VAS** (hip replacement: effect estimate [EE], 1.66 [95% CI, 0.58-2.74]; knee replacement: EE, 1.71 [95% CI, 0.53-2.90])
- **the PROMIS-fatigue** (hip replacement: EE, −0.65 [95% CI, −1.12 to −0.18]; knee replacement: EE, −0.71 [95% CI, −1.23 to −0.20])
- **the PROMIS-depression** score in the hip replacement group (EE, −0.60 [95% CI, −1.01 to −0.18]).




*The mixed-effect models used z scores as outcomes. The z scores were used as outcomes to standardize the different PROM scores on 1 scale and thereby facilitate the comparison of different PROM scores. In their raw form, the PROM scores are measured on different scales and would hence not be directly comparable. The compliance-corrected analysis excludes all patients who did not answer the PROMs at a minimum of 2 intervention time points in the intervention group; effect estimates above zero indicate better health changes in the intervention group, whereas estimates below zero indicate better health levels in the control group. EQ-5D-5L indicates European Quality of Life 5-Dimension 5-Level version; EQ-VAS, European Quality of Life Visual Analogue Scale; HOOS-PS, Hip Disability and Osteoarthritis Outcome Score–Physical Function Shortform; KOOS-PS, Knee Injury and Osteoarthritis Outcome Score–Physical Function Shortform; and PROMIS, Patient-Reported Outcomes Measurement Information System.

**CONCLUSION** In this randomized clinical trial, the PROM-based monitoring intervention led to a small improvement in HRQOL and fatigue among patients with hip or knee replacement, as well as in depression among patients with hip replacement. Further research on the ideal time intervals, the timeframe, and the effects of the different intervention steps, especially the potential caring effect of the monitoring and PROM-based telephone call follow-up conversations, is needed.

This paper has been published in JAMA Network Open

This poster is presented at the ICHOM Conference 2023

ICHOM NEJM Catalyst

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