# DISEASE TRAJECTORY PREDICTION AMONG CANCER PATIENTS

Cancer is the main cause of morbidity and mortality in Lithuania and all around the world. Monitoring oncology patients can be achieved by passively collecting information via smart devices in the patient's natural environment. Methods such as time series analysis and statistical analysis can be extremely useful in predicting the development of an illness or the physical condition of a patient. Moreover, using these methods, patients can be monitored in real-time without direct contact, potential problems can be identified, and early interventions can be planned in case of negative changes in their condition.

## DATA FOR ANALYSIS:

- Accelerometer data was passively collected by LAIMA Monitoring & Intervention System
- Active period hours per day were computed for each patient
- 90 treatment days of 30 cancer patients were analyzed

## ANALYSIS PROCCESS:

1. Data of first 60 treatment days was assigned to the training sample, the next 30 days - to the test sample.
2. The forecasting was performed using five time series models: ARIMA, Holt's Trend, TBATS, Simple Exponential Smoothing and Naïve model.
3. The most suitable model was selected after evaluating the mean absolute percentage error in a training set.
4. 30 days forecasts of active period hours for each patient were performed.
5. The performance of the forecasting models was evaluated using root mean square error (RMSE), mean absolute percentage error (MAPE) and mean absolute error (MAE).

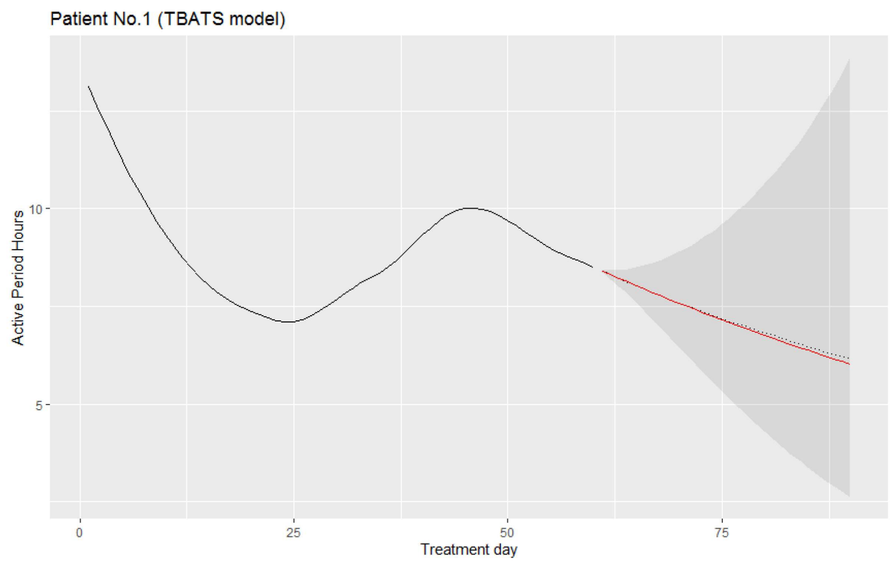
$$RMSE = \sqrt{\frac{\sum_{i=1}^{N}(Predicted_i - Actual_i)^2}{N}}$$

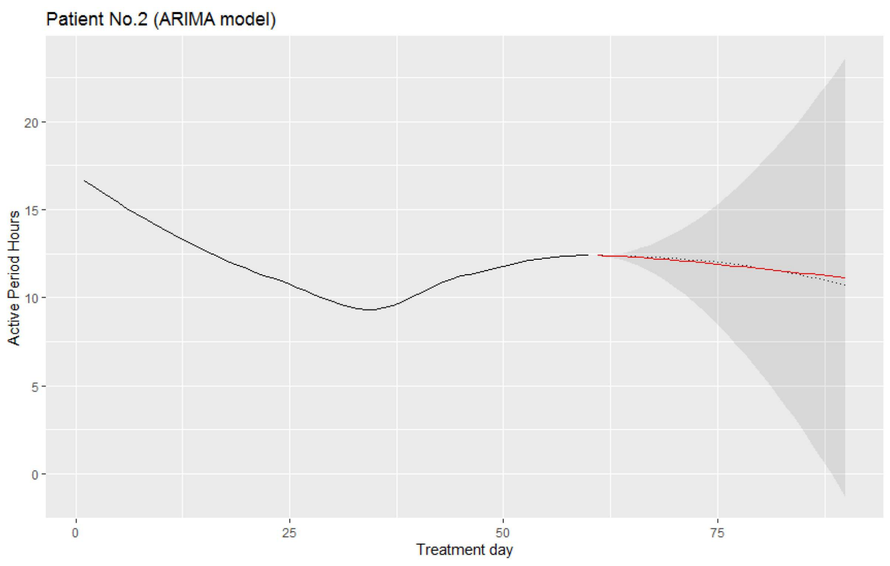
$$MAPE = \frac{1}{N}\sum_{i=1}^{N}\frac{|Actual_i - Predicted_i|}{Actual_i}$$

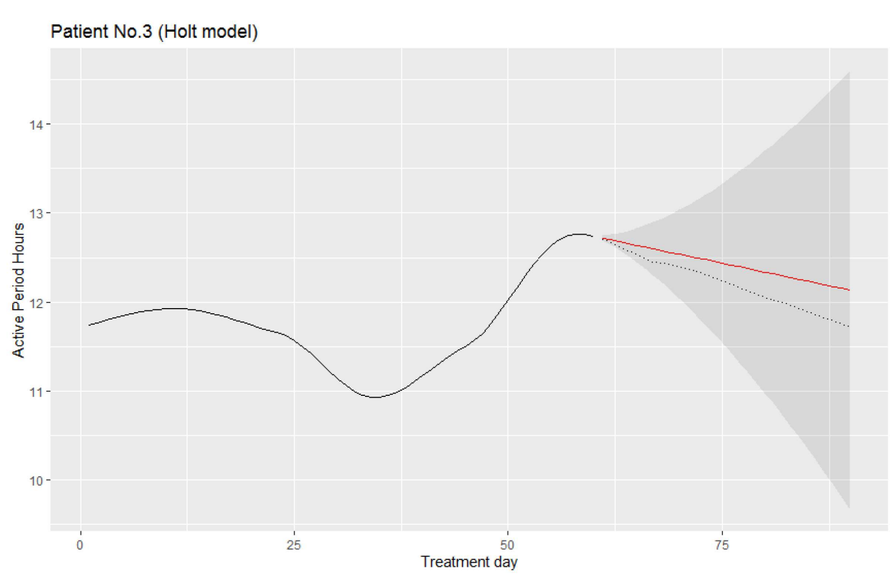
$$MAE = \frac{1}{N}\sum_{i=1}^{N}|Actual_i - Predicted_i|$$

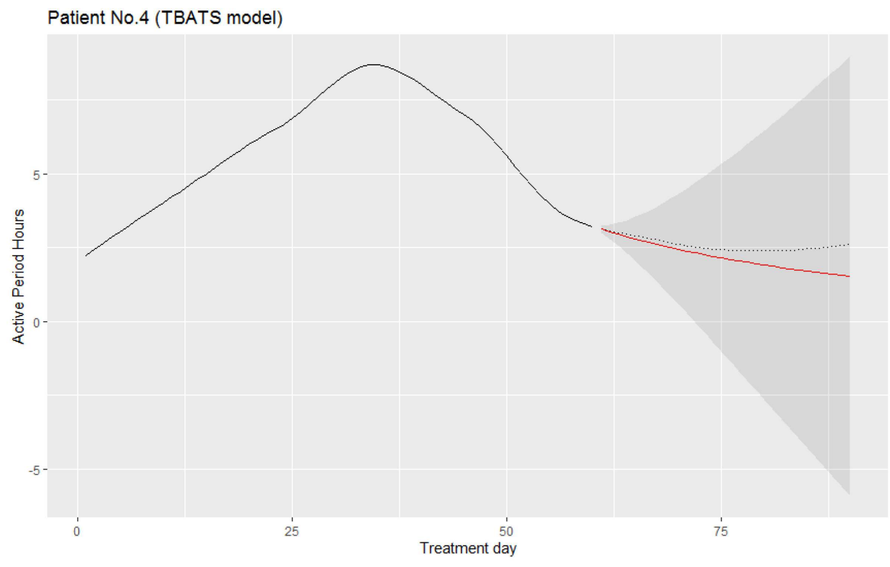
$$MSE = \frac{1}{N}\sum_{i=1}^{N}(Actual_i - Predicted_i)^2$$

| Patient | Model | RMSE | MAPE | MAE | MSE |
|---|---|---|---|---|---|
| No. 1 | TBATS | 0.060 | 0.007 | 0.045 | 0.004 |
| No. 2 | ARIMA | 1.141 | 0.009 | 0.101 | 0.020 |
| No. 3 | Holt | 0.248 | 0.018 | 0.221 | 0.061 |
| No. 4 | TBATS | 0.513 | 0.160 | 0.401 | 0.263 |




## RESULTS:

30 patients' models frequency and the average errors

| Model | Frequency | % | RMSE | MAPE | MAE | MSE |
|---|---|---|---|---|---|---|
| Naive | 7 | 22% | 0.646 | 0.087 | 0.582 | 0.436 |
| Ses | 6 | 19% | 1.621 | 0.266 | 1.155 | 3.739 |
| Holt | 8 | 25% | 0.753 | 0.278 | 0.580 | 0.831 |
| ARIMA | 8 | 25% | 1.035 | 0.111 | 0.810 | 1.406 |
| TBATS | 3 | 9% | 0.525 | 0.083 | 0.383 | 0.423 |

## FUTURE PLANS:

Build prediction models by including additional independent variables and refine predictions.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