Appendix

Univariate analysis

Missing baseline characteristics were imputed, independently for each joint, using Multiple Imputation by Chained Equations (MICE) by predictive mean matching for numeric data, logistic regression for binary data, and multinomial regression imputation for factors with > 2 levels to avoid deletion of near-complete cases.

Predictors of follow-up method

A multinomial logistic regression model was built to determine significant predictors of follow-up group [19]. The reference category chosen was 'automated contact resulting in comparisons being made between the automated and manual contact groups, and the automated contact group and non-responders. First, exploratory analysis was done to identify potential non-linear relationships between numeric predictors and the outcome. Restricted-cubic splines were then added in each multivariate model and were removed if Akaike's Information Criterion (AIC) showed no decrease. The relative contribution (the total effect) of each predictor was then ranked according to the increase in AIC upon removal from the full model. Estimates of relative-risk, 95% confidence intervals, and p-values were computed. Prior to modeling, numeric predictors were scaled by dividing by its maximum to ensure reliable estimation, and coefficients were re-scaled to reflect the original units. The effects of non-linear relationships were visualized by conditioning on the median of observed numeric predictors, and the most frequent class for categorical factors.

Predictors of 1-year pain scores

Proportional-odds logistic regression was used to model the 1-year pain score due to non-normal residuals, making an ordinary linear model inadequate [6]. The relative contribution of characteristics in each model were again ranked by the increase in AIC upon removal from the full model. Odds-ratios, 95% confidence intervals, and p-values were reported for each characteristic. P-values < 0.05 were considered statistically significant. Nomogram representations of the proportional-odds models were obtained by mapping the linear predictor to an expected score by a weighted average, allowing the effects of variables to be observed on the scores themselves.

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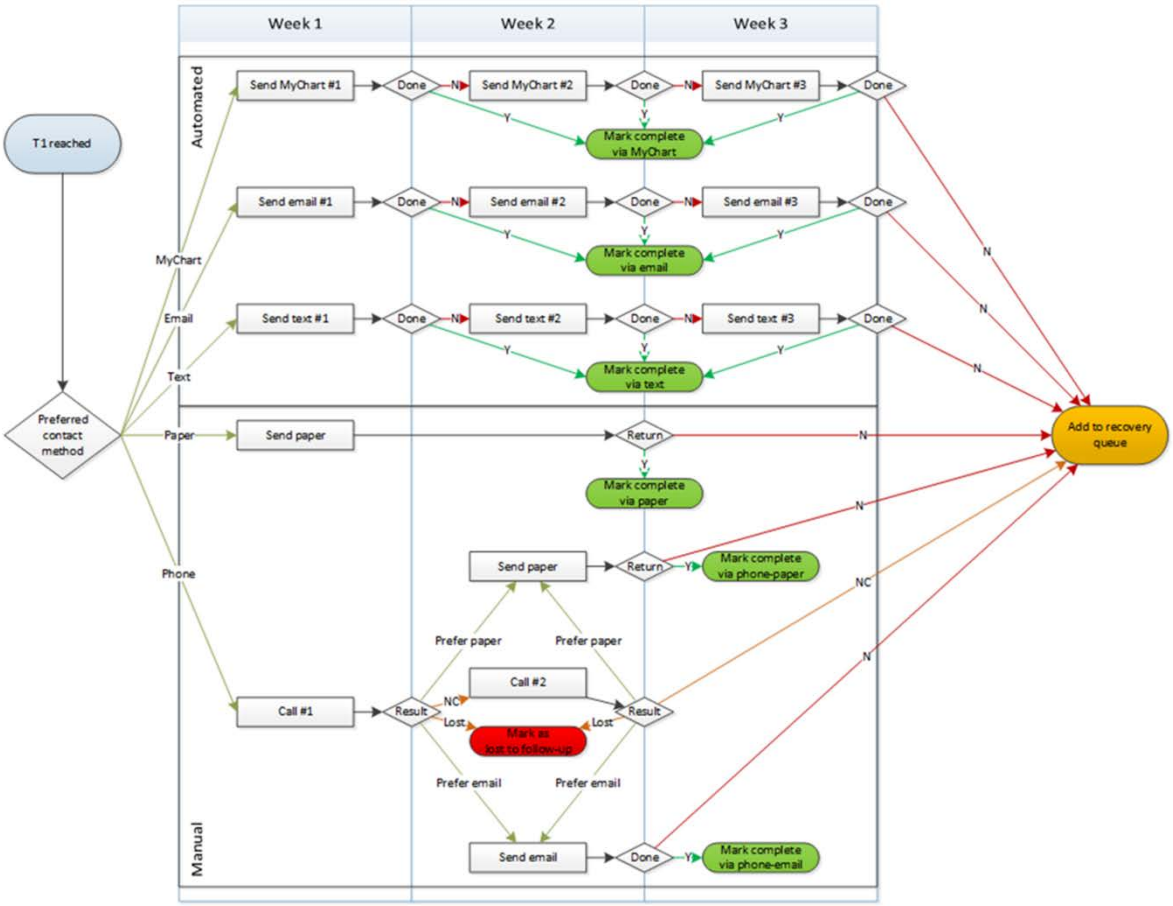
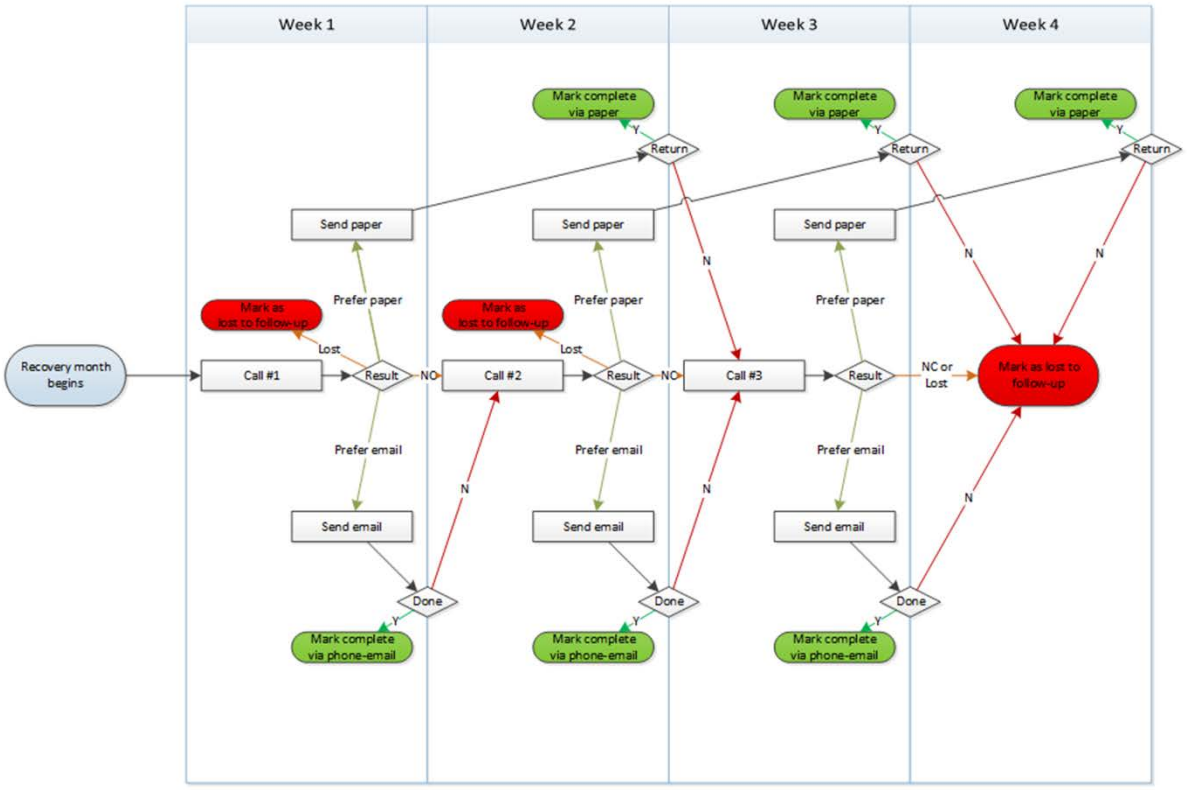
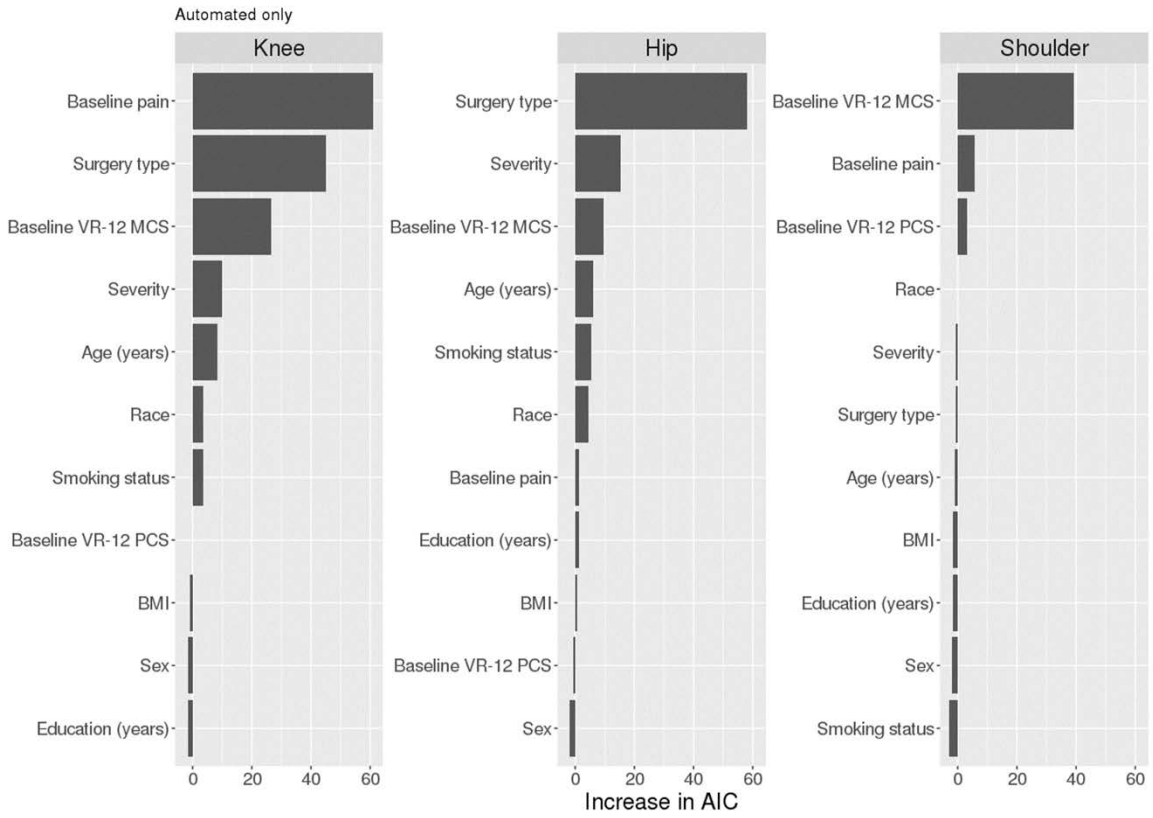


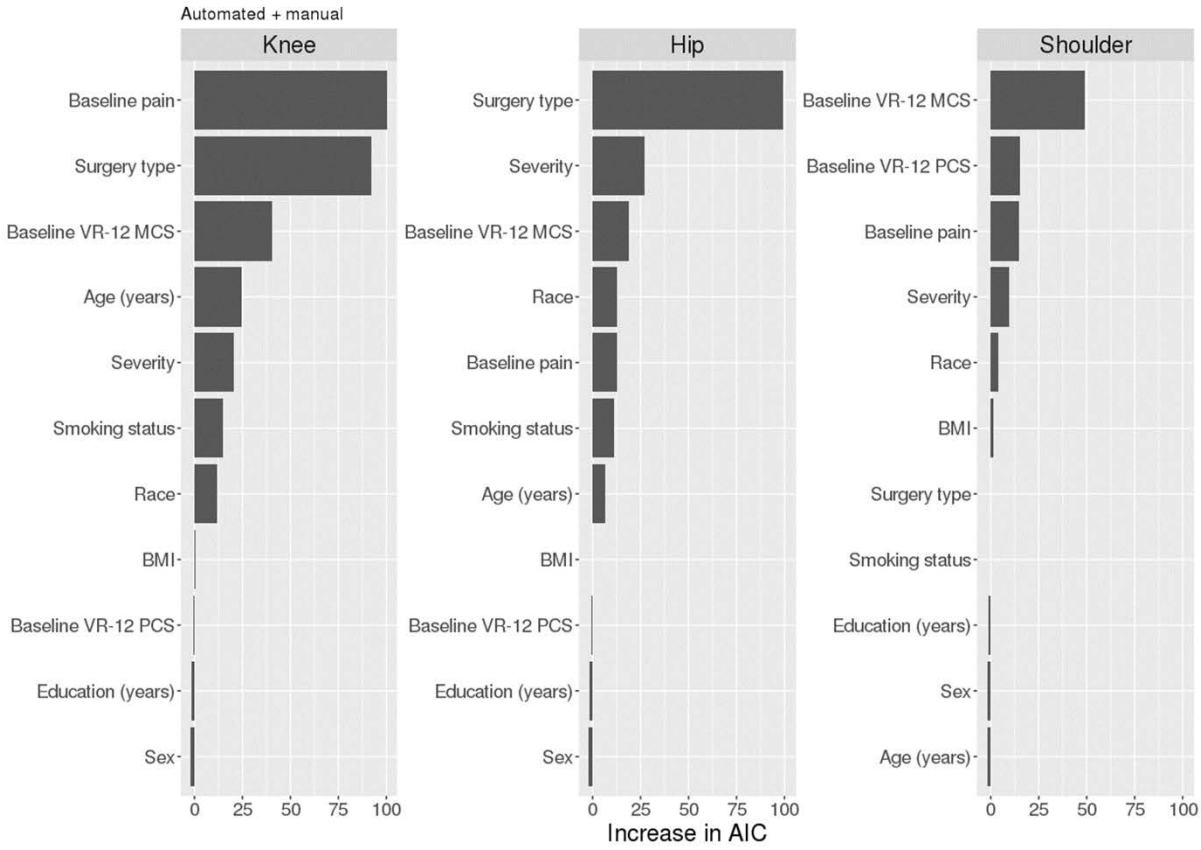
Appendix Figure 1A. Initial stage of follow-up algorithm including automated (patient portal, email, or text messages) and manual (human-operated call or mailed paper questionnaires) methods of patient contact.



Appendix Figure 1B. Recovery stage of follow-up algorithm driven by manual methods (human-operated call) of patient contact.



Appendix Figure 2. Relative contribution of baseline characteristics on predicting 1-year pain for automated follow-up patients based on the removal of each variable from a proportional-odds logistic regression model stratified by joint.



Appendix Figure 3. Relative contribution of baseline characteristics on predicting 1-year pain for automated and manual follow-up patients based on the removal of each variable from a proportional-odds logistic regression model stratified by joint.

Appendix Table 1. Descriptive summary of patient characteristics for the full cohort and stratified by joint of surgery and overall.

		Joint of surgery				
Variable	Level	Knee (N=2968)	Hip (N=1553)	Shoulder (N=1314)	Overall (N=5835)	No. missing
Sex						0
	Female	1490 (50.2%)	754 (48.55%)	468 (35.62%)	2712 (46.48%)	
	Male	1478 (49.8%)	799 (51.45%)	846 (64.38%)	3123 (53.52%)	
Age (years)		53 (31, 65)	59 (47, 68)	54 (41, 64)	55 (38, 66)	0
Race						285
	White	2342 (78.91%)	1292 (83.19%)	1085 (82.57%)	4719 (80.87%)	
	Black	417 (14.05%)	140 (9.01%)	130 (9.89%)	687 (11.77%)	
	Other	85 (2.86%)	31 (2%)	28 (2.13%)	144 (2.47%)	
	(missing)	124 (4.18%)	90 (5.8%)	71 (5.4%)	285 (4.88%)	
BMI		28.89 (25.06, 33.72)	28.03 (24.63, 32.57)	28.18 (25.1, 32.34)	28.4 (24.97, 33.12)	0
Education (years)		14 (12, 16)	14 (12, 16)	14 (12, 16)	14 (12, 16)	0
Smoking status						0
	Never	1912 (64.42%)	875 (56.34%)	743 (56.54%)	3530 (60.5%)	
	Quit	800 (26.95%)	539 (34.71%)	400 (30.44%)	1739 (29.8%)	
	Current	256 (8.63%)	139 (8.95%)	171 (13.01%)	566 (9.7%)	
Surgery type						0
	Arthroplasty	1193 (40.2%)	1233 (79.39%)	236 (17.96%)	2662 (45.62%)	
	Scope/Other	1775 (59.8%)	320 (20.61%)	1078 (82.04%)	3173 (54.38%)	
Severity						0
	Primary	2763 (93.09%)	1394 (89.76%)	1240 (94.37%)	5397 (92.49%)	
	Revision	205 (6.91%)	159 (10.24%)	74 (5.63%)	438 (7.51%)	
Baseline pain		47.22 (33.33, 63.89)	40 (27.5, 50)	13 (8, 18)	37.5 (19, 52.78)	4
Baseline VR-12 PCS		30.74 (24.45, 39.35)	27.15 (21.48, 33.67)	35.38 (28.85, 42.79)	30.79 (24.26, 38.97)	5
Baseline VR-12 MCS		53.9 (43.34, 61.47)	51.02 (39.72, 59.9)	53.58 (43.21, 60.56)	53.11 (42.5, 60.86)	5