Exhibit 1 – Supporting Information

Ice Hockey's Importance to our State

Rinks' and ice hockey clubs' inability to be open in Connecticut has a number of serious and negative effects. First, the over 12,000[1] youth hockey players in the state are deprived of what for many is their primary recreational activity. As all of us with children know – especially in Connecticut, where well over most of our children are already struggling with on-line learning and little physical exercise or social interaction with other children – this carries serious negative mental and physical health side effects. Second, the wider societal effects are singularly negative. The ice hockey community in Connecticut is close-knit, and the sport often makes up a significant amount of a family's total recreation time. Perhaps contrary to popular perception, this sport is not predominantly played by upper-middle to and upper-class White residents. The sport caters to a very diverse socio-economic demographic, made up of primarily working-class families of all races, colors and creeds, with significant Asian-, African- and Other-American participation.

Hockey is effectively the only sport in Connecticut that is unable to play because it is an indoor sport. All other sports can basically be played outdoors. In turn, Connecticut is a significant outlier in the sport of ice hockey in the United States, as it is the only State in New England and in fact where games cannot be played other than New York and it is the only State on the East Coast where practices are effectively banned due to the 4 person group limit.

Because all Massachusetts, Rhode Island, New York, New Hampshire and all other Eastern Seaboard states' rinks allow hockey in some capacity (all but New York allow games and all allow full practices), we are very concerned that without allowing some level of practice or in-house scrimmages, a significant number of the ice rinks in the state will face bankruptcy and close due to families simply choosing to take their and their children's business elsewhere. This will permanently deprive the ice hockey and wider Connecticut communities of the ability to engage in ice sports, even after the pandemic subsides, disproportionately affecting our working-class and ethnically diverse user-base, and quite possibly leading to negative health effects for those groups long-term.

This would be particularly disappointing in Connecticut, where the loss of the ability to practice, even under modified rules and arrangements, would come with no public health benefits to Connecticut. The fact is that if Connecticut is "closed" to hockey, due to the small size of our state and ease with which families can travel to other states, every dedicated hockey family will have the opportunity to play at the large and growing number of clubs in nearby New York, Massachusetts, Connecticut and even New Jersey and New Hampshire and we expect many of them to take that opportunity. Numerous "weekend model" teams have cropped up in faraway places like Florida, Georgia and Tennessee whereby families stay at home during the week and fly to these states on Friday to practice and play all weekend long. This is another option for our families. What we are trying to say is you are creating far more risk by pushing our families to other states as they are not going to stop playing the game entirely. We like this to prohibition – if you put a complete ban on something, they won't stop doing it; you just push it underground.

We strongly believe that our Connecticut hockey players and skaters are much better served – as is the wider community of Connecticut from a public health perspective – in an environment where they play under the guidelines this state, its local clubs and the CHC has laid down, and not some other jurisdiction

[1] USA Hockey registration in Connecticut as of 2019-2020 for under 19 years old.

which may have a made different judgements regarding youth sports than Connecticut's health professionals and elected representatives.

While we understand that the economic impact of the loss of ice hockey games in Connecticut is not the State's first concern, and that the public health considerations are paramount, it is important that we point out the economic costs of a complete shutdown. Revenue generated by hockey programs, figure skating, public skating, concession and equipment sales and service, camps, and ancillary spending (hotels, restaurants, gas, local retail, etc.) is likely in excess of $100 million annually – a significant contributor to our economy. A typical private ice rink pays roughly to $150,000 per year or more in property and other taxes to local municipalities and school boards. A typical rink will employ upwards of 50 people in working class and entry-level jobs, including those which those with disabilities or other impairments can and do perform.

The loss of these tax revenues – and the predominantly working-class, entry-level jobs which ice rinks support for our diverse communities across the state – with little appreciable public health benefit, will be a significant cost for those in our state who can least afford to bear them.

As we demonstrate here in this letter, ice hockey – as played in Connecticut by the vast majority of participants (probably only except the AHL-level teams in Bridgeport and Hartford) – does not in fact meet any of these criteria.

"Close, Sustained Contact Between Participants"

First, we believe that there is a strong misperception – perhaps owing the fact that we don't have an NHL team and we are less of an established hockey community as a result - that ice hockey is played at the recreational and youth levels in the same way as the NHL playoffs appear on television: full-contact, with constant ESPN-style highlight-reel bodychecks, frequent scrums and occasional fisticuffs. The truth, in particular at the recreational level for children under 18, is that the vast majority of our players play in non-checking leagues with exceedingly minimal contact.

Of the State of Connecticut's approximately 14,000 total registered hockey players,8,000 are between the ages of 4 and 13 years old, and 2,000 are mens' and women's' league recreational players, well in excess of 70% of the total number of participants. At these ages and levels of play, no body checking is allowed, period, by rule. As a result, far from being a sport that involves "close, sustained contact between participants", players at those ages often times only endure a light bump on the shoulder pad occasionally during a game, or a fall on the ice away from other players. This contact profile bears no resemblance whatsoever to that of other "high-risk" sports like boxing, where two combatants stand toe-to-toe and (literally) breathe and bleed on each other in sustained combat over up to 15 rounds, or football, where players line up across from each other, with the express intent to tackle an opponent to the ground, or block an opponent through physical contact out of a play, again often ending up lying on one another on the ground.

Hockey's contact profile also bears no resemblance for most youth players to that of boys' outdoor or indoor lacrosse, which involves full contact at a very young age, long scrums between large numbers of players all competing for the same ground balls, FOGOs less than 6 inches from opposing players' faces, often leading to a prolonged scrum; and defensemen in close, frequent skin-to-skin contact with attackmen near the goal crease in the heat and sweat of a spring, summer or fall day.

Moreover, even where bodychecking is allowed – at the 13-to-18 age level, for higher skill levels (some so-called "house" programs for purely recreational players at this age group also do not allow checking) only – the contact is entirely different than in lacrosse or football. In both those sports, the goal is to make physical contact with the opponent in order to knock him to the ground, often resulting in the player himself being taken out of the play too, in close proximity to others. It is routine in both sports for the player delivering the "hit" to end up on top of the person tackled or hit, and then hit or tackled himself. Again, this is with significant skin-to-skin contact, heavy amounts of sweat in the heat, and often blood is involved. These are pure contact sports.

This is not the case in ice hockey. The intent of hockey is not contact play-after-play. The speed of the game, with players even at the youth level each reaching 15 mph on skates, requires that players stay on their feet and keep up with the play. One rarely sees an ice hockey player lying on the ice alone or not in motion, let alone piled on other players. Because players are skating, with momentum that carries them forward or backward at speed and requires strong athletic moves to stop even within a 6-10 foot space, the players inherently are unable to be closely packed during play for any period of time. This again is entirely unlike lacrosse, soccer, football or other sports played on foot, where players can and do stop in 1-3 feet, even when running at full speed, and in particular lacrosse, basketball and football where contact occurs routinely throughout the game mostly with skin-to-skin contact. Hockey is also unlike wrestling where participants are lying on top of each other sweating with skin to skin contact or indoor basketball where players are sweating profusely, constantly touching each other with no skin levelprotection.

Ice hockey's playing surface is the largest of any indoor sport. A standard NHL-sized ice rink (on which many of Connecticut's hockey games are played) measures 200 ft. long by 85 ft. wide. This translates to 17,000 sq. ft. of playing space for a total of 12 players on the playing surface at any one time, only 2 fewer than a basketball court. By contrast, indoor sports such as basketball, volleyball, wrestling, tennis, and standard water polo/swimming pools are much smaller and involve much more densely packed players/participants on the playing surface. Moreover, an appreciable number of ice hockey games in Connecticut are played not on NHL-sized (200 ft. by 85 ft.) rinks, but on Olympic-sized ice sheets, which carry dimensions of 200 ft. by 100 ft., providing an additional 3000 sq. ft. of playing space for the 10 total skaters and 2 goaltenders on the ice at any one time. See Exhibit 2 for a miniature scale comparison of playing surfaces. A standard basketball court is 94x50 or 4,700 sq. ft. A typical basketball game with 10 players on the court therefore has 470 sq. ft. per person. Hockey has three times the space per person as basketball. While a football field is larger, football players are clustered in a very small area for every play. The same is true for lacrosse where typically 13 players are clustered on half the field in close proximity to each other.

Game play has recently been the subject of at least two independent studies that confirm the very short period of time that hockey players are in close proximity (CRET- close range exposure time) to other players during a game.

Exhibit 3 to this letter is a recent study by Wisehockey, a data analytics company dedicated to statistical and next-generation analysis of game, which concluded that during a typical game where full contact is allowed, a player is likely to be within two meters of another player for only 3-4 minutes during the course of the 60-minute game. Of course, those 3-4 minutes do not represent continuous proximity – they are broken down into smaller increments, as the player is not on the ice, or in a position close to other players, for more than a few seconds at any time. As even a moderately-skilled youth player will be traveling between 5 and 15 mph while skating, the simple nature of the game does not allow for much proximity between players except in fleeting instances. As the standard youth hockey game in

Connecticut only runs 45 mins., even if those games included checking, the players would be within 6 meters of each other 25% less than this study found, or 2.25 mins. - 3 mins. While the study does not address non-check games, it is reasonable to assume a much lower close-proximity time than even the 2.25 mins. – 3 mins. figure for a standard Connecticut youth hockey game.

Apparently corroborating the logic and findings of the Wisehockey study, the second study, by Eastern Michigan University (at Attachment 4) fine-tunes this concept even closer and has determined that in a normal 45-minute game allowing checking, a 13-years-or-older youth hockey player is in "immediate proximity" with another player for less than three total seconds. Thus, given that most games in Connecticut are 45 min. in length and played with no-checking by rule, these studies almost certainly significantly overstate the amount of contact that actually takes place in the total population of Connecticut hockey games each year. We believe this data is critical for assessing the proximity risk associated with ice hockey, that it is very low, and that it is vastly lower than commonly perceived.

"Significant Protective Barriers"

Ice hockey players have significant protective barriers to SARS-CoV-2 droplets. In fact, the equipment worn during ice hockey games is significantly *more* protective than virtually any other sport that allows any kind of similar contact. Accompanying this letter as Attachment 5 is a series of photos of a current 10U player dressing in her standard equipment.

As the Exhibit shows, her equipment is layered, and includes no fewer than 3 layers of protection. As an outer layer, she wears a jersey covering her torso, arms and shoulders. Under that jersey, there is a full layer of padding (shoulder pads and elbow pads), followed by a further layer under the padding of athletic underclothing (typically covering the entire arm, torso and shoulders as well). Around her torso and legs are an outer layer of thick protective pants, an under-shell (akin to shorts, used to hold up hockey socks and containing a boy's cup or girls' protective shield) and underneath the under-shell, another layer of athletic clothing (typically shorts, or full-length spandex-like sheer pants). On the legs, thick hockey socks are pulled over armored knee and ankle guards. Socks are worn on the feet, inside skates. Players' hands are fully protected at all times by large padded gloves which cover up to a portion of the skater's forearms.

No players' equipment is shared. Team gears such as pucks, sticks, nets or other items are only touched by players with their gloves on. There has been no sharing of water bottles in youth hockey for many years. In short, in terms of body protection, there is many times as much as any boys' lacrosse, soccer or football player, who wear only a light "pinney" jersey, shoulder pads and a helmet or only a jersey and shin guards (soccer) – all in a game with far less contact than either sport. This is also in contrast to competitive swimming and water polo – both played indoors – where there are no protective barriers whatsoever.

As for head protection, hockey helmets cover thoroughly 75% of the head's surface, with a wire cage or clear plastic shield allowing the player to see out the front. The clear plastic shields favored by some players already provide very significant protection against droplet exposure. Simple modifications to those shields would not only offer additional protection, they would also fully comply with the legal definition of a "face covering." For those participants who do not own such shields (a typical youth version can cost up to $100), cloth face coverings can be worn on the bench or, if necessary, during game play. We more fully address face coverings and masks in the Game Play Modifications section, below.

There has been significant research into the effectiveness of these barriers to transmission. For example, in the State of Massachusetts, where ice hockey is a primary sport played by a comparatively large percentage of the population, Dr. Alan B. Ashare, MD of St. Elizabeth Medical Center in Boston, has advised the USA Hockey affiliate for Massachusetts, Massachusetts Hockey, as well as ice rink owners and other hockey organizers, "hockey equipment and uniforms provide perhaps the most protective barrier of any sport. It virtually covers the entire surface of a participant's skin".[2]

In short, especially when the clear shields and face covering, and other Game Play modifications we describe below are taken into account, we believe that ice hockey is safer than outdoor sports like lacrosse, soccer, competitive swimming and water polo, and most of the indoor sports like boxing, basketball, wrestling and even volleyball where there is sharing of a ball with no skin protection.

Arena Safety Measures Currently in Place

Ventilation

Ice hockey – at least before the winter months in Connecticut – of course must be played indoors. While there are a few outdoor only rinks in use in the state, we want to emphasize that ice rinks maintain special industry-specific dehumidifying systems that are employed to ensure the air inside an ice arena can be exchanged multiple times per day if necessary. For example, Champions Ice Arena's ventilation system constantly introduces outside air into the facility, while at the same time dehumidifying and straining through industrial grade HEPA filters existing air from inside the building. In normal operation, Champions' system provides a constant stream of at least 3000 cubic-feet-per minute airflow for each of Champions' two ice sheets. The dehumidifying unit dehumidifies and heats the return air, while introducing as much or as little outside air as the operator desires. The system takes in air from the rink and outside (in volumes determined by the operator) and heats it to approximately 220 degrees Fahrenheit as part of the dehumidification process. It then reintroduces the dehumidified and filtered air into the area. Because HEPA-grade or similar filters are used, this system not only changes the air inside the building at a robust rate, it also has the effect of removing any SARS-CoV-2 viruses from the air it treats. HEPA filters and those with comparable performance characteristics have been demonstrated by NASA as perhaps the best filters available to filter the SARS-CoV-2 virus. As a result, given this airflow purification rate, the standard ice rink facility will completely change the air above an ice rink playing surface (approximately 25 ft. ceilings, and 17,000 sq. ft. ice surface, for 340,000 cu. ft.) at a rate of once per every 94.4 min., thus moving air from above the immediate playing surface to the filtration system within a matter of minutes, further reducing any possible SARS-CoV-2-infused droplet exposure to players.[3]

Aggressive Cleaning Protocol

Using Milford Ice Arena as an example, that facility has adopted an aggressive cleaning and disinfecting protocols in accordance with CDC guidelines and CDC-approved disinfecting products. At the moment,

[2] Dr. Ashare is active in the field of sport safety and medicine, and he chairs the Massachusetts Interscholastic Medical Sports Committee and the Massachusetts Medical Society Sports Medicine Committee. In addition, he has served twenty years as Team MD for USA Hockey Junior World Champion Teams and is President of the North American Hockey Equipment Certification Council, chairs USA Hockey's National Safety Committee, and directs ASTM's Committee on Medical Biomechanics. His understanding of the game and potential risk is based on extensive study and many years of direct involvement with the sport.

[3] See https://ntrs.nasa.gov/citations/20170005166. HEPA filters capture particles down to the 0.01 micron size level; the SARS-CoV-2 virus is approximately 0.125 microns in size.

while the facility is effectively closed to all but a skeleton staff and those who physically go on the ice, virtually all areas of the facility are not in use. Should parents and family members be allowed into Milford rink to spectate the large majority of the facility would still remain closed. Patrons would only be allowed to use bathrooms, and stand, socially distanced, in family groups around the rink in compliance with rink rules.

All high touch areas and bathrooms are disinfected at least once every 2 hours, with adequate amounts of soap and hand sanitizer available for customers and employees. Bathrooms are already outfitted with automatic no-touch soap and automatic hot and cold-water faucets.

Ingress and Egress

Since all ice rinks were closed in the State of Connecticut in March 2020, and then re-opened beginning in June 2020, many have enacted strict entry and exit protocols to protect the very limited number of patrons who have been inside the building.

Again, using Milford as an example, nobody other than a skeleton staff required to maintain the facility, skaters going on the ice, and skeleton coaching staff for each team (typically no more than 2-3 adults), has been inside since the pandemic began. To enter the facility, skaters must put all their equipment on outside the rink, typically in the parking lot. Locker rooms are not being used and remain closed indefinitely. There is very limited, socially-distanced space (with places to sit marked with "Xs") for younger patrons to have their skates tied on benches just inside the open entrance door. All skaters, coaches and employees must have their temperatures checked each time they enter the facility. Water fountains are turned off.

All employees, coaches and skaters – including while engaged in skill-building and drills on the ice – must wear a face covering that complies with county requirements.

Once they have been cleared to enter the building, skaters cannot congregate or socialize – they have socially-distanced "Xs" marked on the concourse where they may stand for 1-2 minutes while a coach prepares to lead them on the ice. Once on the ice, in accordance with Montgomery County law, they do not engage in physical contact of any kind, but instead only do skill-building exercises and drills. They are not able to use the benches and so remain on the ice, in motion, at all times.

Once the session is over, the skaters and coaches cannot congregate in the building and are required to go outside to take off their skates and equipment. This then also takes place in the parking lot. There is one-way traffic inside the building so that patrons from the rink do not cross paths with any other skaters entering or exiting from the rink.

Game Play Modifications

In light of the data provided in this document, we believe that ice hockey in all its forms is safe to play with the arena and other modifications set out in this letter. That said, in the interest of providing the State with a pathway to return to play, and to assist in helping with your decision-making process, the following rules could be instituted as well:

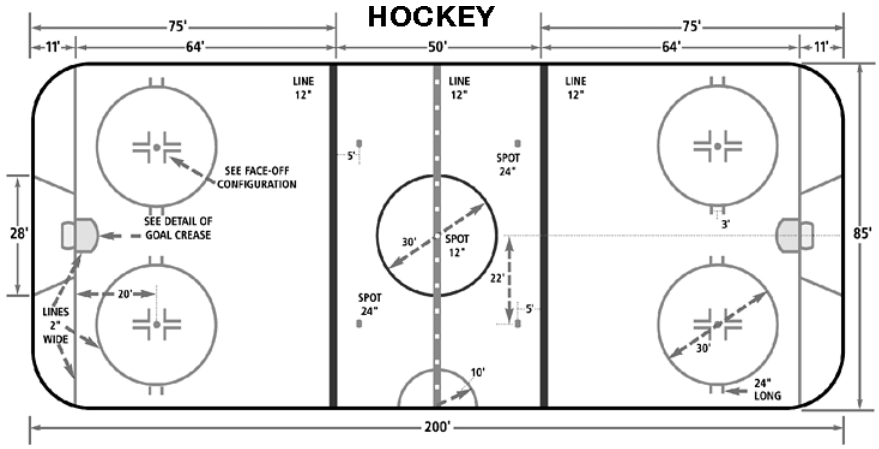
- Each player will be required to have his/her own water bottle.

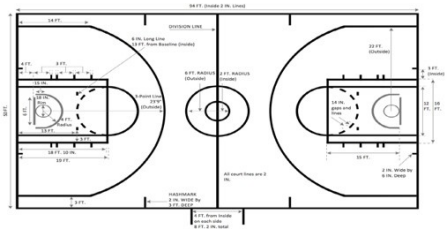
- The customary handshake at the end of a hockey game – where the teams line up after competition, and congratulate each other in the spirit of fair play and sportsmanship – will be modified so that teams will spread out on their respective blue lines (socially distanced) and tap their sticks in appreciation of the opposing side.
- No chalkboard huddles.
- Once on the ice, the skaters will not be allowed to remove any equipment unless required for safety reasons.
- Spitting, “high fives”, hugs and other horseplay also will not be allowed.
- Coaches and players will always wear a face covering.
- Penalized players will not use the penalty box, unless that area is one that contains glass which shields the box from other areas of the rink. Only one player may be in the box (which is a confined space) at any one time. In the event of multiple penalized players on one team, any additional players will serve their penalties in a socially-distanced manner.
- One person will operate the game clock and scoreboard and be the scorer. This will allow for only one person to be in the scorer’s box (also a confined space, segregated from the rest of the rink, benches and penalty boxes by glass) at any one time, enabling social distancing.
- While on the bench, players will be required to wear a face covering, in addition to being socially distanced from other players and the coaches while awaiting their next shift.

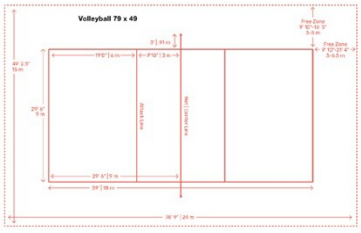
Failure to follow these restrictions will result in removal of the player after reasonable warnings.

EXHIBIT 2: INDOOR FACILITY/SURFACE COMPARISONS

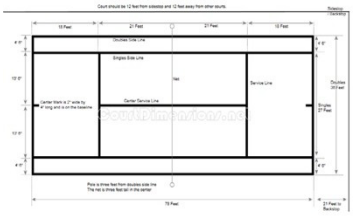
Hockey = 200 x 85; Basketball = 94 x 50; Volleyball = 79 x 49; Tennis 78 x 36; Bowling - 85 x 5; Wrestling Mat - 38 x 38





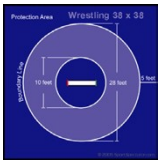


1 Volleyball Court



1 Tennis Court

1 Bowling Alley (30 Lanes Average)



1 Wrestling Mat

EXHIBIT 3 – EASTERN MICHIGAN UNIVERSITY REPORT FOR USA HOCKEY

Report Regarding Immediate Proximity Associated with Body Contact in Ice Hockey

Prepared for USA Hockey

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May 19, 2020

Duration of Immediate Proximity Associated with Body Contact in Ice Hockey

Introduction

As part of the *Leveraging Technology to Address Player Safety and Enhance Player Development in US Ice Hockey* project, wearable sensors have been used to collect data for on-ice activities from players between the ages of 12 to 18 years old. To this end, over 15,000 sessions have been collected for on-ice activities across all of these age groups. The scope of the project has included multiple objectives, but specific to this report, a primary objective has been to quantify impacts incurred by players in practices and games to inform decisions regarding body contact and player safety. Of the more than 15,000 on-ice sessions collected, 10,793 were included in impact analysis based on rigorous data quality standards. From this impact data, some information may be inferred with regard to the amount of time youth hockey players are in "immediate proximity" that would be associated with physical contact.

Impact Characterization

As a first step to determining not only the quantity of impacts experienced by youth hockey players, but also the nature/characteristics of these impacts, a video corroboration study was performed (Pilotti-Riley, A., Stojanov, D., Sohaib Arif, M. and McGregor, S.J. *PLoS One,* 2019). Although impacts were being measured for this project, players could experience impacts due to numerous circumstances, not all of which would include other individuals (i.e. checking). Therefore, this study was performed with the use of video observation to confirm and characterize impacts identified by sensors.

In each of the studies referenced in this report, subjects consented to procedures approved by the Eastern Michigan University Human Subjects Committee. Also, in each of these associated studies, Bioharness-3 (Zephyr, MD) were used as wearable sensors and triaxial accelerometry signal was recorded at 100 Hz to identify impacts. Specifically for this video corroboration study, National Team Development Program (NTDP) U18 players wore Bioharness-3 (Zephyr, MD) wearable sensors (WS) to record occurrences of player incurred impacts (PII) during games. Impact waveforms were generated using Impact Processor (Zephyr, MD) from raw triaxial accelerometer signal sampled at 100 Hz. Players were observed using video and synchronized with game video collected by NTDP staff. Impacts identified by WS of 6–7.9 g (Z3), 8–9.9 g (Z4) and 10+ g (Z5) from the Impact Processor were used to corroborate PII. Preliminary studies indicated that impacts that fell below these thresholds were not associated with PII. Magnitude and duration of each identified impact were compared by category using MANOVA with Tukey post hoc (α= 0.05; SPSS 22.0, IBM, NY).

Event	Definition	Sub-category	Frequency (N)	% of total
Player incurred impacts	Board contact/no check	1	17	4.1%
	Board contact/check	2	74	17.7%
	Open ice check	3	202	48.2%
	Player fall	4	65	15.5%
Non-player incurred impacts	Other form of player to player event	5	19	4.5%
	Hard Stop	6	16	3.8%
	Slapshot	7	19	4.5%
	Other identifiable player event	8	6	1.4%
False positive			1	0.2%
		Total	419	100%

https://doi.org/10.1371/journal.pone.0218235.t003

Figure 1. Frequency of events observed by wearable sensors by sub-category. Pilotti-Riley, A. et al. (2019) .

On average, U18 players experienced 17.5 impacts per game. Of these impacts, 28% did not involve other players (e.g. falling on the ice, board contact, slap shot, hard stop; Figure 1). The remaining 72% of impacts did involve other individuals (teammates or opponents). The duration of these player to player interactions lasted 0.098 seconds on average (Figure 2).

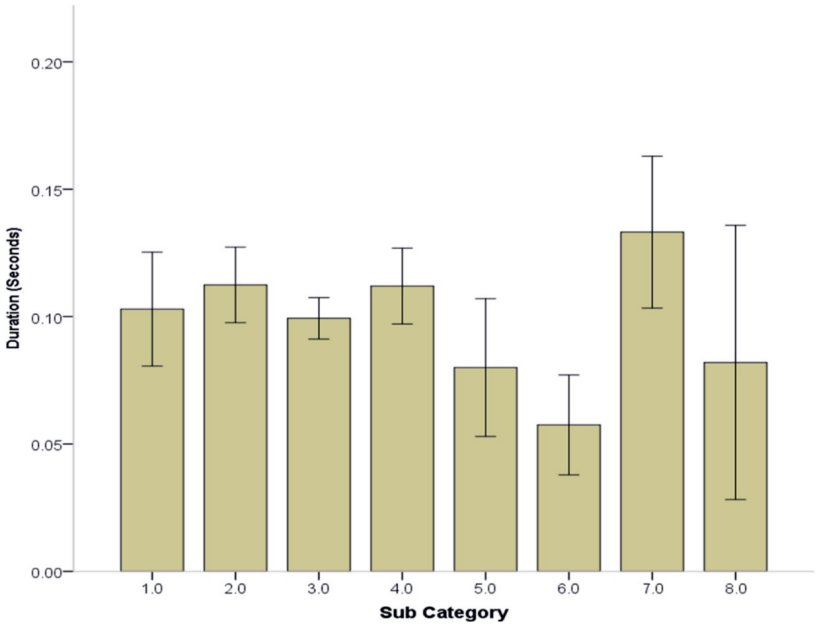

Figure 2 Mean durations of events observed by wearable sensors. Sub-category (1) Board contact/no check, (2) Board contact/check, (3) Open ice check, (4) Player fall, (5) other form of player to player event, (6) Hard Stop, (7) Slapshots and (8) other identifiable player events. Pilotti-Riley, A. et al. (2019).

Therefore, if we assume 72% of the 17.46 impacts per player with an average duration of 0.098 seconds, the duration of immediate proximity with other individuals totals 1.23 seconds per player per game. If we extend these observations to the entire data set collected as part of the larger project, this is what can be inferred with regard to impacts incurred at each level of play and the result time of immediate exposure as a result (Figure 3). As can be seen from the complete dataset, which is more robust (e.g. n= 1210 games for U18), that the inferred duration of immediate proximity is greater than determined from the video corroboration dataset, but is still less than 3 seconds for each and level.

Team/Level	Session Type	Impacts per Player per Session	Inferred Duration of Immediate Proximity (Seconds)
12 U	Game (n = 529)	13.41	0.95
	Practice (n = 376)	14.13	1.00
13 U	Game (n = 452)	15.41	1.09
	Practice (n = 322)	11.20	0.79
15 U	Game (n = 272)	10.32	0.73
	Practice (n = 176)	7.68	0.54
U17	Game (n = 1538)	34.16	2.41
	Practice (n = 3297)	20.98	1.48
U18	Game (n = 1210)	30.76	2.17
	Practice (n = 2621)	24.77	1.74

Figure 3. Impacts per player per session and inferred duration of immediate proximity. Impacts determined from triaxial accelerometry Bioharness-3 (Zephyr, MD). Duration of immediate proximity inferred from previous work (Pilotti-Riley, A. et al. (2019)). Data in preparation.

Player proximity inferred from ice rink dimensions

These data indicate the duration of time that players are in immediate proximity, but it does not provide direct evidence as to how long players are in close, but not immediate proximity. Although it is likely players are in immediate proximity for shorter periods of time than are commonly believed it cannot be determined from this data if that is the case for other distances. That being said, given the surface area of a North American ice rink, (approximately 200 ft x 85 ft = 17,000 ft^2), each player could be evenly distributed with 1,416.67 ft^2 to themselves. Of course, as a dynamic game, it is highly unlikely that players would be evenly distributed over the ice surface. A typical scenario that is more likely to be encountered in most game situations would be when one team is trying to maintain possession within the attacking zone and all players (save one goalie) are in one offensive zone. The dimensions of one team's zone (e.g. blue line to boards) are typically 75 ft x 85 ft = 6,375 ft^2. Therefore, if the zone was populated with 11 players (10 skaters and 1 goalie), the average area occupied by each player would be 579.55 ft^2 or 24 ft x 24 ft. Although players may not be evenly distributed in the zone, strategy generally dictates players maintain a structure that keeps them spread over the entire zone in relatively even proportions. This is likely the most concentrated on the playing surface players would generally be, on average, at any given time during a game. So, although hockey is a dynamic game, where players do come within immediate proximity numerous times per game, the

players are not limited to small distances and therefore may not be in close proximity for substantial amounts of time.

In conclusion, using a relatively large, robust dataset collected in ecologically valid settings (i.e. on-ice practices and games), it can be determined that youth hockey players are in immediate proximity for less than a few seconds for practices and games, regardless of age or level of play. Additional datasets will be necessary to determine duration of exposure of players at other distances, but it is plausible that the durations of exposure of ice hockey players to others in close proximity during on-ice activities is less than is commonly believed.

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EXHIBIT 4 – WISE HOCKEY REPORT ON CONTACT

WISEHOCKEY®

A game changer

Player Close Range Exposure

Analysis

2020-05-27

This analysis aims to produce information on player to player close range exposure time (CRET). Close range between two players is defined as a distance of less than two meters. The analysis focuses on time players spend within close range. The distances were calculated for all the players on ice, regardless of whether the game was active or not. A total of 15 games were analyzed and the data for the analysis was produced by the Wisehockey system.

1. Player Pairs

The first phase of the analysis involved pairing all players of each individual game. The pairs were formed the way described in table 1.

Table 1: Pair formation in a game.

	Player_1	Player_2	Player_3	$\cdots$	Player_N
Player_1	-	$\text{Pair}_{1,2}$	$\text{Pair}_{1,3}$	$\cdots$	$\text{Pair}_{1,N}$
Player_2	$\text{Pair}_{2,1}$	-	$\text{Pair}_{2,3}$	$\cdots$	$\text{Pair}_{2,N}$
Player_3	$\text{Pair}_{3,1}$	$\text{Pair}_{3,2}$	-	$\cdots$	$\text{Pair}_{3,N}$
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\ddots$	
Player_N	$\text{Pair}_{N,1}$	$\text{Pair}_{N,2}$	$\text{Pair}_{N,3}$		-

After pairing the players the total CRET for all pairs was calculated. Table 2 shows the results. Please notice that not all players were on ice at the same time – this lowers the median, mean, Q1, and Q3 considerably. This data represents the overall exposure.

Table 2: Total CRET statistics for all pairs in all games (s).

Game	Mean	Max	Std	Q1	Median	Q3
1	17.4	113.1	18.6	3.8	11.0	23.8
2	17.5	96.8	17.6	4.4	12.5	23.9
3	21.5	111.7	19.6	7.7	16.0	28.5
4	22.3	110.8	21.0	6.4	16.8	29.7
5	21.2	111.0	20.8	5.8	14.1	30.6
6	23.0	113.5	23.6	6.2	14.8	31.6
7	22.2	108.4	24.3	5.1	13.5	29.7
8	22.4	111.1	21.1	6.7	16.6	32.2
9	20.6	108.4	20.1	5.6	14.6	29.0
10	25.9	111.6	24.4	7.1	17.8	37.4
11	18.9	111.7	19.7	5.0	12.1	25.3
12	24.4	113.4	23.3	7.4	15.7	34.7
13	19.2	113.3	19.3	4.2	13.3	27.2
14	23.3	112.5	21.9	7.5	16.2	32.3
15	21.6	112.0	22.3	5.8	14.0	29.3

An aggregate statistics table 3 summarizes the table 2. The first column on the left describes the statistic and the rest of the columns show the aggregate results corresponding to the definition on the first row.

Table 3: Aggregate statistics of table 2.

	Mean	Min	Max	Std	Q1	Median	Q3
Mean	21.4	17.4	25.9	2.4	19.9	21.6	22.7
Max	110.6	96.8	113.5	4.1	110.9	111.7	112.8
Std	21.2	17.6	24.4	2.1	19.7	21.0	22.8
Q1	5.9	3.8	7.7	1.3	5.0	5.8	6.9
Median	14.6	11.0	17.8	1.9	13.4	14.6	16.1
Q3	29.7	23.8	37.4	3.7	27.8	29.7	31.9

2. Continuous Exposure

Statistics in table 4 are similar to the ones in table 2 but with one key difference: the CRET is calculated for all continuous exposures separately. In other words, the statistics are not calculated for pairs but rather for continuous exposures. Continuous exposure is defined as the time it takes a pair to exit close range after entering it.

Table 4: Continuous CRET statistics for all pairs in all games (s).

Game	Mean	Max	Std	Q1	Median	Q3
1	1.9	43.4	2.9	0.6	1.1	2.0
2	2.0	41.9	2.9	0.6	1.1	2.1
3	1.9	41.7	2.6	0.6	1.0	2.1
4	2.3	41.8	3.4	0.6	1.2	2.4
5	2.3	61.4	3.7	0.6	1.2	2.4
6	1.5	52.1	2.1	0.4	0.9	1.8
7	2.6	96.9	5.6	0.6	1.2	2.5
8	2.2	60.5	3.5	0.6	1.2	2.4
9	2.0	55.7	3.0	0.6	1.1	2.1
10	2.3	70.9	3.8	0.6	1.1	2.4
11	2.1	48.5	3.4	0.6	1.1	2.4
12	2.1	55.6	3.1	0.6	1.1	2.3
13	2.2	69.5	3.3	0.6	1.2	2.5
14	2.4	63.7	4.0	0.6	1.2	2.5
15	2.2	83.7	4.0	0.6	1.1	2.2

The table 5 shows the aggregate statistics of the table 4. The statistics are derived the same way they were derived in table 3.

Table 5: Aggregate statistics of table 4.

	Mean	Min	Max	Std	Q1	Median	Q3
Mean	2.1	1.5	2.6	0.3	2.0	2.2	2.3
Max	59.1	41.7	96.9	16.1	46.0	55.7	66.6
Std	3.4	2.1	5.6	0.8	3.0	3.4	3.8
Q1	0.6	0.4	0.6	0.0	0.6	0.6	0.6
Median	1.1	0.9	1.2	0.1	1.1	1.1	1.2
Q3	2.3	1.8	2.5	0.2	2.1	2.4	2.4

3. Player CRET Totals

Table 6 shows the total time other players spent within close range of a player while on ice. The results are derived from all games as a summary. This data describes the overall exposure of a player to all other players. Please note that the time is not the time player was exposed to a close range but a sum of the exposure to all other players separately. While some of the exposures probably occurred simultaneously, the sum exposure counts them as if they happened one at a time – hence the higher values.

Table 6: Other players to one player CRET (s).

Mean	Max	Std	Q1	Median	Q3
880.6	1628.2	247.2	695.4	894.9	1040.8

Table 7 shows the time a player spent in close range of any other player. Here the value is the time player was in close range exposure regardless of how many simultaneous exposures the player was in.

Table 7: Player CRET (s).

Mean	Max	Std	Q1	Median	Q3
595.4	996.9	187.8	459.8	598.4	713.5

4. CRET Relation to Player Game Time

Table 8 shows the relative player CRET. The CRET is similar to one shown in table 7 but it is measured only when the game is active and it is divided by the active game time of the player.

Table 8: Active Player CRET / Player Game Time

Game	Mean	Max	Std	Q1	Median	Q3
1	0.20	0.31	0.07	0.17	0.21	0.26
2	0.20	0.33	0.08	0.16	0.21	0.25
3	0.20	0.34	0.07	0.16	0.22	0.25
4	0.23	0.40	0.09	0.18	0.24	0.27
5	0.21	0.35	0.08	0.16	0.23	0.26
6	0.22	0.32	0.07	0.18	0.22	0.26
7	0.23	0.38	0.09	0.18	0.23	0.30
8	0.24	0.39	0.09	0.19	0.26	0.30
9	0.21	0.33	0.08	0.17	0.23	0.27
10	0.23	0.43	0.09	0.17	0.25	0.28
11	0.20	0.32	0.08	0.14	0.21	0.24
12	0.20	0.30	0.07	0.15	0.21	0.26
13	0.22	0.37	0.09	0.17	0.24	0.28
14	0.22	0.32	0.07	0.18	0.23	0.27
15	0.19	0.30	0.08	0.15	0.19	0.26

Table 9 shows the aggregate results of table 8.

Table 9: Aggregate statistics of table 8.

	Mean	Min	Max	Std	Q1	Median	Q3
Mean	0.21	0.19	0.24	0.01	0.20	0.21	0.22
Max	0.35	0.30	0.43	0.04	0.32	0.33	0.37
Std	0.08	0.07	0.09	0.01	0.07	0.08	0.09
Q1	0.17	0.14	0.19	0.01	0.16	0.17	0.18
Median	0.23	0.19	0.26	0.02	0.21	0.23	0.24
Q3	0.27	0.24	0.30	0.02	0.26	0.26	0.27

Figure 1 represents the time player is in close range exposure during active game as the function of active game time of the player. The figure is derived using the information in table 9.

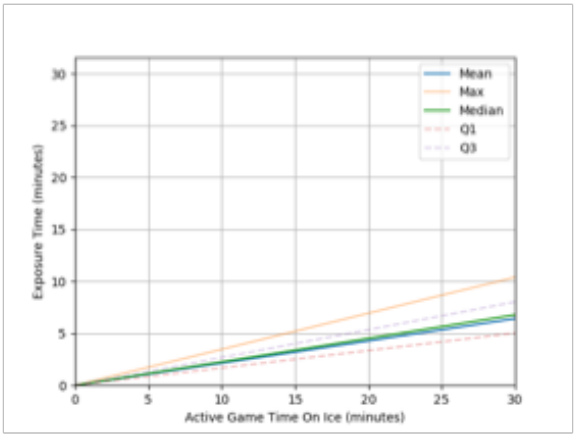

Figure 1: Active player CRET as function of player game time.

In table 10 the data is similar to the data in table 8 but the CRET is calculated when the player is on ice, regardless of whether the game is active or not – CRET similar table 7. The player game time is still calculated from the time when the game is active.

Table 10: Player CRET / Player Game Time

Game	Mean	Max	Std	Q1	Median	Q3
1	0.55	1.14	0.22	0.40	0.58	0.67
2	0.53	0.82	0.17	0.39	0.56	0.62
3	0.66	1.21	0.22	0.53	0.66	0.76
4	0.64	1.06	0.23	0.53	0.68	0.80
5	0.51	0.95	0.20	0.40	0.57	0.62
6	0.70	1.33	0.28	0.50	0.69	0.82
7	0.64	1.26	0.27	0.47	0.67	0.80
8	0.65	0.95	0.22	0.57	0.68	0.82
9	0.59	1.35	0.28	0.39	0.60	0.73
10	0.76	1.01	0.20	0.67	0.81	0.90
11	0.53	0.81	0.16	0.40	0.53	0.65
12	0.70	1.21	0.27	0.54	0.72	0.84
13	0.54	0.89	0.22	0.41	0.56	0.68
14	0.60	0.89	0.19	0.49	0.62	0.73
15	0.60	0.93	0.23	0.50	0.65	0.76

Table 11 shows the derived results of table 10.

Table 11: Aggregate statistics of table 10.

	Mean	Min	Max	Std	Q1	Median	Q3
Mean	0.61	0.51	0.76	0.08	0.54	0.60	0.66
Max	1.05	0.81	1.35	0.18	0.91	1.01	1.21
Std	0.22	0.16	0.28	0.04	0.20	0.22	0.25
Q1	0.48	0.39	0.67	0.08	0.40	0.49	0.53
Median	0.64	0.53	0.81	0.08	0.57	0.65	0.68
Q3	0.75	0.62	0.90	0.08	0.68	0.76	0.81

Figure 2 represents the time player is in close range exposure while on ice as the function of active game time of the player. The figure is derived using the information in table 11. Please note that the players spend more time on ice than in the actual active game – hence, the maximum exposure time can be higher than the actual time on ice.

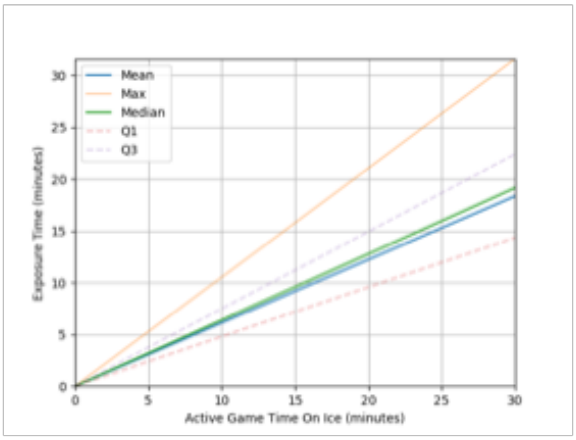

Figure 2: On-ice player CRET as function of player game time.

Exhibit 5 – Example of layers of protective gear

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