Introduction:
Annually in Denmark 2000 surgical interventions are performed for degenerative cervical spine disease. Of these 2 out of 3 reach 1-year patient satisfaction. The Danish national spine surgical database, DaneSpine (DS), is the national biggest patient reported outcome measure (PROM) database. Big data analysis methods, such as Machine Learning (ML), can recognize complex data patterns, which in DS can be used to predict PROM. Big data-driven prediction may assist the preoperative counseling of patients and their selection for surgery. We hypothesize that ML is superior of conventional stepwise logistic regression (CSLR) when predicting 1-year patient satisfaction.
Methods:
Patients registered from 1st Jan 2009 - 31st Dec 2020 in DS with and surgically treated for cervical radiculopathy (M501 & M472a), who returned baseline and 1-year PROM were included. Following imputation of missing data an 80/20 split of data was made for model development and validation respectively. 2 CSLR and 2 ML models was developed. CSLR variable selection was based on a univariate (uni-multi) and a multivariate (multi-multi) approach across all preoperative variables. Variables of association strength $p \leq 0.1$ in the majority of the imputed datasets was chosen. Summative models were constructed by Rubin's Rule. Gradient Boosting Trees (GBT) and Random Forest (RF) algorithms was used as ML models. All preoperative variables were included in development and accuracy was used to choose the best model. Accuracy was the primary comparative outcome.
Results:
9877 patients were eligible nationally. 2199 met inclusion criteria. From these the average missing data rate was 19.6% why 20 imputed datasets were produced. The mean proportion of 1-year satisfaction was 67%. Internal validation of developed models on test data yielded accuracies of 66%, 67%, 69% and 70% for uni-multi, multi-multi, GBT and RF.
Conclusion:
This study was not able to provide a clinically relevant prediction models of 1-year patient satisfaction following treatment for cervical radiculopathy.