

The Paradox of First Powerplay in Ice Hockey: Examining the Limited Impact of Early Numerical Advantage

Liuxi Mei, Yuting Huang, Xiaochen Liu, and Lei Meng

Linköping University, Linköping 58183, Sweden

Abstract. In ice hockey, securing an early power play is traditionally viewed as an advantageous opportunity, yet statistical evidence reveals a counterintuitive phenomenon: teams gaining this numerical advantage frequently fail to secure victory. Through comparative statistical analysis of professional league data, this research highlights two key patterns associated with this paradox: increased backchecking distances during first power plays (averaging 81.93 units versus the normal 78.62) and heightened vulnerability to opponent shots despite numerical advantage. Teams with early power plays expend excessive energy retrieving opponent dump-outs while showing no improvement in offensive efficiency. This study suggests that successful power play conversion requires balancing offensive aggression with defensive stability, providing practical insights for strategic adaptation in competitive ice hockey.

Keywords: Power Play · Ice Hockey · Strategic Analysis.

1 Introduction

When a penalty is assessed against a team in ice hockey, the opposing team receives a "power play" - a numerical advantage with one additional player on the ice. Securing this advantage early in competition is conventionally regarded as a strategic benefit [1]. However, our analysis of 156 professional ice hockey matches reveals a counterintuitive relationship between power play opportunities and match outcomes. Teams that secure the first power play win only 49.68% of the games, effectively demonstrating no advantage over their opponents. Furthermore, teams accumulating more power play opportunities throughout the game actually lose more frequently (50.64% of matches) than they win (45.51%), with 3.85% of games showing equal power play distribution.

This paradoxical relationship between power play opportunities and match outcomes warrants investigation. When a team has a power play, they may focus too much on scoring quickly and neglect defensive responsibilities. Meanwhile, the penalized team can use this time to regroup and plan counterattacks. Our analysis indicates that during first power plays, players must run longer distances to retrieve pucks after opponent dump-outs (averaging 81.93 units compared to the normal 78.62), potentially contributing to increased fatigue.

This paper examines why early power plays do not always lead to wins through statistical analysis of game data. Similarly to the approaches used by Bagchi et al. [2] who identified key game-related statistics that discriminate between winning and losing teams in field hockey, we hope to provide practical advice to coaches and players by analyzing specific game examples and strategies.

2 Background

A power play in ice hockey occurs when a team gains an additional player on the ice because the opposing team broke a rule (e.g., tripping or slashing). This advantage lasts for 2 minutes, giving the penalized team fewer players to defend. Teams prioritize getting power plays early in games because they believe it creates a strong chance to score.

Barilla et al.[6] highlight that power plays represent approximately 17-20% of total match time in modern ice hockey, with teams having 5-6 power play opportunities per match on average. Their analysis of power play efficiency revealed that the success rate of power plays has a significant impact on match outcomes, with winning teams converting 22.31% of their power play opportunities compared to just 11.36% for losing teams. However, the correlation between power play efficiency and final tournament standings was only moderate, suggesting that other tactical elements beyond power play conversion influence overall success.

This finding aligns with Tian and Xu’s [4] research on elite women’s ice hockey, which demonstrated that the quality of offensive execution rather than merely having numerical advantage situations is what determines match outcomes. They found that specific offensive tactics and shot selection during advantage situations were more important predictors of success than the frequency of power plays or other offensive opportunities.

These insights provide important context for our investigation into why early power plays don’t consistently translate to match victories despite their apparent strategic advantage.

3 Methods

For comparison, we looked at the win rates of teams when they leverage some critical moments, and compared them to the win rates when they got their first power play.

Before showing the result, there are some initial assumptions about the expected outcomes. Without a doubt, scoring the first goal would have a significant impact on the final result of the game, because leading in a game is the most direct way to win, the first shot would likely follow in importance, and the team that gets the first power play should also have a positive advantage toward winning. As for the other events, their impact is probably neutral or relatively minor.

Table 1. Definitions of the Derived Metrics

Event	Description
first shot	Obtaining the first shooting opportunity
first faceoff	winning in first faceoff event at the beginning of the game
first powerplay	the first opportunity to obtain a powerplay
first goal	score the first goal in the game
first check	player uses their body or stick to block an opponent or take the puck away successfully
first offside	committing the first offside foul during the game
first puckprotection	use their body to stay between the puck and the defender

Then we want to look into what happens during the first power play from the defensive and offensive sides, from the offensive sides, there are two critical numbers will be counted, they are described as below:

$$\text{Team Shot Successful Rate} = \frac{\sum(\text{Team Successful Shots})}{\sum(\text{Player Shots})}$$

$$\text{Player Goal Rate} = \frac{\sum(\text{Player Goals})}{\sum(\text{Player Shots})}$$

From the perspective of offense, we calculate the distance the player from the advantaged team covered when backchecking from their most recent recorded position to the current puck location where they regained possession after disadvantaged team dump out, because we found that during power plays, disadvantage teams frequently rely on a defensive tactic: after successfully executing an lpr, clear the puck and relieve pressure by dump-out, its events sequences are described as follows:

lpr: player from the team at disadvantage get the puck successfully
dump-out: dump-out to clear the puck
block (optional): power play team try to block the dump-out
lpr: player from power play team successful get the puck again

4 Result Analysis

Figure.1 show the probability that the side that triggers a specific event in each game eventually wins. The base statistic is the average winning probability, draw probability and losing probability of the team throughout the entire season. As hypothesized earlier, the first goal and the first shot both have a positive impact on achieving the final victory in the game, especially the teams that scored the first goal in the game achieved a 54% winning rate, which exceeds the seasonal average winning percentage by 14%, The first shot and first check respectively have a 47% and 46% probability of securing a match victory, exceeding the seasonal average by 14% and 13%, first offside exhibits a near-neutral impact,

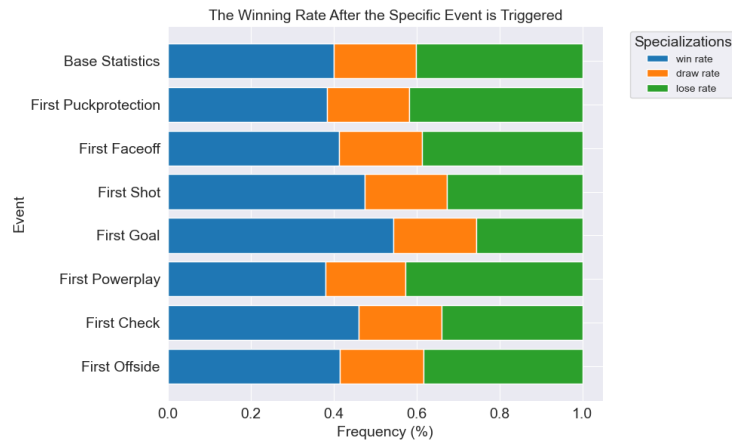


Fig. 1. The winning rates for different events

whereas the first puck protection and first power play have negative impacts on match outcomes.

Based on the Tab.2, it can be observed that teams gaining the first power play experience a significantly higher probability of being shot upon by opponents compared to both the seasonal average shot-success rate and the shot-success rate of teams maintaining a man-advantage in power play scenarios. However, their goal rate remains roughly consistent with these benchmarks. Although the goal rate shows no obvious improvement.

Table 2. Teams Performance at Different Period

Teams	Succ Shots/Goals/Shots Shot	Successful Rate	Goal Rate
Teams During Whole Season	8731/806/16107	0.542	0.050
PP Teams	1333/186/2371	0.562	0.078
SH Teams	180/17/240	0.750	0.070
Teams During First PP	280/39/513	0.545	0.076
Teams During First SH	42/4/54	0.778	0.074

Table 3. Player Backchecking Distance at Different Period

Period	First pp	pp	Season
Distance	81.93	78.62	72.11

According to Tab. 3, during the first power play, players have to run longer distances to handle dump-outs from the disadvantaged team. it's 3 units longer than the average distance during power play periods. also 10 units longer than the average distance during the entire season and each dump-out not only requires the retrieving player to sprint but also demands coordinated movement from the entire advantaged team, leading to greater overall physical exertion.

This finding aligns with research by Atalı et al.[3], who demonstrated that the most goals in ice hockey are scored from central areas directly in front of the net, which suggests that teams on powerplay may be compromising optimal shooting positions in their aggressive offensive formations. Additionally, Bagchi et al.[2] identified circle entries as a primary discriminating factor between winning and losing teams, which supports our hypothesis that the quality of offensive opportunities rather than merely having a numerical advantage is crucial for success.

5 Overview and Discussion

Team with first power play show strong offensive desire than any time in the game which can be seen from how far they run back to retrieve the puck, however, there are no obvious improvement on the offensive efficiency, you can find it from the shooting accuracy and goals scored rate in Tab.1. So this seems like a trap. If the attack works, it boosts the team's confidence and win rate. But if fails, it hurts morale and wastes energy, because teams with fewer players can use the 'dump-out' tactic to tire the other team and take advantage of the moment to score goals from counterattacks or create dangerous shots.

Similar dynamics have been observed in studies of other sports performance factors. Parshakov and Zavertiaeva [5] found that in competitive contexts, teams with apparent advantages (such as resource availability) don't always translate those advantages into performance outcomes, suggesting that strategic implementation of advantages rather than merely possessing them determines success.

6 Future work

Our research could be expanded in several directions to develop deeper insights into this phenomenon. Future studies should apply logistic regression methods similar to those used by Koo et al.[7] to identify specific variables that best predict power play success. Methodologically, combining discriminant analysis with logistic regression models would provide more robust statistical evidence for the relationship between early power plays and match outcomes. Creating a confidence index based on first power play performance also could help predict match outcomes and provide coaches with practical indicators for making in-game adjustments.

7 Code appendix

The code used for this project can be found in the following [GitHub Repository](#).

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