



FORECASTING POST-MATCH PHYSICAL CAPABILITY RECOVERY IN ELITE FOOTBALL

CAN GPS TRAINING LOAD IMPROVE TIME SERIES FORECASTING ACCURACY?

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DEMANDS OF ELITE FOOTBALL

- Involves high intensity running, ball involvement, tackles, sprinting and explosive movements throughout the game. ₁
- Physical demands create fatigue that affect subsequent performance. ₂
- Monitoring of training load is essential to maintain elite performance standards throughout the season. ₃



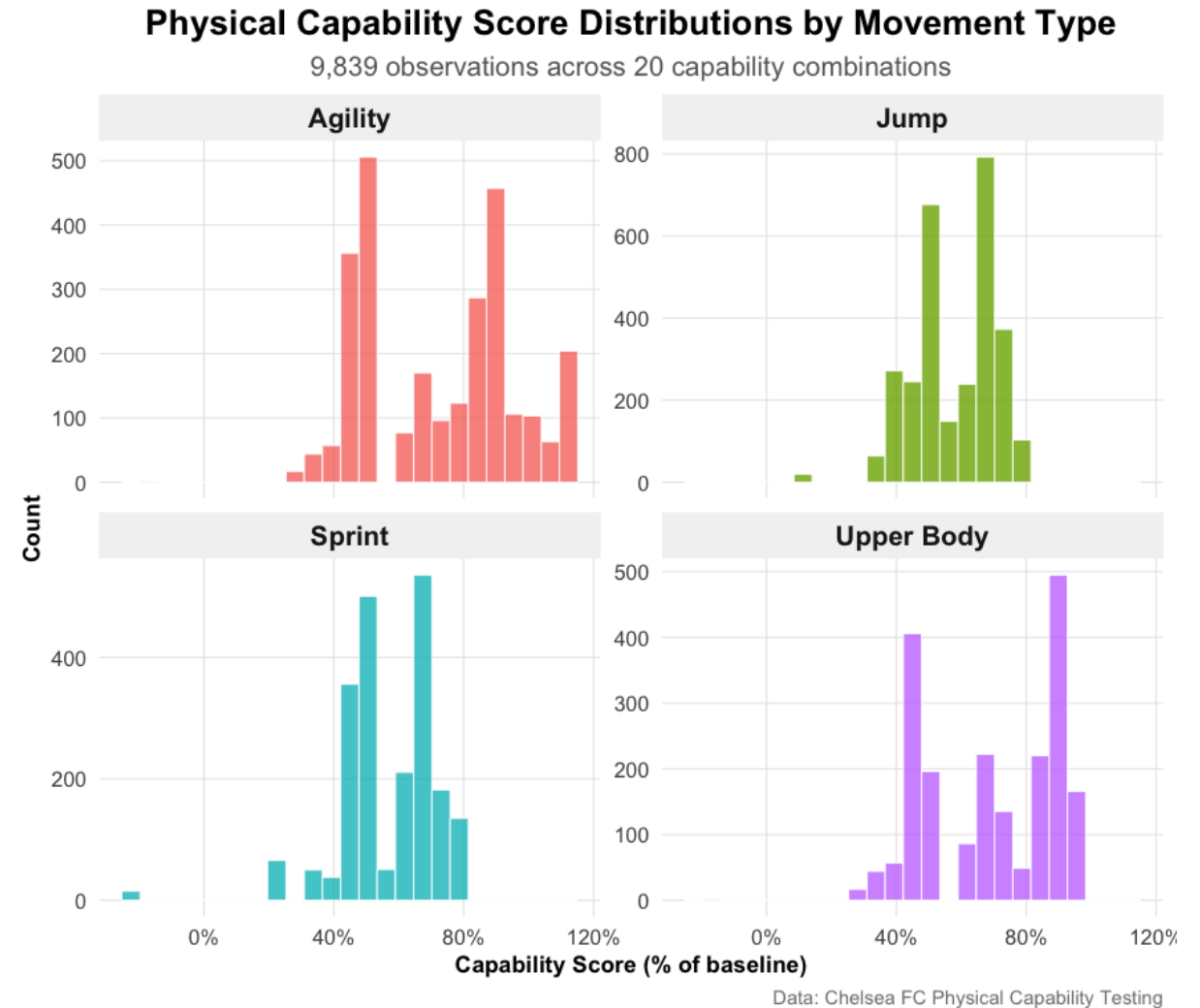
THE NEED TO FORECAST PLAYER CAPABILITY

- Individual player capability is composed of anthropometric, physiological and physical attributes. ⁴
- Influenced by training load and game intensity. ⁵
- Incorrect planning can lead to increased injury risk and/or performance loss, decreased capability ⁶
- Evidence based modelling tools will optimise decision making and training load management of players



THE DATASET

- Chelsea FC dataset spanning over 2+ years.³
- Includes physical capability and GPS and HR data.⁴
- 20 different capability combinations across 4 movement types. 5 HR Zones
- After data cleaning – 93 match codes available to analyse



AIM

- Develop evidence-based forecasting tools for coaching and S&C staff to predict physical capability recovery patterns following match demands in elite football

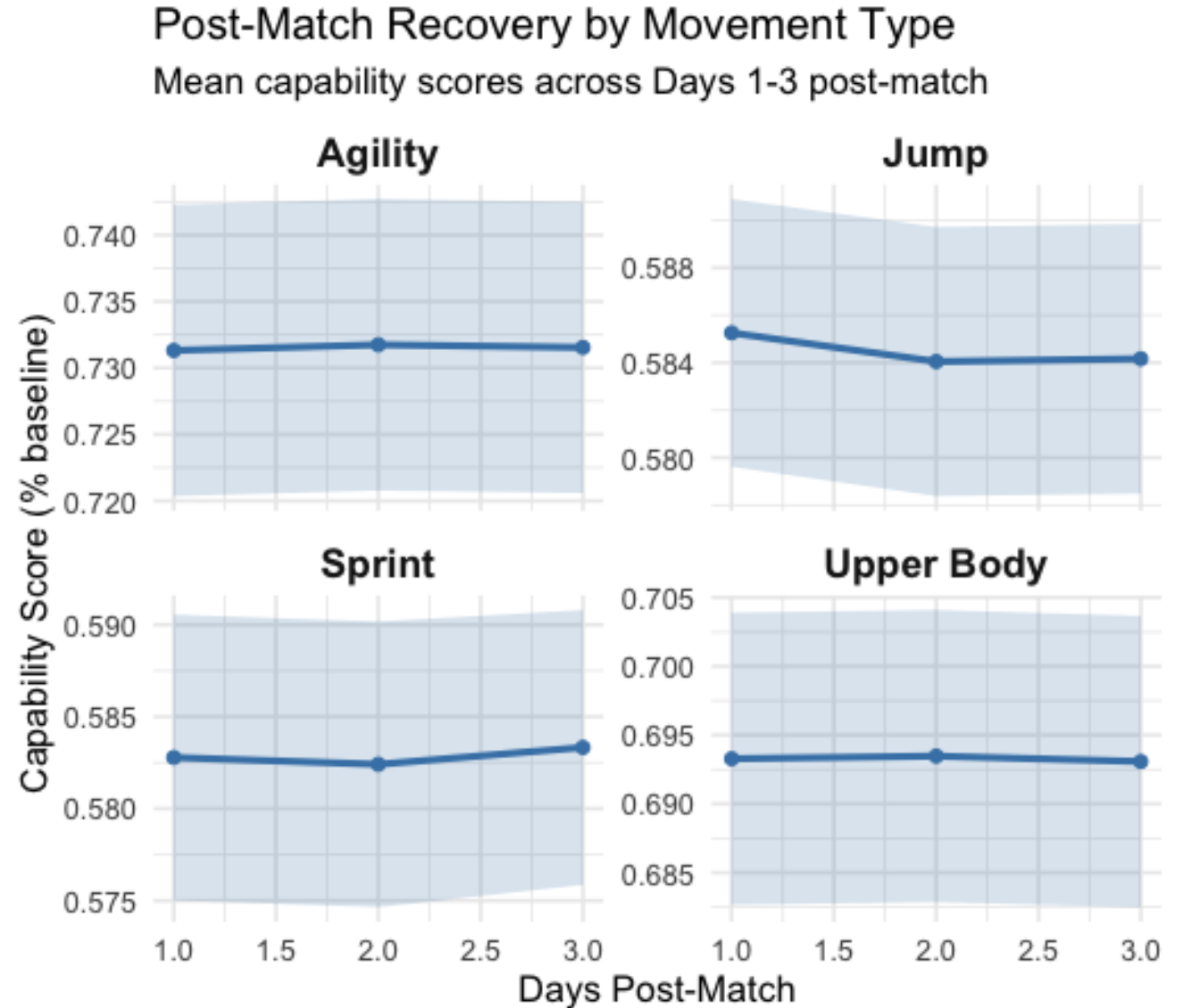
HYPOTHESIS

- GPS and HR match intensity data will not improve time series forecasting accuracy of physical capability recovery compared to capability-only models

METHODOLOGY

STUDY DESIGN

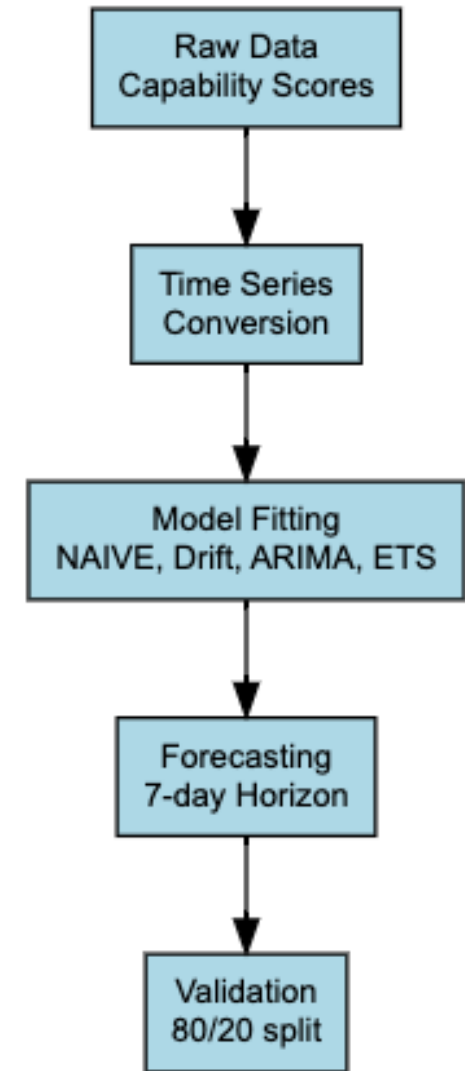
- Recovery window: Days 1-3 post-match
- Median 4.5 days between matches
- 93 matches over 2+ years
- Recovery patterns analysed per movement type
- 4603 total observations



METHODOLOGY

FORECASTING

- Daily capability scores converted to tsibble format
- Systematic fpp3 forecasting applied
- Four model types fitted: NAIVE, Drift, ARIMA, ETS
- 80/20 train-test split for validation
- 7 day forecast horizon generated
- Independent modelling per capability / movement type
- RMSE selected as primary accuracy metric



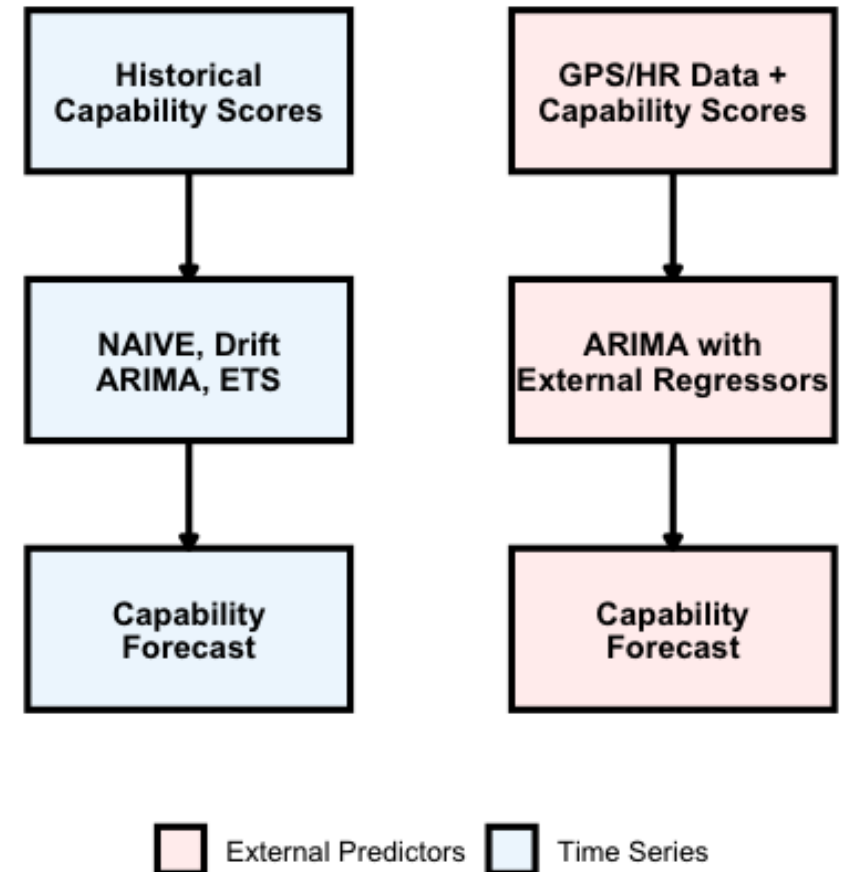
METHODOLOGY

GPS / HR VARIABLE FORECASTING

- Filler
 - Filler

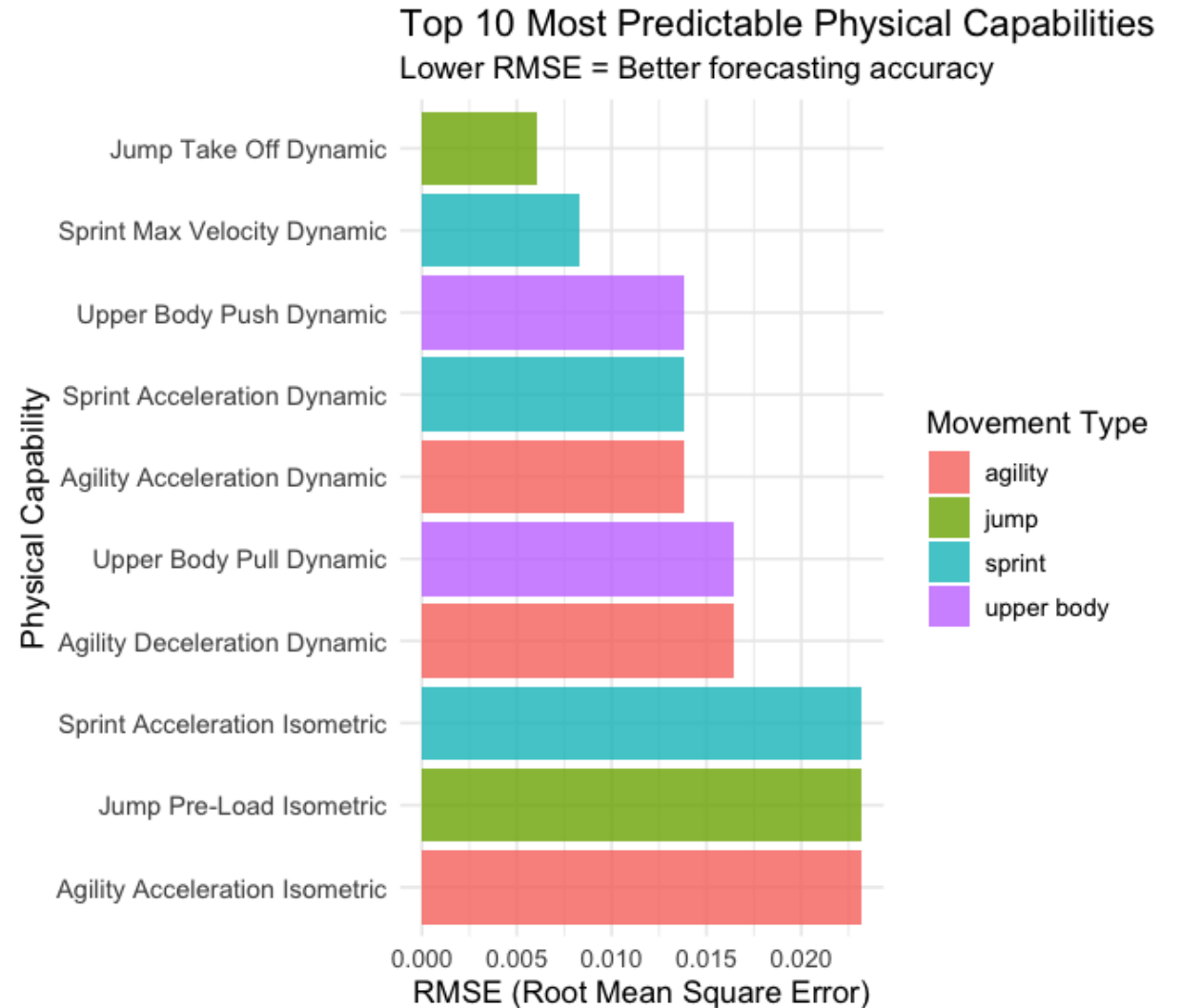
Forecasting Method Comparison Framework

Pure time series vs ARIMA with GPS/HR external regressors



INDIVIDUAL CAPABILITY FORECASTING

- Movement type influences forecasting accuracy
- Explosive movements generally more predictable than control movements
- Dynamic more predictable than isometric

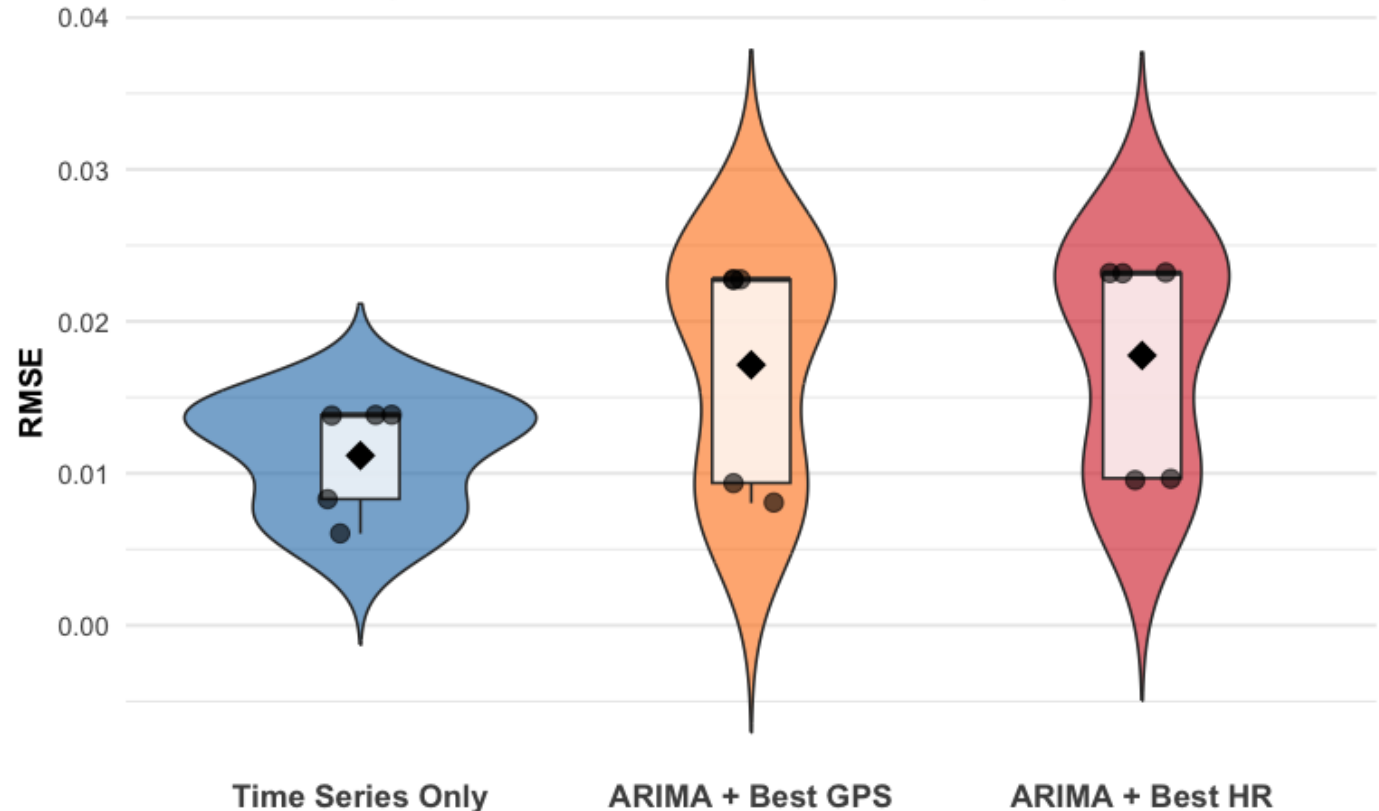


TIME SERIES VS EXTERNAL VARIABLES

- Time series: 0.031 RMSE & Won 16/19
- Best individual GPS/HR predictor (HSR >27): 0.042
- Combined GPS (HSR>27,>24 + Accel>4.5): 0.042
- Combined GPS + HR (HSR>27. + HR zones 4+5): 0.042

Time Series Methods Outperform External Predictors

Comprehensive test: 17 GPS/HR metrics across top 5 capabilities



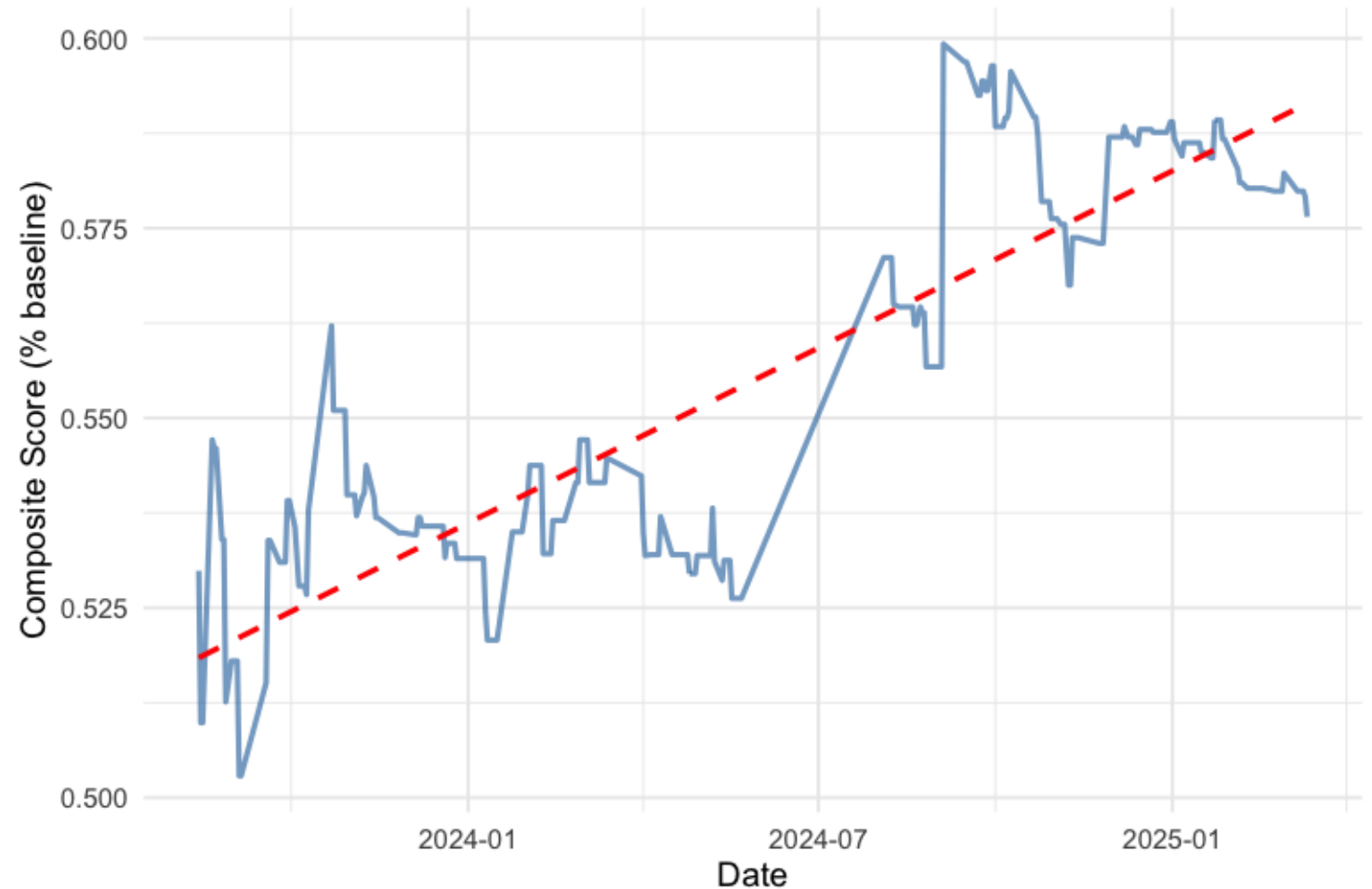
Lower = Better | Diamond = Mean | Best single predictor shown per capability

COMPOSITE SCORE ANALYSIS

- Top 4 capabilities combined into composite metric
- Temporal autocorrelation validates time series approach
- Upward capability trend
- Cycle fluctuations

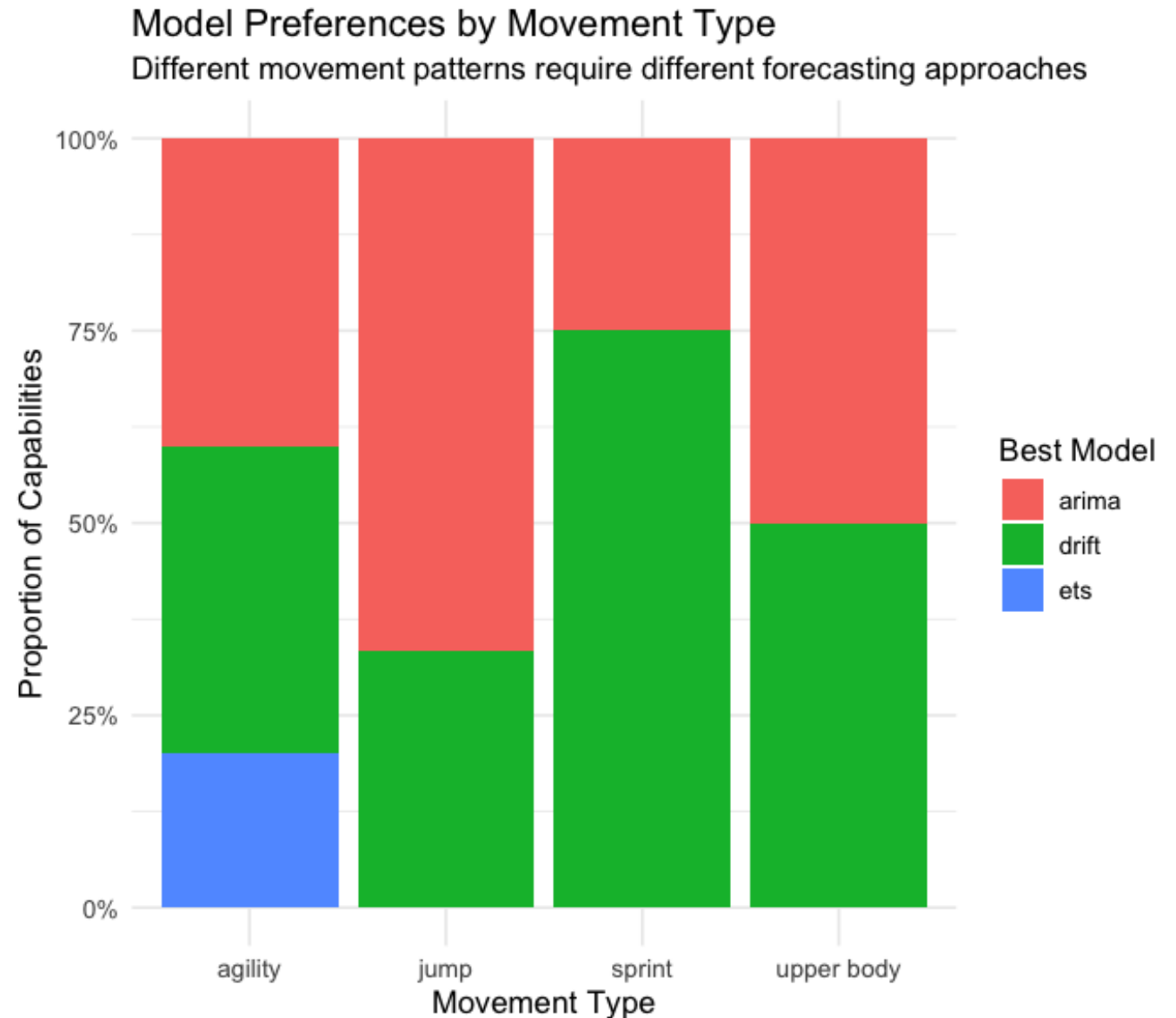
Composite Capability Score Over Time

Combined top 4 capabilities show predictable temporal patterns



MOVEMENT SPECIFIC INSIGHTS

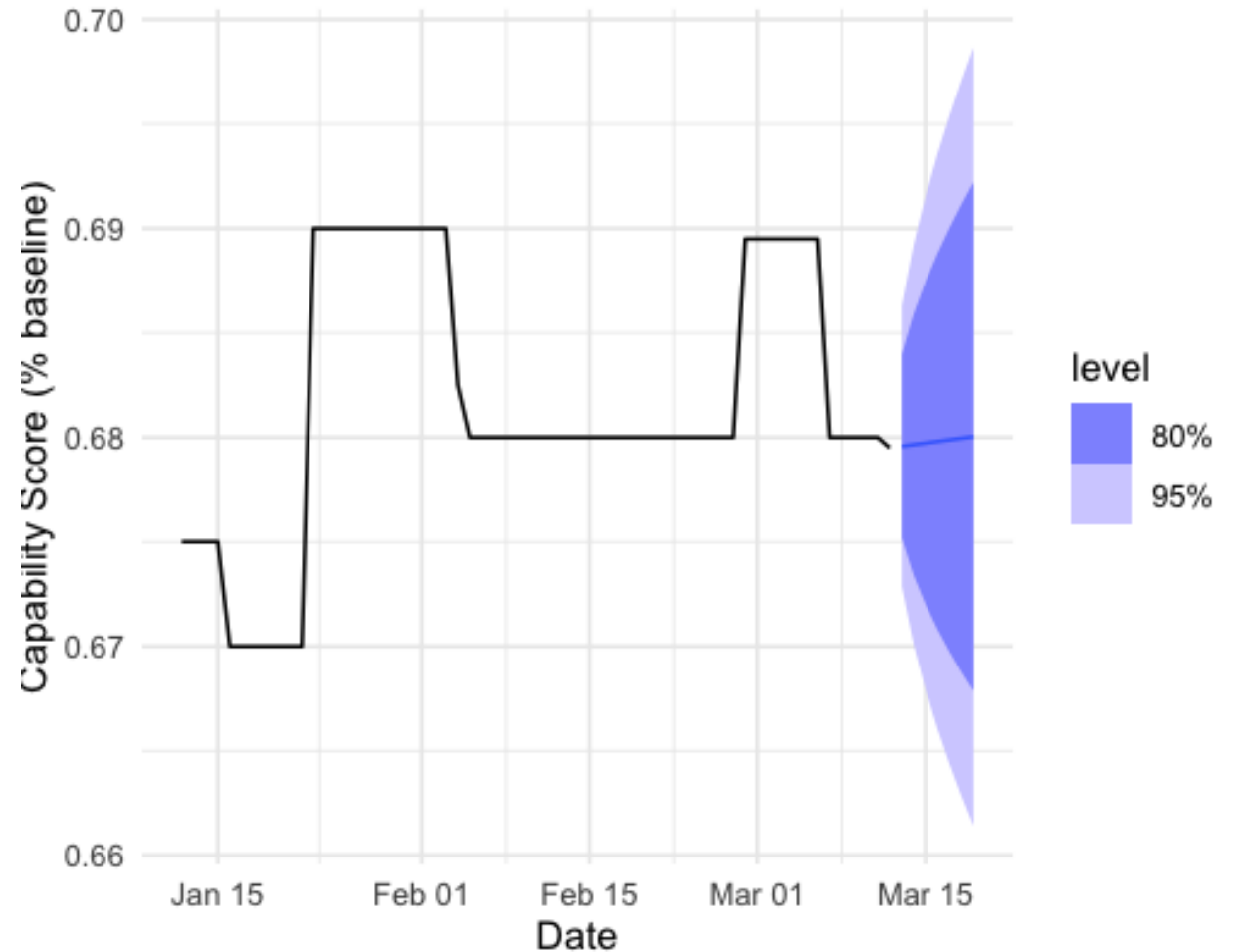
- Sprint capabilities:
Drift models optimal
- Jump capabilities:
ARIMA models optimal
- Agility & upper body:
Mixed model
- Movement specific modeling vital for accuracy



FUTURE CAPABILITY PREDICTIONS

- 7-day Jump Takeoff forecast: Drift Model
- Stable prediction at ~68-69%
- Confidence levels indicate uncertainty increasing over time

7-Day Capability Score Forecast Example
Jump Takeoff Dynamic - Drift Model (RMSE: 0.00604)



DISCUSSION HIGHLIGHTS

- Sprint models favour Drift; jump favour Arima; mixed for agility/upper body.
- GPS/HR improved 3/19 capabilities with <1% of gains when present.
- Historic capability trends > Match intensity for recovery and capability readiness
- Coaches can forecast recovery without GPS / HR tools



FUTURE RESEARCH & LIMITATIONS

■ Future research

- Player-specific forecasting models
- Contextual match factors
- Integration of physiological biomarkers with subjective wellness reporting

■ Limitations

- Single club dataset
- Small match sample
- Short recovery window (3 days)
- Missing injury/illness data



THANK YOU



REFERENCES

1. /S0001433821090395