

Rotman

**Master of
Management
Analytics**

WOMEN'S HOCKEY TEAM

Analyze Historical Data to Select Top Players Under “Power Play” and
“Penalty Kill” Situations

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AGENDA

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Business Problems and Objectives

The Canadian Olympic Women's Hockey Team

Business Problems

The Canadian Olympic Coaching Team is preparing for the 2020 world championships. Coaches are looking forward to receiving some help from our data science team to choose top players under different situations. The problem that we are going to solve is to help the coach of the **Women's Hockey Team to select five power play specialists and four penalty kill specialists**. The team needs those specialists to compete against opponents under certain situations.

Objectives

- Initiate several models and approaches to analyze all players' performance under power play and penalty kill, including skills such as **successful shots, takeaways, and precise passes**
- Utilize our **scoring system to rate each player**, and select five top players for power play and four top players for penalty kill based on their score rankings
- **Our ultimate objective:** is to visualize our key findings and clearly present the results to coaches, thus helping them to select the best players
- Furthermore, we aim to consistently assist the Canadian Hockey Team in preparing them for success

Overview Data Sources Used

- Conduct analysis based on The Canadian Olympic Women and Men's Hockey Team's historical game data during the year of 2018 and 2019.
- We only look at women's data to address this problem. Followings are the data used to measure players' performance:

Data Used For Power Play

- Player's name
- Receiver's name if event is "Play"
- Situation type: only measure power play situations
- Event: Shot & Play only
- Event successful: some index only use "true" data to determine success rate
- Shot type: to determine if the shot is long distance or short
- X, Y coordinates of the event happening at that moment
- Receiver's X, Y coordinates used only to measure player's passing ability

Data Used For Penalty Kill

- Player's name
- Receiver's name if event is "Play"
- Situation type: only measure penalty kill situations
- Event: Takeaway & Play only
- Event successful: most index only use "true" data to determine success rate
- Game name and event time: to determine at that moment whether the takeaway happened at defensive side
- X, Y coordinates of the event happening at that moment
- Receiver's X, Y coordinates used only to measure player's passing ability

Analytical Approaches

Utilize Python 3.0 with library “Pandas” to filter and process the historical data

- Only focus on the Olympic (Women) – Canada Team

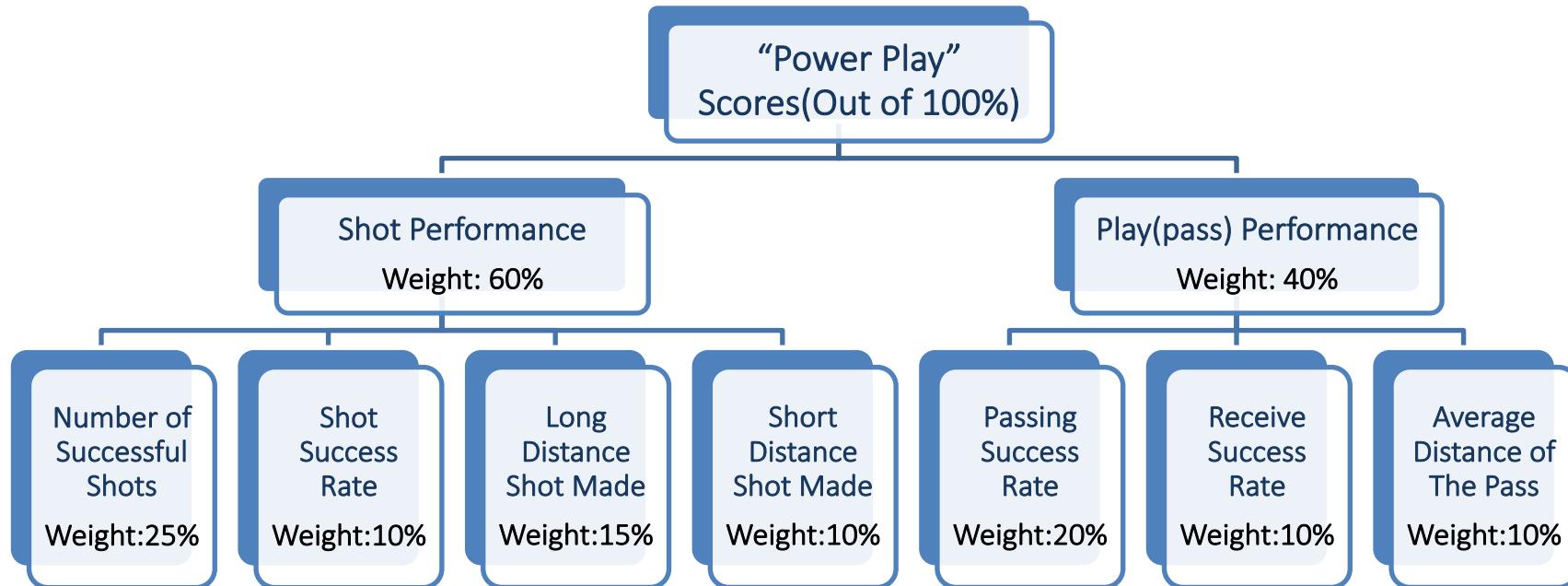
Using player as key to filter data only for Penalty-kill and Power-play situations with the following events:

- Play:
 - Analyze the player's **accuracy in delivering a pass** and the **success rate in receiving a pass** from player
 - Evaluate the player's passing skill in computing the **average distance** of a successful pass
- Shot
 - Count through the **goal attempts**.
 - The **total number of successful shot** that resulted a goal
 - Measure **long distance** shot and **short distance** shot respectively
- Takeaway
 - The total number of takeaways
 - Assess the **takeaway location** during the penalty kill

Process the raw data and compute into player statistics and determine a situational score

- Key attributes:
 - Penalty-kill : Takeaway for excellence in defense and accurate pass to avoid opponents' procession.
 - Power-play: Aggressive play style in attempting a goal and accurate pass to avoid opponents' takeaway

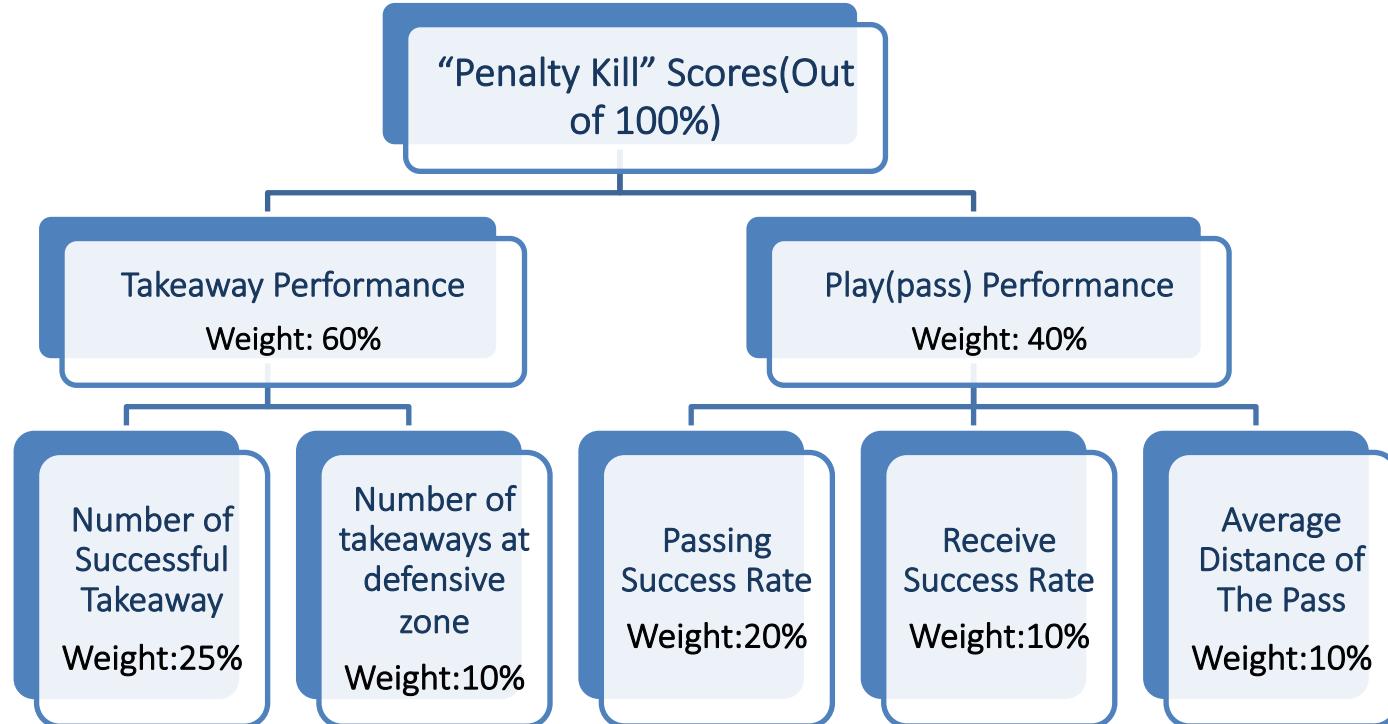
Weighted Scoring System For Power Play



Reasoning behind each element:

- **Score Policy:** under each criterion, the player who ranked first gets 100 and whoever behind her get 95, 90, 85,..., 0 (no negative score)
- **“Power Play” specialists** should have key skills such as successful shots and precise passes, with more weightings on shots
- **Measuring player’s shot performance:**
 - The number of successful shots is the most important criterion because it directly reflects a player’s scoring ability. However, we should also encourage players to make more shot attempts, thus the shot success rate is proper to measure the ratio of success shots over total shots
 - Long/short distance shot made: distance of the shots matters, and long distance shots are tougher than short distance
- **Measuring player’s play(pass) performance:**
 - Passing and receiving success rates are both imperative, while initiative passing ability should be weighted higher than receiving ability
 - Average distance of the pass could provide more insights about a player’s passing ability, since longer distances means better passes

Weighted Scoring System For Penalty Kill



Reasoning behind each element:

- **Score Policy:** under each criterion, the player who ranked first gets 100 and whoever behind her get 95, 90, 85,..., 0 (no negative score)
- **“Penalty Kill” specialists** should have key skills such as successful takeaways and precise passes, with more weightings on takeaways
- **Measuring player’s takeaway performance:**
 - The total number of successful takeaways (25%) is useful to determine a player’s defending ability
 - Takeaways at defensive zone (10%) is especially necessary because it’s the last barrier to stop the opponents
- **Measuring player’s play(pass) performance:**
 - Passing and receiving success rates are both imperative, while initiative passing ability should be weighted higher than receiving ability
 - Average distance of the pass could provide more insights about a player’s passing ability, since longer distances means better passes

Top Players Selected– Power Play and Penalty Kill

- Through computing the weighted scoring system. The following top players are selected for Power Play and Penalty Kill.

Top Players for Power Play (Top 5):

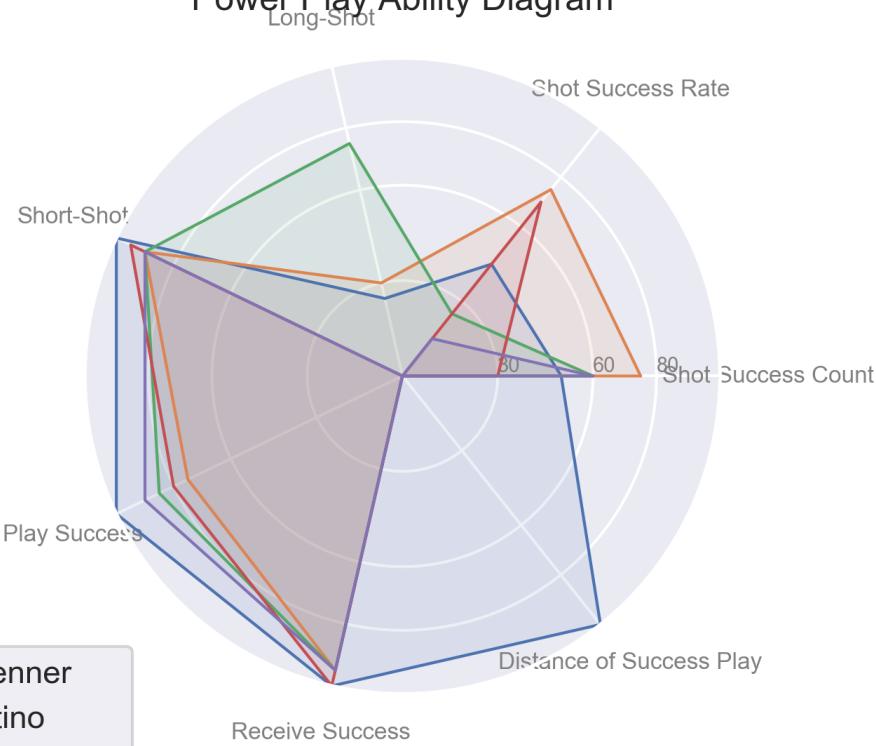
Player Name	Power Play / Penalty Kill (Score / 100)
Brianne Jenner	77.00 / 71.5
Laura Fortino	69.75 / 81.5
Meghan Agosta	67.25 / 28.0
Rebecca Johnston	59.75 / 84.5
Sarah Nurse	59.25 / 20.5
Haley Irwin	56.50 / 0
Lauriane Rougeau	40.00 / 30.5
Jamie Lee Rattray	39.50 / 0

Top Players for Penalty Kill (Top 4):

Player Name	Penalty Kill / Power Play (Score / 100)
Jocelyne Larocque	95.5 / 30.0
Erin Ambrose	89.5 / 24.5
Halli Krzyzaniak	89.0 / 13.0
Laura Stacey	88.5 / 25.5
Emily Clark	88.0 / 16.5
Jillian Saulnier	84.5 / 22.5
Rebecca Johnston	84.5 / 59.75
Marie-Philip Poulin	82.0 / 35.0

Selected Players' Ability Diagram

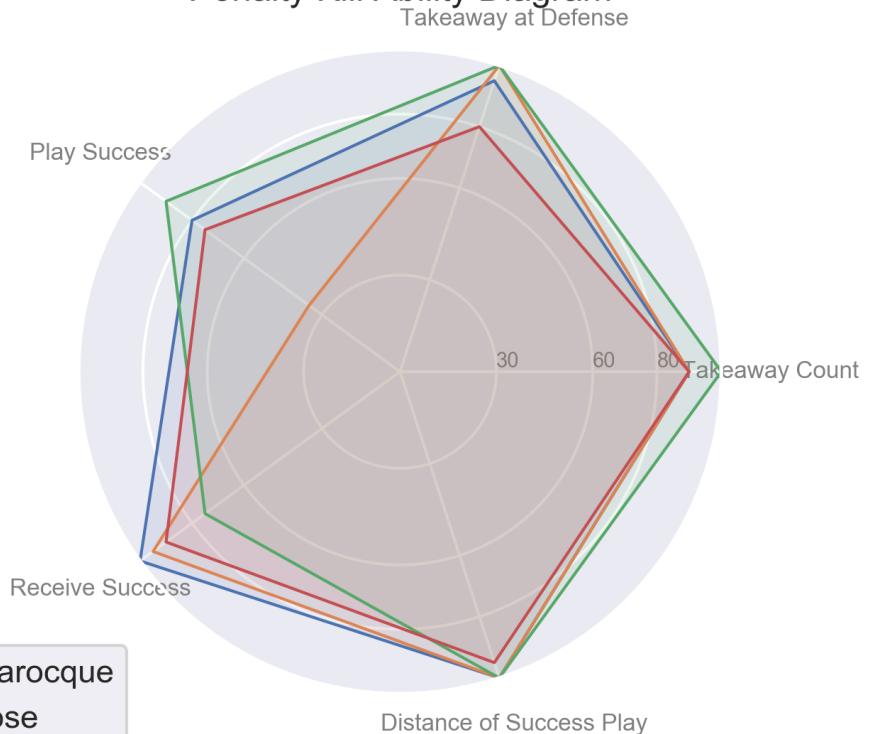
Power Play Ability Diagram



Legend for Power Play Ability Diagram:

- Brianne Jenner
- Laura Fortino
- Meghan Agosta
- Rebecca Johnston
- Sarah Nurse

Penalty Kill Ability Diagram



Legend for Penalty Kill Ability Diagram:

- Jocelyne Larocque
- Erin Ambrose
- Halli Krzyzaniak
- Laura Stacey

Recommendations

Recommendation One – Power Play Specialists

- Amongst the 5 selected top players, there are 3 players that should definitely be included on the team: Brianne Jenner, Laura Fortino, and Rebecca Johnston. Reasons are:
 - They all receive relatively high scores under power play situation, and have made the most goals scored
 - Besides, they are excellent players who can make precise passes, which help them receive high scores under penalty kill situation as well
- The average score for power play is relatively low. This is mainly because less goals were scored during power play situation than normal “5 on 5” situation. If necessary, some top players that are skillful at both offending and passing under “5 on 5” could also be trained specially for power play situations

Recommendation Two – Penalty Kill Specialists

- The 4 selected top players all receive quite high scores for penalty kill with an average of over 90.6, but their scores for power play are all very low. This means that they are the best defending players specially for penalty play situations
- Rebecca Johnston can be positioned as a rotation player – she is at least the “Top 6” player for both situations. It reflects her versatile ability when compared with other players
- Erin Ambrose – even though she receives the 2nd highest score, she is short of making successful passes. Therefore, if Erin is selected on the team, she could improve her passing ability to increase the play success rate



Exhibits

Exhibit A – Power Play Players' Data Visualization

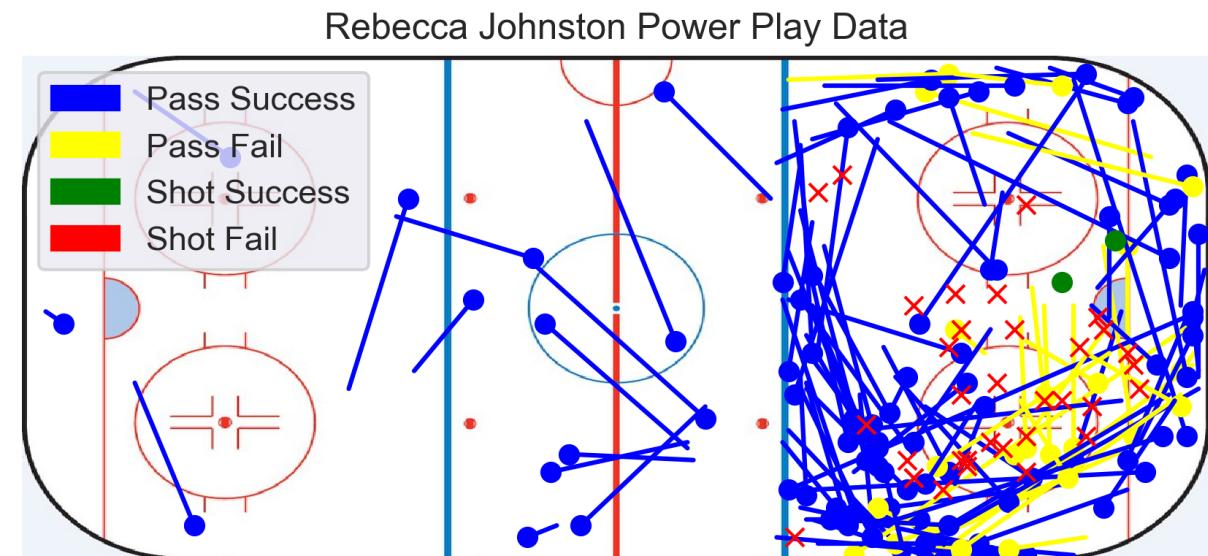
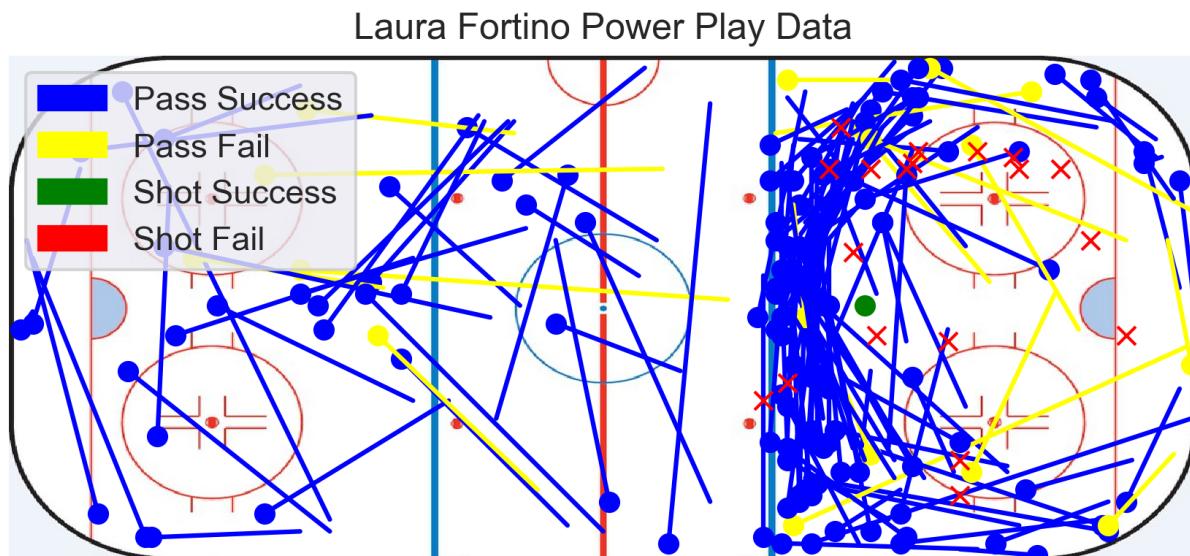
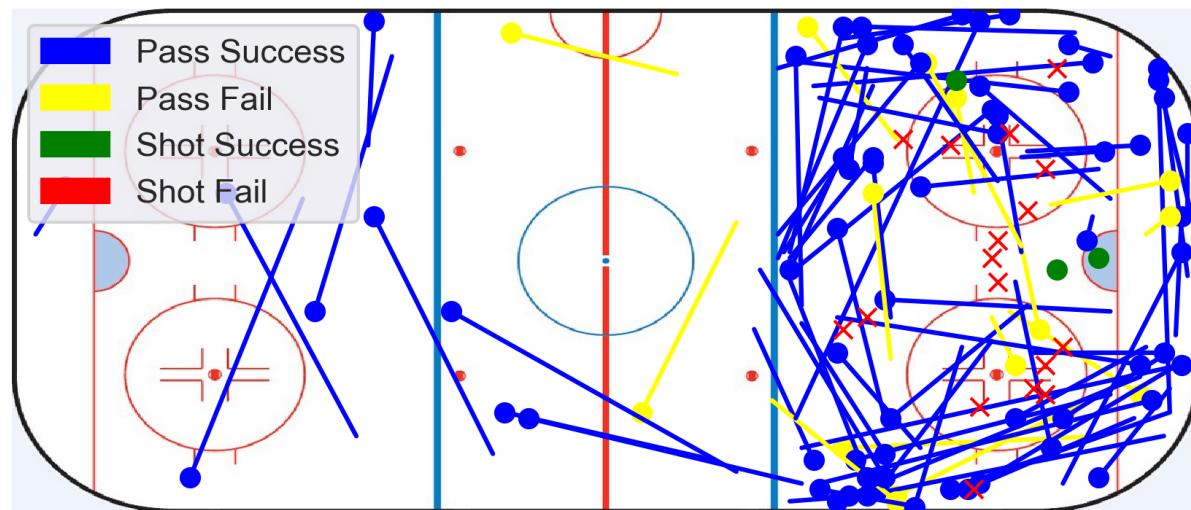


Exhibit A – Power Play Players' Data Visualization Cont'd

Brienne Jenner Power Play Data



Meghan Agosta Power Play Data

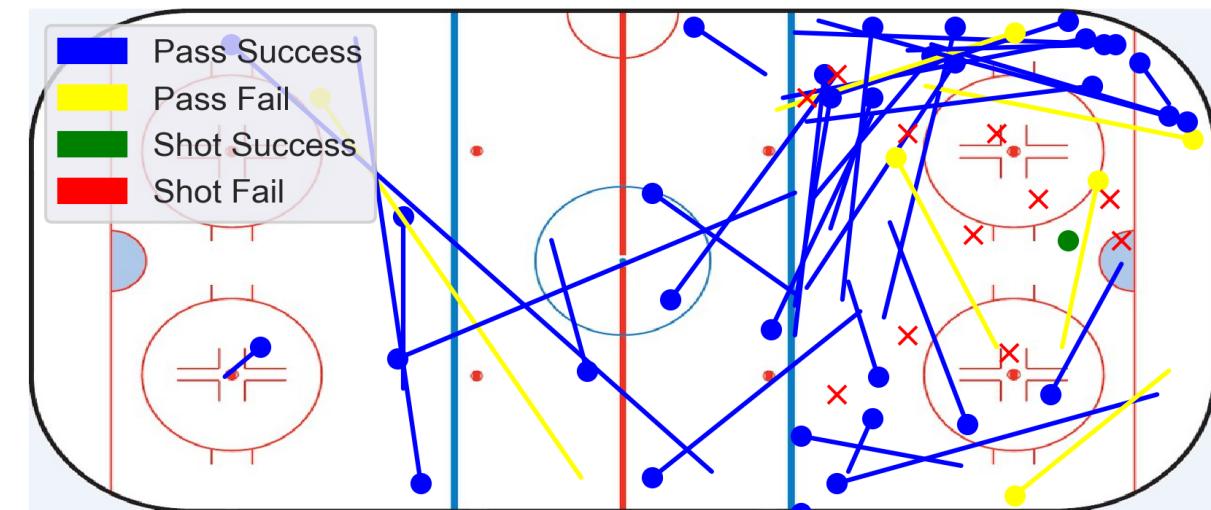


Exhibit A – Power Play Players' Data Visualization Cont'd

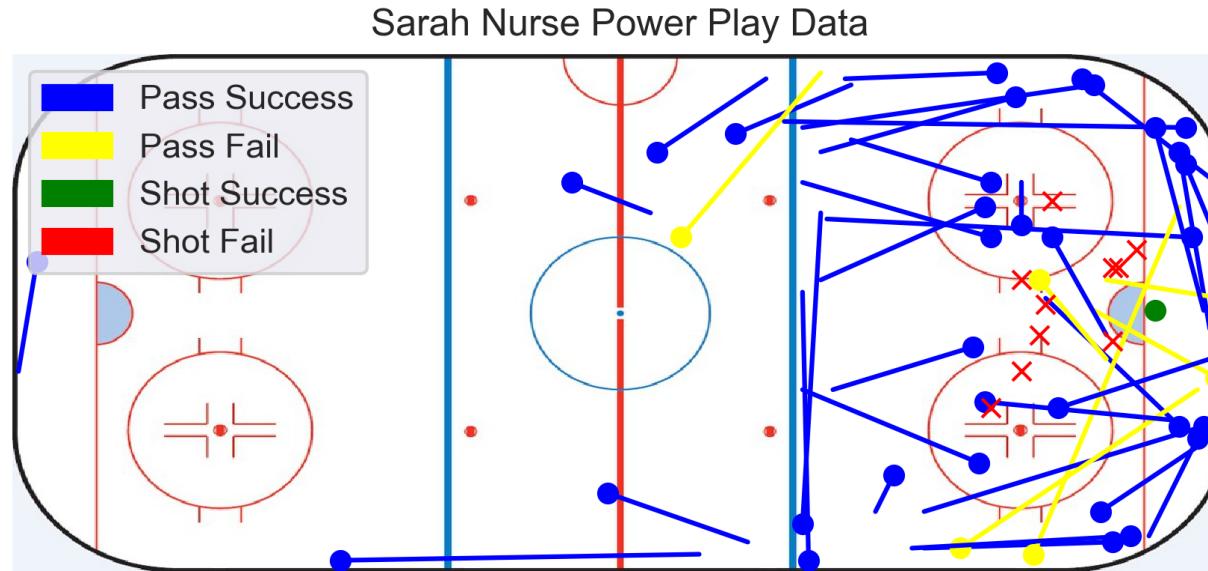
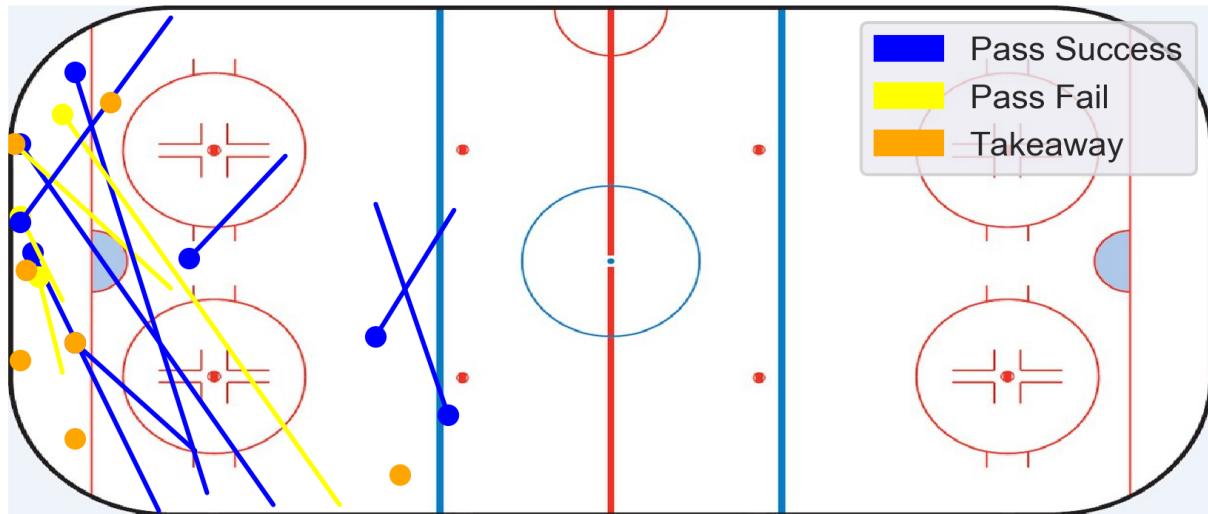


Exhibit B – Penalty Kill Players' Data Visualization

Jocelyne Larocque Penalty Kill Data



Erin Ambrose Penalty Kill Data

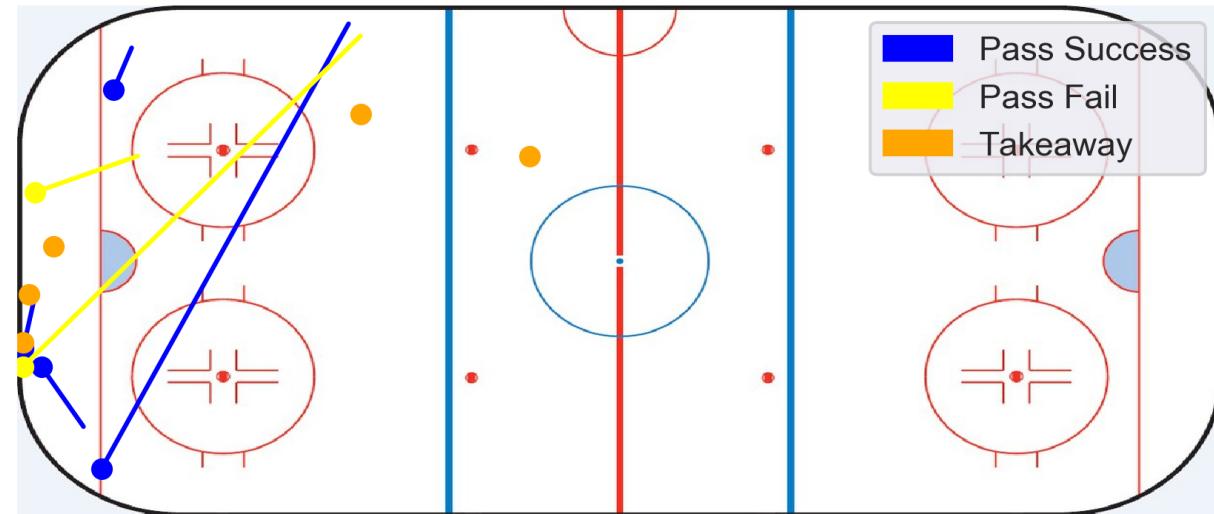


Exhibit B – Penalty Kill Players' Data Visualization Cont'd

