Injuries and Protective Equipment Use in Play and Recreation: Analysis of CHIRPP Data

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INTRODUCTION

Unintentional injuries are the leading cause of death and hospitalization for children and youth in Canada,[1] and sports and recreation-related injuries account for one third of all child and youth injuries treated in Manitoba Emergency Departments.[2] British Columbia research of sports and recreation activities that resulted in Emergency Department visits showed the leading causes of sports-related Emergency Department visits are hockey, cycling, and skateboarding in boys; and soccer, cycling and playground injuries in girls.[3] Canadian data suggest that fractures and other orthopedic injuries account for 76% of all sports and recreation injury hospitalizations, and head injuries account for 13% of all injuries.[4] Sports and recreational activities are the third leading cause of traumatic brain injury admissions to Canadian hospitals.[5]

Playing at playgrounds is a popular activity among toddlers and children with children between one and nine years of age spending an estimated 14 hours per week during spring and summer on playgrounds.[6] It is therefore not surprising that playground injuries are the leading cause of injury presenting to British Columbia Emergency Departments among children in this age group.[3] Over 90% of playground injuries occur due to falls, and the most common injuries sustained are fractures (35%) and superficial wounds (19%) to the upper limb, head and neck (73%).[3]

Cycling is another physical activity with very high participation rates among children and youth.[7] Cycling injuries are the most common injury of summer sports and recreational activities, and they comprise half of all Canadian hospital admissions in this category.[8] In British Columbia, cycling is the second leading cause of injury-related Emergency Department visits for children and youth aged five to 14 years.[3] The most common injuries sustained are fractures (32%) and 14% of injuries are head injuries, with 3% requiring hospital admission.[5] The evidence suggests that helmets can reduce the risk of head injury by 85-88%,[9] and although not currently required in Manitoba, helmets use during cycling is legislated in many Canadian provinces.

Over half of children and youth five to 17 years of age participate in in-line skating.[7] Together, skateboarding, roller skating and in-line skating are the leading cause of sports and recreational

injury visits to British Columbia Emergency Departments for youths 10 to 14 years of age, and the third leading cause of visits for children five to nine years of age and youths 15 to 19 years of age.[3] The most common injuries sustained during these activities are fractures and sprains/strains to the upper limb due to falling.[3] Biomechanical evidence suggests that many of these injuries can be prevented by the use of wrist guards.[10] The International In-line Skating Association recommends that in-line skaters always wear full protective gear including a helmet, wrist guards, knee and elbow pads.[11] Similar equipment is recommended for skateboarders and roller skaters.

Ice skating and hockey are two popular winter activities for children and youths between the five and 17 years of age.[7] Ice skating injuries were the third leading cause of hospitalizations and Emergency Department visits due to sport and recreation injury in Ottawa between 2004 and 2008.[12] The majority of ice skating injuries are fractures and open wounds due to a fall, with 28% of injuries affecting the head and neck.[3] An Alberta study identified that hockey was the third leading cause of injury among sports played by junior high students.[13] The most common injuries in hockey are concussions, shoulder and knee injuries.[14] Helmet use is required by Hockey Canada for individuals playing organized hockey and is recommended in the literature for ice skaters.[15 16]

Although swimming is a popular recreational activity for children and youth with over 70% of individuals between one and 17 years of age participating,[7] swimming injuries account only 1% of all sport and recreational injuries seen in British Columbia Emergency Departments.[3] However, the consequences of these injuries can be severe or fatal. Nearly half of all swimming-related presentations to BC Emergency Departments involved injury to the head and neck.[3] Drowning is the second leading cause of injury-related death to Canadian children.[17] It is recommended that infants, toddlers and weak swimmers wear a personal floatation device (PFD) when swimming or playing near water and that all individuals regardless of age of swimming ability wear a PDF when in a boat.[18]

PROJECT AIM

The aim of this project was to use the Winnipeg Children's Hospital subset of the CHIRPP database for injury surveillance in order to characterize patterns of injury for the following recreational activities: cycling, in-line/roller skating, scooter riding, skateboarding, hockey, ice skating, swimming, boating, and playground use. This research project used 2009 CHIRPP data to investigate injury rates and characteristics associated with these recreational activities. We also piloted "rapid analysis" of CHIRPP injury surveillance forms collected from June 2012 until January 2013 to gain information on current injury rates, type of injuries sustained and protective equipment used during these activities. The analysis of these two sets of data was undertaken to determine whether head injuries, fractures, and drowning associated with these sports and recreation activities have changed over time.

In 2012, IMPACT began working closely with partners in government, non-profit organizations and sports and recreation and injury prevention organizations as part of the Manitoba Coalition of Active and Safe Kids. This group aims to increase the use of protective equipment (i.e. wrist guards, helmets, knee and elbow pads and PFDs) among children and youth and to raise awareness about preventing injury during recreational activities including swimming, cycling, wheeled sports, playing at playgrounds and ice skating. The rapid analysis of CHIRPP injury surveillance forms was undertaken to inform the injury prevention initiatives implemented by the Manitoba Coalition of Active and Safe Kids.

OBJECTIVES

The objectives of this project are:

1. To establish injury patterns among children and youth who participate in popular recreational activities using the most recent full year of CHIRPP data.

2. To monitor and report in real-time head injury, fractures and drowning/near-drowning sustained while participating in wheeled sports, ice skating, hockey, swimming/boating, and playground use.

3. To monitor and report the use of protective equipment (helmets, wrist guards, elbow pads, knee pads, and PFDs) reported by injured children for the target activities.

METHODS/DESIGN

Injury patterns were summarized using the most recently available year of Winnipeg CHIRPP data. After consultation with the national office, this was deemed to be 2009, which had 6,162 records. The data were manually coded to identify cases that comprised sport and recreation activities that have high participation rates among children and youth. The recreational activities that were investigated were playing at playgrounds, cycling, skateboarding, in-line/roller skating, scooter riding, hockey, ice skating, swimming and boating. Injury types of interest were head injury, fracture, open wound, and drowning. The "other injury" category included dislocations, sprains, strains, superficial, dental and eye injuries.

The number and type of injuries associated with the different sport and recreational activities were determined. Injuries that occurred at the playground were reported according to the type of equipment that was being used when the injury occurred. Due to a recent report of increased fracture risk among children who go down a slide with an adults[19] and an increased number of injuries seen in Children's Hospital Emergency Department in 2011-2012 that involved this injury mechanism, injuries associated with slides were further divided into those that occurred when children were sliding alone and those that occurred when children with sliding with others.

Protective equipment use was also investigated. The main categories of protective equipment use examined were personal floatation device (PFD), protective eye wear or face masks, sports padding, protective clothing, and helmets. As such equipment is not used when playing at playgrounds, protective equipment use was investigated only for the other recreational activities considered. There were no recorded uses of protective eyewear or face masks for these activities, and the variable code "safety device" in the CHIRPP system does not include a code for wrist guards. Therefore, protective equipment use was only evaluated for helmet, sport padding/protective clothing and PFD use.

Winnipeg CHIRPP forms were extracted for the most recent eight month period with complete data (n=4909). For each month forms were provided to the Project Research Assistant who scanned them to determine those that involved the desired sports and recreation activity types

(i.e. inclusion criteria). The following data was extracted from included records: date of injury, age, gender, activity, protective equipment use, injury type and hospital admission (see data collection form in Appendix A). Data are summarized descriptively by these variables.

RESULTS

Analysis of 2009 CHIRPP Data

There were a total of 6,162 cases in the 2009 CHIRPP database from Winnipeg's Children's Hospital Emergency Department. A total of 910 cases were identified that involved playgrounds (n=260; 28.6%), cycling (n=203; 22.3%), skateboarding (n=82; 9.0%), in-line/roller skating or scooter riding (n=27; 3.0%), hockey (n=265; 29.2%), ice skating (24; 2.6%), swimming (n=47; 5.2%) and boating (n=1; 0.1%). Hockey, playground use and cycling were the activities responsible for the greatest number of injuries among the recreational activities. Together they contributed to over 80% of the total number of sports and recreation injuries investigated.

Among injuries that occurred at the playground, most injuries (40.4%) were during general play (n=105), 27.3% were on the monkey bars (n=71), 16.5% were on the slide (n=43) and 15.8% were on the swing (n=41). When injuries on the slide was further divided by sliding alone or with a companion, there were 31 injuries in the database in which children were identified as sliding alone and 12 in which they were sliding with an adults or another child.

Injuries during Recreational Activities

Table 1 shows the types of injuries sustained during cycling, inline/roller skating/scooter riding, skateboarding, ice hockey, ice skating, swimming and boating in the 2009 CHIRPP data. The most common injury types sustained during these activities are fractures (28.3%) and "other injuries" (38.2%) which include dislocations, sprains/strains, superficial, dental and eye injuries and dog bites. Nearly one-fifth (18.4%) of injuries were head injuries, 15.0% were open wounds and less than 1% were drownings.

The greatest number of fractures and open wounds occurred at the playground (n=77, 30% and n=48, 35%, respectively); whereas, head injuries were most common among individuals playing hockey (n=80; 48%). Other injuries most commonly occurred during hockey and playground play (both n=98; 28%). Swimming was the cause of the drownings (n=2).

Table 1. Number of injuries (%) by recreation activity

	Cycling	Other Wheeled[1]	Skbdg[2]	Hockey	Ice Skating	Play-ground	Swim/boat [3]	**Total**
Fracture	55 (21.4)	10 (3.9)	29 (11.3)	68 (26.5)	14 (5.4)	77 (30.0)	4 (1.6)	257 (100)
Drowning	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (100)	2 (100)
Head Injury	32 (19.2)	2 (1.2)	10 (6.0)	80 (47.9)	2 (1.2)	37 (22.2)	4 (2.4)	167 (100)
Open Wound	38 (27.9)	2 (1.5)	7 (5.1)	19 (14.0)	3 (2.2)	48 (35.3)	19 (14.0)	136 (100)
Other injury	78 (22.4)	13 (3.7)	36 (10.4)	98 (28.2)	5 (1.4)	98 (28.2)	19 (5.5)	347 (100)
Total	203 (22.3)	27 (3.0)	82 (9.0)	265 (29.2)	24 (2.6)	260 (28.6)	48 (5.3)	909 (100)

[1] Other wheeled = inline/roller skating and scooter riding
[2] Skbdg = skateboarding
[3] Swim/boat consists of 47 swimming injuries and 1 boating injury. The boating injury was an open wound.

The types of injuries that occurred at the playground and the distribution of injuries across the different types of playground equipment are outlined in Table 2. Injuries most commonly occurred during general playground play (n=105; 40% of total injuries) followed by use of the monkey bars (n=71; 27.3% of total injuries). The most common injuries at the playground were fractures which accounted for nearly 30% of the injuries seen at the Children's Hospital Emergency Department (n=77) and "other injuries" which accounted for 38% of injuries (n=98). Fractures most commonly occurred during general playground play (35%), playing on the monkey bars (30%) and slides (26%); whereas, head injuries most commonly occurred during general play (38%), swings (27%) and monkey bars (24%).

Table 2. Number of injuries (percentage) by playground activity

	General	Slides	Monkey bars	Swing	Total
Fracture	27 (35.1)	20 (26.0)	23 (29.9)	7 (9.1)	77 (100)
Head Injury	14 (37.8)	4 (10.8)	9 (24.3)	10 (27.0)	37 (100)
Open Wound	26 (54.2)	5 (10.4)	8 (16.7)	9 (18.8)	48 (100)
Other injury	38 (38.8)	14 (14.3)	31 (31.6)	15 (15.3)	98 (100)
Total	105 (40.4)	43 (16.5)	71 (27.3)	41 (15.8)	260 (100)

Injuries that occurred on slides were further investigated to determine the injuries sustained when one child was on the slide at a time and when a child was sliding with another child or adult. Of the 43 injuries reported on slides, 31 occurred when sliding alone and 12 occurred when sliding with others. Fractures were the most common injury that occurred on the slide irrespective of mechanism with approximately half of sliding injuries being fractures (sliding alone: 14 out of 31; sliding with another: 6 out of 12).

Protective Equipment Use in Recreational Activities

Protective equipment use was evaluated for cycling, skateboarding, other wheeled activities, hockey and ice skating. Although helmets are recommended for cyclists, skateboarders and people on scooters and in-line skates, 70-78% of individuals in the CHIRPP database who were injured participating in these activities were not wearing helmets (Table 3). In contrast, helmet use was higher among injured hockey players (85%) and ice skaters (46%). Few individuals wore any other protective clothing or sports padding among any of the sports or recreation activities investigated.

Table 3. Number of individuals wearing protective equipment (%) by recreation activity

	Cycling (n=203)	Other Wheeled[1] (n=27)	Skate-boarding (n=82)	Hockey (n=265)	Ice Skating (n=24)
Helmet	60 (29.6)	6 (22.2)	20 (24.4)	226 (85.3)	11 (45.8)
Sports padding/ Protective clothing	1 (0.5)	1 (3.7)	0 (0)	8 (3.0)	1 (4.2)

[1] Other wheeled = inline/roller skating and scooter riding

There was only one boating injury reported in the CHIRPP database, and this individual was wearing a PFD. Only 13% of the 47 injured swimmers were wearing PFDs.

Real-time analysis of 2012-2013 Data

From June 2012 to January 2013, 717 cases were identified that involved playgrounds, cycling, inline skating, scooter riding, skateboarding, ice hockey, ice skating, swimming or boating. The number of cases in per month is outlined in Table 4. The proportion of injuries involving these activities per month varied from 12 to 17% with the most injuries occurring in July and August (16-17%) and the least in December and January (12%).

Table 4. Total number of cases and number of sports and recreation injuries per month from June 2012 until January 2013

Month	Sport and Recreation Cases[1]	Total Cases	Proportion Cases with Sport/ Recreation Cause[1]
June 2012	105	650	16.2%
July 2012	86	510	16.9%
August 2012	108	660	16.4%
September 2012	101	662	15.3%
October 2012	88	602	14.6%
November 2012	71	550	12.9%
December 2012	79	626	12.6%
January 2013	79	649	12.2%
Total	717	4909	13.8%

[1] Sport and recreation cases refers to those that involved cycling, inline skating, scooter riding, skateboarding, ice hockey, ice skating, swimming or boating.

As expected due to the popularity of different activities for different seasons, the types of sports and recreation activities in the CHIRPP database varied monthly. The number of summer (i.e. cycling, inline skating, scooter riding, skateboarding, swimming and boating) and winter (i.e. ice hockey and skating) activities each month is depicted in Figures 1 and 2 respectively. As expected, cycling, skateboarding and other wheeled activities, playground use, swimming and boating were more common from June to September; whereas, hockey and ice skating were more common mechanisms of injury from November to January.

Figure 1. Number of the different summer sports and recreational activities in the CHIRPP database per month (n=467)

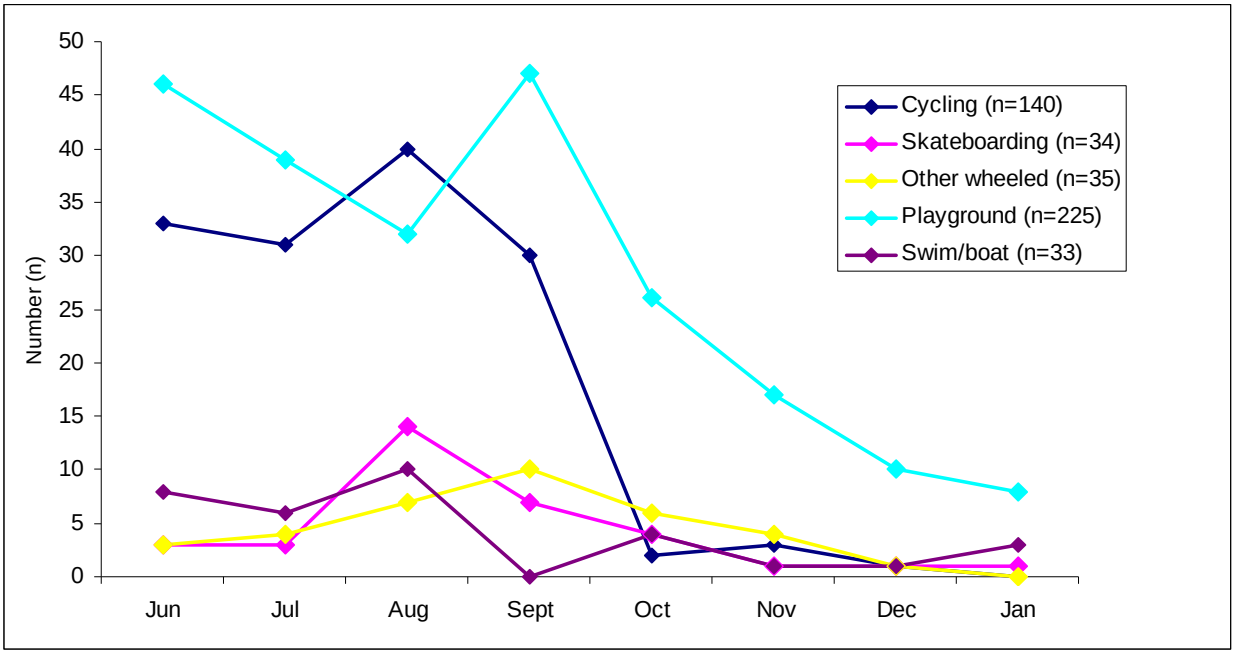
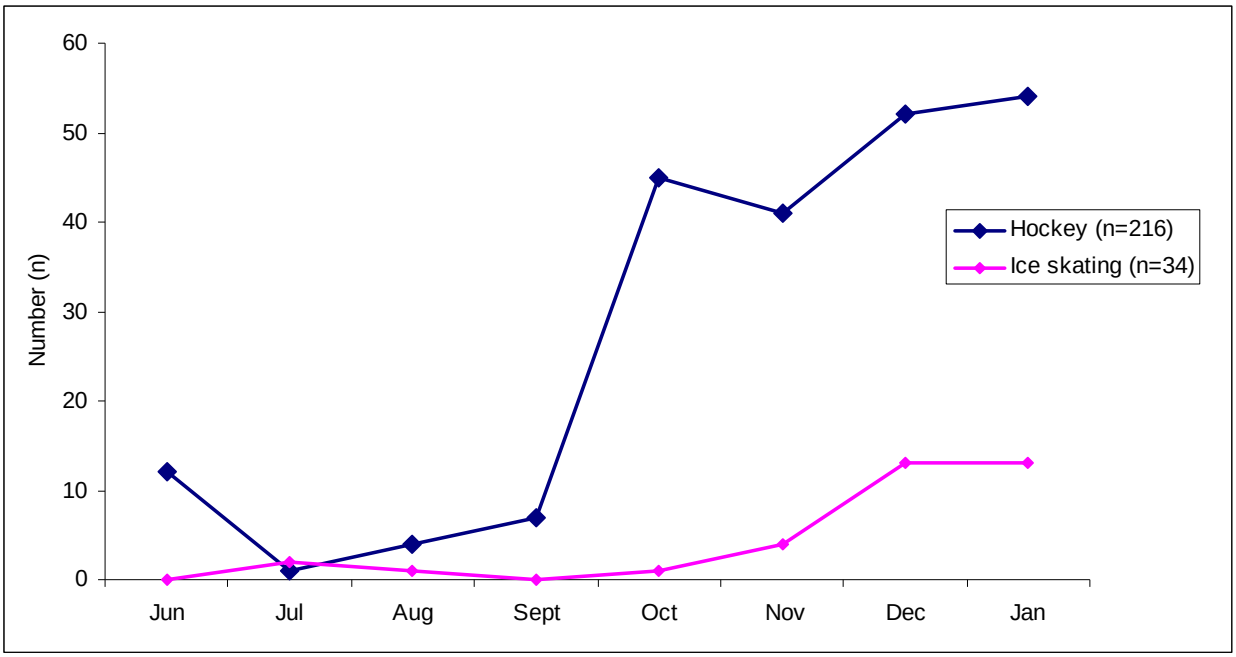


Figure 2. Number of the different winter sports and recreational activities in the CHIRPP database per month (n=250)



Sports and Recreation Injuries by Age and Gender

Our real-time analysis of the CHIRPP database identified sports and recreational injuries to children and youth aged 0 to 17 years. The majority of injuries were to children and youth aged 5-9 and 10-14 years of age with 36% and 42% of injuries involving these respective age groups. (Table 5)

Table 5. Number of sport and recreational injuries (%) by age group

Age Group	Number of Injuries (%)
0-4 years of age	70 (9.8)
5-9 years of age	255 (35.6)
10-14 years of age	303 (42.3)
15-17 years of age	89 (12.4)
Total	717 (100)

Between June 2012 and January 2013 there are more males (66%) in the CHIRPP database than females (34%) who sustained injuries during sport and recreation activities (Table 6).

Table 6. Number of sport and recreational injuries (%) by gender

Gender	Number of Injuries (%)
Male	470 (65.6)
Female	246 (34.3)
Unknown	1 (0.1)
Total	717 (100)

Types of Sports and Recreation Injuries

The most common injury in the CHIRPP database between June 2012 and January 2012 that involved cycling, inline skating, scooter riding, skateboarding, ice hockey, ice skating, swimming or boating were "other" injuries (n=254), which included dislocations (n=9), sprains/strains (n=199), superficial wounds (n=39), dental (n=5) and eye injuries (n=1) and dog bites (n=1). There were four cases of missing data in the "other" injury category. Fractures (n=220; Table 7) were the second most common injury and they involved the forearm (n=61, 28% of all fractures), wrist (n=44, 20% of all fractures), other bones in the upper extremity (n=50, 23% of all fractures) and other areas of the body (n=65, 30% of all fractures).

Table 7. Number of sport and recreational injuries (%) by injury type

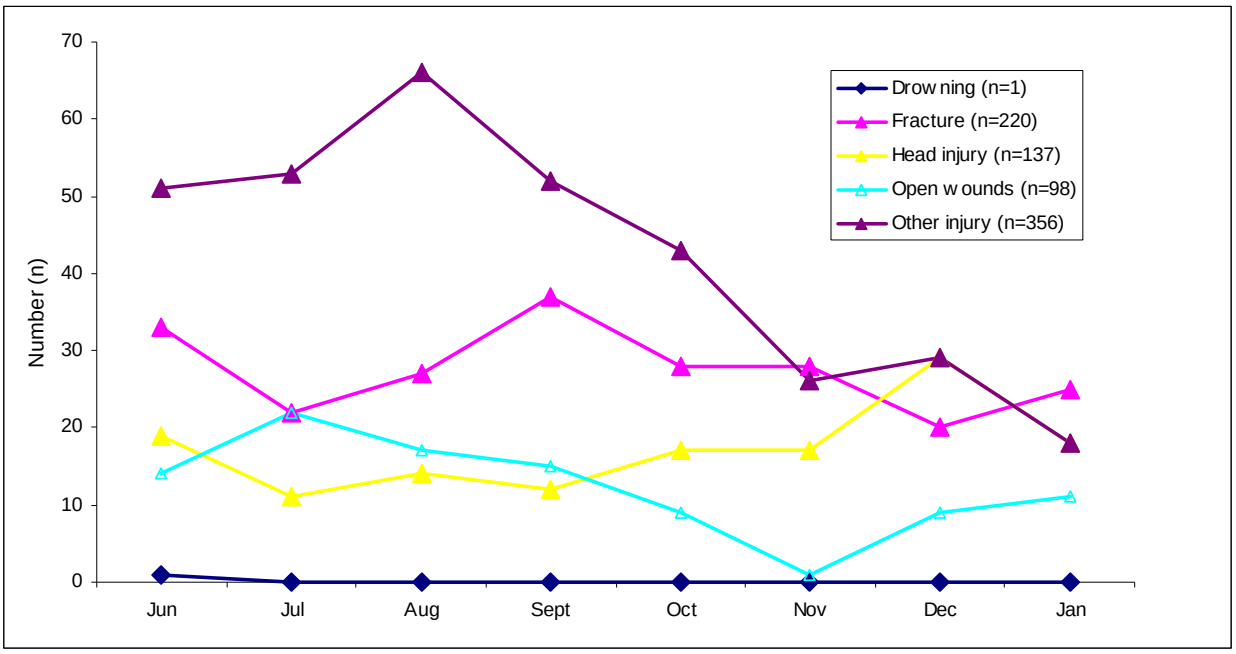
Type of Injury	Number of Injuries (%)
Drowning	1 (0.1)
Fracture	220 (30.8)
Head injury	137 (19.2)
Open wound/laceration	98 (13.7)
Other injury	258 (36.1)
Total	714 (100)[1]

[1] Three cases in the CHIRPP database did not provide data for type of injury (n=714).

Figure 3 shows the distribution of the types of injuries per month from June 2012 until January 2013. The occurrence of fractures was fairly stable each month ranging from 37 in September to 20 in December. Head injuries were highest in December (n=29) and lower in most other months ranging from 11 to 19 cases; whereas, the number of "other" injuries (including strains/sprains,

dislocations and superficial injuries) seen was higher from June to October (n=43-66) and lower from November to January (n=26-36). Open wounds varied between nine and 22 cases per month except for November during which there was only one injury in this category. The single near-drowning case in this time period occurred in June. The total number of sports and recreational injuries in the CHIRPP database each month varies from 71 in November, accounting for 10% of the total injuries, to 107 in August, accounting for 15% of the total injuries.

Figure 3. Number of injuries in the CHIRPP database per month (n=714)



Sports and Recreation Injuries by Activity Type

The most common sports and recreation activities in the CHIRPP database were playground use (31%), hockey (30%) and cycling (20%) (Table 8). Fractures (37%), open wounds (34%) and "other" injuries (31%) were most common at the playground; whereas, over half of head injuries occurred when playing hockey (Table 8; 52%).

Fractures and "other" injuries are the most common injury types seen in skateboarding (38% and 41% respectively), other wheeled activities (40% each) and playground play (37% and 35% respectively). Injuries during swimming/boating (39%) and cycling (40%) most commonly fell into the "other injury" category. Fractures were the most common injury presentation during ice skating (37%); whereas, head injuries (33%) and "other" injuries (34%) were most common during hockey.

Table 8. Number and type of injuries (%) by recreation activity

	Cyclists	**Other Wheel**[1]	**Skate-board**	**Hockey**	**Ice Skate**	**Play-ground**	**Swim/ Boat**[2]	**Total**
Fracture	32 (14.5)	14 (6.4)	13 (5.9)	60 (27.3)	14 (6.4)	82 (37.3)	5 (2.3)	220 (100)
Head injury	19 (13.9)	1 (0.7)	3 (2.2)	71 (51.8)	6 (4.4)	30 (21.9)	7 (5.1)	137 (100)
Open wound	32 (32.7)	6 (6.1)	4 (4.1)	12 (12.2)	4 (4.1)	33 (33.7)	7 (7.1)	98 (100)
Drowning	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	1 (100)
Other injury	56 (21.7)	14 (5.4)	14 (5.4)	72 (27.9)	10 (3.9)	79 (30.6)	13 (5.0)	258 (100)
Total	139 (19.5)	35 (4.9)	34 (4.8)	215 (30.1)	34 (4.8)	224 (31.4)	33 (4.6)	714 (100)

[1] Other wheeled = inline/roller skating (n=16) and scooter riding (n=19)
[2] Swim/boat = boating (n=1) and swimming (n-32)

Playground Injuries by Play Equipment Use and Injury Type

Due to the high number of injuries that occurred at playgrounds (n=224) and the range of activities and play equipment available at most playgrounds, playground injuries were further investigated. Data indicate that injuries that occurred at playgrounds most commonly occurred during general playground play (48%; n=109) and when using the monkey bars (24%; n=54) and slide (17%; Table 9). The types of injuries that occurred at the playground and the distribution of injuries across the different types of playground equipment are also outlined in Table 9. The most common injuries were fractures (n=82; 37%) and "other" injuries (n=79; 35%). Fractures most commonly occurred when playing on the monkey bars (n=32); whereas, head injuries, open wounds and "other" injuries were most common during general play.

Table 9. Number of injuries (%) by playground activity

	General Playground	Slide	Monkey bars	Swings	Total
Fracture	27 (32.9)	17 (20.8)	32 (39.0)	6 (7.3)	82 (100)
Head injury	20 (66.7)	3 (10.0)	5 (16.7)	2 (6.7)	30 (100)
Open wound	18 (54.5)	4 (12.1)	2 (6.1)	9 (27.3)	33 (100)
Other injury	43 (54.4)	14 (17.7)	15 (19.0)	7 (8.9)	79 (100)
Total	108 (48.2)	38 (17.0)	54 (24.1)	24 (10.7)	224 (100)

Due to an increased number of Children's Hospital visits associated with children and toddlers sliding down the slide with a parent or another child, further data was extracted regarding this injury mechanism. Among the 38 injuries that occurred on the slide, 30 injuries (79% of sliding injuries) occurred when sliding alone and 8 injuries (21% of sliding injuries) occurred when sliding with others. Data indicate that 14 of the 30 children sliding alone presented with fractures (47%) and three of the eight children sliding with others presented with fractures (38%). The characteristics of the eight cases of children sliding with others are outlined in Table 10. All of the eight cases were discharged from the Emergency Department and none required hospital admission.

Table 10. Characteristics injuries when sliding down the slide with a parent or another child (n=8)

Case	Injury type	Injury location	Age	Gender
1	Fracture	Unknown	2 years	Female
2	Fracture	Lower leg	5 years	Female
3	Fracture	Forearm	6 years	Male
4	Sprain/strain	Unknown	1 year	Male
5	Soft tissue injury	Unknown	1 year	Male
6	Soft tissue injury	Unknown	1 year	Male
7	Soft tissue injury	Unknown	2 years	Male
8	Pulled Elbow	Unknown	4 years	Female

Hospital Admission for Sports and Recreation Injuries

The majority (98%) of sport and recreation injuries seen at Children's Hospital Emergency Department and recorded in the CHIRPP database were discharged from the Emergency Department after medical attention was received (Table 11). Only sixteen cases (2.2%) of injuries required hospital admission and these injuries were fractures (n=14, 88%), head injury (n=1, 6%) and one case of open wound/laceration.

Table 11. Number of sports and recreation injuries (%) discharged or admitted to hospital

Disposition	Number (%)
Discharged	698 (97.5)
Admitted to hospital	16 (2.2)
Left without being seen	2 (0.3)
Total	716 (100)[1]

[1] One case in the CHIRPP database did not provide data for type of injury (n=716).

Sports and Recreation Injuries and Protective Equipment Use

Data was collected to investigate the protective equipment use among Emergency Department admissions recorded in the CHIRPP database. Playground use was excluded from this analysis as there are no protective equipment recommendations for children playing at playgrounds. Helmets were most common among children and youth who were injured while playing hockey (91%), ice skating (47%) and cycling (45%; Table 12). Nearly 80% of individuals in the

database who were playing hockey were wearing protective padding/equipment; whereas, even though elbow and knee pads and wrist guards are recommended for skateboarders, inline skaters and roller skaters, none of the individuals participating in these activities wore any protective padding. None of the 32 swimmers in the CHIRPP forms were wearing PFDs, but the single boater was wearing a PFD.

Table 12. Number (%) of individuals in each recreation activity category wearing protective equipment

	Cyclists (n=139)	Other Wheel* (n=35)	Skateboard (n=34)	Hockey (n=215)	Ice Skating (n=34)
Helmet	63 (45.3)	5 (14.3)	8 (23.5)	195 (90.7)	16 (47.1)
Sports Padding	2 (1.4)	0 (0)	0 (0)	171 (79.2)	2 (5.9)

[1] Other wheeled = inline/roller skating and scooter riding

DISCUSSION

Real-time Rapid Analysis of 2012-2013 Data

Extraction of data in real-time between June 2012 to January 2013 identified 717 cases which involved playing at playgrounds, cycling, skateboarding, in-line/roller skating, scooter riding, hockey, ice skating, swimming and boating. Children and youth between five and 14 years of age were most likely to attend the Emergency Department at the Winnipeg Children's Hospital for injuries from these activities. Two-thirds of cases were males; whereas, only one-third were females.

The most common sport and recreation activities that resulted in injuries were playground use (31%), hockey (30%) and cycling (20%). The high prevalence of playground and cycling injuries is not surprising due to the high participation rates in these activities. Playing at playgrounds has been identified as the most popular recreational activity done by children between the ages of one and four years with a participation rate of 95%.[7] This is also popular among children aged five to 12 with a participation rate of over 80%.[7] Cycling is the most popular sport and recreation activity among children and youth aged five to 12 (90% participation rate) and the second most popular activity among youth aged 13 to 17 years.[7] Participate rates in hockey have been

estimated to be considerably lower than for playgrounds and cycling with an estimated 6-8% of females and 36-36% of males between the ages of 5 and 17 years participating.[7] Interestingly, despite these low participation rates, hockey was associated with 30% of injuries in the sports and recreation injuries in the CHIRPP data between June 2012 and January 2013. This suggests that injury rates may be higher among children and youth playing ice hockey compared to other recreational activities.

Fractures accounted for 31% of injuries in the activities investigated. The most common site of fracture was the upper limb with 70% of fractures affecting this area. Fractures most commonly occurred at the playground, specifically when playing on the monkey bars and during general play. This finding is consistent with previous reports that fractures are almost twice as likely to occur on monkey bars than on slides.[20] There are a number of possible reasons why monkey bars many be associated with more fractures. First, there may be an increased risk of falling due to the high level of upper body strength and coordination required to hang on the monkey bar;[21] and second, monkey bars are often greater than 1.5 metres from the ground and falling from this height has been associated with increased risk of injury.[22]

Over one third of injuries (36%) in the CHIRPP surveillance forms between June 2012 and January 2013 fell into the category “other” injury which mainly consisted of dislocations, sprains/strains and superficial soft tissue injuries. These injuries were most common among individuals at the playground (31%) and those playing hockey (28%). Open wounds were most common among children playing at the playground (34%) and cycling (33%). Over half of all head injuries reported in the CHIRPP database occurred when playing hockey. This finding is supported by research by Emery et al. (2006)[14] that identified concussion to be the most common injury type in hockey.

The majority of sport and recreation injuries recorded in the CHIRPP database were discharged from the Children’s Hospital Emergency Department after medical attention was received. Injured individuals were only admitted to hospital in 2% of cases. The overall hospital admittance rate for CHIRPP cases from 1998-2007 is 6.3% (60,917 cases with 3,821 hospital

admissions). This suggests that sport and recreational injuries are perhaps less severe than other injury mechanisms.

Protective equipment use varied according to recreational activity. Helmet (91%) and protective padding (79%) use was highest among injured hockey players. This is expected as Hockey Canada requires all players in senior, junior, minor and women's leagues to wear helmets. Helmet use among ice skaters was considerably lower at 47%. Skate Canada recommends the use of a Canadian Standards Association (CSA) approved hockey helmet for beginner ice skaters of all ages[23] and most arenas recommend helmet use for all participants, but few arenas required helmet use among skaters. The differences in helmets use between individuals participating in hockey and ice skating suggest that developing and enforcing mandatory helmet use policies is important to increase the rate of helmet use.

Only 45% of injured cyclists in the 2012-2013 CHIRPP surveillance forms were wearing helmets As helmets have been shown to reduce the risk of head injury by 85-88%,[18] increased rates of helmet use many decrease the incidence of head injuries among cyclists. Studies have shown that helmet use can be improved by bike helmet legislation[24 25] and community-based interventions that involve education, promotion and/or free helmets. [26 27] In Manitoba, legislation mandating bicycle helmet use for individuals less than 18 years of age will be introduced in 2013 which could decrease the number of head injuries among cyclists seen in Winnipeg emergency departments.

IMPACT has conducted observations of helmet use among cyclists and ice skaters in Winnipeg. [28] There were 1682 cyclists observed from April to June 2012, and the overall rate of helmet use was 41%. Helmet use among children and youth aged one to 19 years was 30% (n=581). This suggests that helmet use is similar in individuals seen in Children's Hospital Emergency Department for cycling injuries as it is for the general Winnipeg population. Between December 2012 and January 2013, IMPACT observed helmet use among 694 ice skaters at indoor arena and outdoor and pleasure rinks in Winnipeg. The overall rate of helmet use was 50%; whereas, helmet use among children and youth was 55% (n=613). This again suggests that helmet use

among injured ice skaters presenting to Children's Hospital Emergency Department is similar to that observed among other child and youth ice skaters in Winnipeg.

Only 24% of skateboarders and 14% of individuals in the CHIRPP data who were participating in other wheeled activities wore helmets. Although the use of wrist guards was not specifically recorded in the CHIRPP surveillance forms, none of the individuals injured during these activities indicated they were wearing any sports padding. This is consistent with data from previous studies that found children and youth participating in skateboarding, in-line skating and scooter riding wore less protective equipment than recommended[29] and helmets were only worn in 12% (scooter riding) to 18% (in-line skating) of participants.[30] Suggested strategies to improve protective equipment use and decrease risk of injury are education, parent reinforcement, protective equipment policies and the provision of free helmets.[29 30]

PDF use was also low among injured swimmers and boaters with only 3% of these individuals wearing PFDs. However, this data is difficult to interpret. PFD use is recommended for individuals in boats and infants, toddlers and weak swimmers who are in or near water. As swimming ability is not known from the CHIRPP data, we are not able to determine how many swimmers should have been wearing PFDs.

Comparison of 2009 and 2012-2013 Data

The type of injuries sustained and the distribution of injuries by sport and recreation activity were similar between the 2009 and the 2012-2013 data analyses. In both time periods, playgrounds, hockey and cycling were responsible for the greatest number of injuries among the activities investigated. The proportion of fractures was also consistent between time periods with fractures accounting for 31% of 2012-2013 and 29% of 2009 injuries, and playing at playgrounds was consistently the most common activity associated with this type of injury. Half of all head injury cases in the CHIRPP database for both 2009 and 2012-2013 occurred among children and youth playing hockey.

Helmet use among hockey players and ice skaters was similar between the 2009 and the 2012-2013 datasets (hockey: 85% in 2009 and 91% in 2012-2013; ice skating: 45% in 2009 and 47% in 2012-2013). However, helmet use among injured cyclist in the 2009 CHIRPP database was only 30% compared to 45% in the 2012-2013 data. This finding is consistent with the increase in helmet use that has been documented among Winnipeg cyclists over this time period. Observations of bike helmet use in 2008 and 2010 found that 35-38% of cyclists wore helmets; whereas, rate of helmet use was 41% in the 2012 observations. Helmet use among skateboarders and individuals participating in other wheeled activities was similar between timeframes. Hockey players were the only group in which more than a few people reported using protective in both 2009 and 2012-2013. Interestingly, the reported use of protective padding was considerably higher in 2012-2013 with 79% of injured hockey players using protective padding compared to only 3% in 2009.

Limitation in Using CHIRPP Data

The CHIRPP database contains information about a sample of children and youth who present to the Winnipeg Children's Hospital Emergency Department. Although almost 50,000 children are treated at the Winnipeg Children's Hospital Emergency Department each year, not all parents complete the CHIRPP forms as requested. The CHIRPP database is thought to under-represent critically and fatally injured children. Furthermore, the CHIRPP database only contains information about the Children's Hospital Emergency Department, and therefore excludes those children and youth who present to other Winnipeg hospital Emergency Departments.

The rapid analysis method undertaken in this report enabled analysis of current data which is important to provide timely information of injuries and evaluation of injury prevention initiatives. However, the 2012 and 2013 data used was not CHIRPP-coded or screened for errors. As we were interested in injury rates and characteristics for specific sports and recreation activities, only cases who reported these injury mechanisms were included in analysis. Therefore, we are unable to report these injuries as a percentage of total injuries in the Winnipeg CHIRPP database. As data capture can vary over time, we also acknowledge that true incidence cannot be reported, and comparisons of injury occurrence must be interpreted with caution.

Conclusions

The high number of injuries and proportion of more severe injuries that occurr at playgrounds and when playing ice hockey compared to other sports and recreational activities suggests that these activities warrant attention. Strategies to reduce playground injuries due to falls include maintaining playground structures at less than 1.5 meters in height,[21 22 31 32] removing monkey bars (i.e. horizontal ladders),[21] and using energy-absorbent surfaces under the equipment, such as loose fill (i.e. course sand or pea gravel) or rubber,[21 33 34] with an impact absorption of less than 150g.[35] Research has shown that compliance with these safety guidelines can reduce fall-related injuries and Emergency Department visits.[36 37] Considerable attention has been given to the problem of injuries, particularly head injuries, in hockey. A recent systematic review identified that changing rules to restrict body checking can reduce injury rates by three to 12 times.[38] It is important that injury prevention strategies such as these be implemented to protect Canadian children and youth from injury and to decrease the burden on the healthcare system.

Protective equipment use is recommended in many recreational activities to decrease the risk of injury. Data from the CHIRPP forms indicate equipment use is high in hockey but lower for ice skaters, cyclists and those participating in other wheeled activities. As helmets and other protective equipment can prevent injuries in these activities, continued advocacy, promotion and incentives are important.

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APPENDIX A - CHIRPP RAPID ANALYSIS DATA EXTRACTION FORM

ID Number _____	
Date of Injury	Date: _____ DD/ _____MM / _____ YYYY
Age	_____ **years**
Gender	Male ☐ Female ☐ Unknown ☐
Activity	☐ CYCLIST ☐ IN-LINE/ROLLER ☐ SCOOTER ☐ SKATEBOARD ☐ HOCKEY ☐ ICE SKATING ☐ SWIMMING ☐ BOATING ☐ PLAYGROUND: ☐ Slide ☐ Sliding with parent/other person ☐ Swing ☐ Monkey bars
Protective Equipment Use	☐ Helmet ☐ Wrist Guards ☐ Knee Pads ☐ Elbow Pads ☐ PFD
Injury Type	Head Injury ☐ Drowning ☐ Fracture ☐ If fracture, specify: ☐ Wrist ☐ Forearm ☐ Other upper extremity ☐ Other _____
Disposition	☐ Admitted to Hospital ☐ Discharge