Volleyball Nations League Analysis
An Executive Summary by Victoria Hannaford and Megan Lieb

Background: We procured data for the women's Volleyball Nations League tournament in order to explore what statistics make a volleyball team successful. The VNL is an annual international tournament featuring both men's and women's national volleyball teams. It consists of a round robin tournament, followed by a final, championship round. The tournament has been active for three years: 2021, 2022, and 2023, with the fourth tournament occurring in May of 2024. Our statistical analysis included an ARIMA time series model and expanding window cross validation to predict a 2024 VNL women's tournament winner. Once we predicted a winner for the 2024 women's VNL, we examined the statistics of past players on that team to determine if certain player attributes contributed to their predicted victory.

Methods: Using R, we fit an ARIMA time series model for tournament points won, total sets won, and point ratio of each team from the prior three seasons, to predict the winner of the 2024 VNL. Following our time series analysis, we used expanding window cross validation to determine the accuracy of our time series model. We performed three separate cross validations, one for each variable, and examined the RMSE and MAE for each model. Additionally, we performed Support Vector Machine regression using individual player statistics to predict various statistics for the 2024 VNL. We specifically created models predicting the attacking efficiency and blocking success of the players. These two variables were previously found to contribute most to team success in women's volleyball.

Results: The results from our time series analysis indicated that Italy would win the 2024 VNL. To validate this prediction and assess our model's forecasting ability, we used expanding window cross validation. We did cross validation for three time series models: tournament points, total matches won, and point ratio. The cross validation results for tournament points produced an RMSE of 5.19 and MAE of 3.86. The results for the total matches won cross validation produced an RMSE of 1.95 and MAE of 1.36. The point ratio cross validation results produced an RMSE of 0.13 and MAE of 0.09. Following our team analysis, we used SVMs to investigate the individual player statistics that contributed to Italy's predicted win. We created two models: the first with efficiency as the explanatory variable, and the other with blocking successBoth models used total points as the response variable. The first model underestimated the total points scored for players with higher efficiencies. Our second model underestimated the total points for those with a block success rate between 15 and 25 percent, however, it overestimated the number of players who have high rates of block success.

Conclusion: Based on our time series model, Italy was our predicted winner for the 2024 women's VNL tournament. This could be attributed to the fact that their players have been improving over time. They also have high efficiency ratings and block success rates, which are indicative of team success in both competitive and lopsided matches. In the future it would be interesting to look at teams like Turkey who won the VNL in 2023 and the United States who won in 2021.