

Proceedings From the Ice Hockey Summit on Concussion: A Call to Action

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Objective: The objective of this proceeding is to integrate the concussion in sport literature and sport science research on safety in ice hockey to develop an action plan to reduce the risk, incidence, severity, and consequences of concussion in ice hockey.

Methods: A rationale paper outlining a collaborative action plan to address concussions in hockey was posted for review two months prior to the Ice Hockey Summit: Action on Concussion. Focused presentations devoted specifically to concussion in ice hockey were presented during the Summit and breakout sessions were used to develop strategies to reduce concussion in the sport. This proceedings and a detailed scientific review (a matrix of solutions) were written to disseminate the evidence-based information and resulting concussion reduction strategies. The manuscripts were reviewed by the authors, advisors and contributors to ensure that the opinions and recommendations reflect the current level of knowledge on concussion in hockey.

Results: Six components of a potential solution were articulated in the Rationale paper and became the topics for breakout groups that followed the professional, scientific lectures. Topics that formed the core of the action plan were: metrics and databases; recognizing, managing, and return to play; hockey equipment and ice arenas; prevention and education; rules and regulations; and expedient communication of the outcomes. The attendees in breakout sessions

identified action items for each section. The most highly ranked action items were brought to a vote in the open assembly, using an Audience Response System (ARS). The strategic planning process was conducted to assess: Where are we at?; Where must we get to?; and What strategies are necessary to make progress on the prioritized action items?

Conclusions: Three prioritized action items for each component of the solution and the percentage of the votes received are listed in the body of this proceeding.

Key Words: concussion, hockey

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INTRODUCTION

Ice hockey is a fast, collision sport played by both sexes in all age groups and at all skill levels¹ predominantly in North America, Europe and countries of the former Soviet Union.² The speed, hard ice, boards, sticks, pucks, player collisions, body checks and illegal on-ice activity³ contribute to the prevalence of concussion.⁴ The evidence-based foundation for the Ice Hockey Summit: Action on Concussion, held at Mayo Clinic 2010, was derived from research on concussion and focused on recognition, assessment, management and return to play guidelines (Zurich, 2008)^{5–7} integrated with ice hockey specific research. The sport science research addressed equipment, impact forces, standards testing, at-risk behaviors, rule enforcement, education and behavioral modification programs.^{8–13} Although quality guidelines for sport related concussion management have been written,^{5–7} there are unique features that distinguish ice hockey from other contact sports. Professional hockey is a skilled, exciting game, rooted in a heavily reinforced culture of aggressive play^{14–22} and it is the only professional sport, other than boxing and mixed martial arts, that ‘tolerates’ fighting during play. To eliminate behaviors or major penalties that increase the risk of concussive brain injury and related neurotrauma (ie, head hits, blind side hits, fighting and checking from behind), consistent educational messages must be delivered, compliance with rules must be rewarded and infractions must be penalized across all levels of participation.^{23–27} Other aspects of prevention pertain to player equipment^{28–33} and facilities.^{34,35} As important as prevention is, there is also a recognized need for astute detection, accurate

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diagnoses, optimal management and appropriately followed Return to Play guidelines.^{5-7,36,37} The goal of the Summit was to identify appropriate strategies to decrease concussion in hockey.

METHODS

The Ice Hockey Summit objectives provided the template for a rigorous curriculum that met Continuing Medical Education (CME) credit standards. The attendees were actively engaged in prioritizing action items and identifying implementation strategies for a multi-factorial solution. After reviewing the literature prior to the Summit, it was hypothesized that the components of a solution to concussions in hockey were those depicted in the Figure.

The methodology that generated the matrix of prioritized actions included a pre-summit concussion literature review,^{7,13} on-site shared content by presenters and panelists, as well as discussion and debate during breakout sessions. The attendees in breakout sessions identified action items for each section. Each breakout leader presented action items based on agreement along with a strategic plan to the general assembly. The most highly ranked action items were brought to a vote in the open assembly, using an Audience Response System (ARS). Attendees voted on preferred actions items for all six sessions. The three in each category considered the highest priority become part of the group's official recommendation. The strategic planning process assessed: Where are we at? Where must we get to?; and What strategies are necessary to implement the action plan.

The following action items from each breakout were prioritized by popular vote using ARS. The percentage of attendees voting a particular action item to be of immediate importance (in need of being tackled first) is listed below. Attendees were then asked to choose their second priority and then their third choice. NOTE: Some breakouts offered more than 3 choices. Listed are the top 3 for each breakout, thus not all equal 100%.

RESULTS

I Databases and Metrics (Breakout A): (1) Collect concussion data using a consistent hockey-specific definition in small, well-designed studies (**60.9%**); (2) Standardize funded, hockey concussion research similar to football, lacrosse, etc (**18.5%**); and (3) Partner with pending legislative action to collect concussion data (**15.2%**).

II Recognizing, Diagnosing, Management and Return to Play (Breakout B): (1) Mandate education for coaches, parents and referees (**46.5%**); (2) Remove athletes from play for all suspected concussions (**39.4%**); and (3) Ensure that concussed athletes do not return to play (practice or game) until cleared by medical personnel (**14.1%**).

III Player Equipment and Facilities (Breakout C): (1) Educate the hockey community on the actual role of equipment (**53%**); (2) Emphasis that the helmet is only one factor that may reduce concussion risk (**34%**); and

(3) Continue to support research that develops and tests both equipment and facilities (**13%**).

IV Prevention and Education (Breakout D): (1) Engage organizations (USA Hockey, Hockey Canada, International Ice Hockey Federation, etc) to educate coaches, parents and student athletes (**79.2%**); (2) Take advantage of the currently available educational content in programs such as the Hockey Education Program (Fair Play), Centers for Disease Control and Prevention's (CDC) Heads Up program, Play it Cool and ThinkFirst (**6.9%**); and (3) Ensure that educational efforts drive a behavioural and cultural change (**5.0%**).

V Rules and Enforcement (Breakout E): (1) Eliminate all head contact (intentional and unintentional) (**74%**); (2) Postpone legal body checking in youth games until age 13 (Bantam level) (**18.7%**); and (3) Eliminate fighting at all levels of hockey participation (**7.3%**).

VI Communication (Breakout F): (1) Require an in-person, pre-season meeting each year for all hockey participants (including parents) (**33.7%**); (2) Provide a unified message for delivery (**31.7%**); and (3) Create a multi-media package, including a robust social media presence (**19.8%**).

The prioritized action items from each breakout group were accompanied by a strategic planning process that was unique to each component of the solution, but there were some areas of overlap.

DISCUSSION

A strength of this Summit was the diversity of the stake holders who shared their expertise and concerns about concussion. The Rationale manuscript posted as pre-reading on the registration web site raised many questions that were subsequently discussed from the podium and during the breakout sessions. Many hockey enthusiasts hoped that advances in hockey equipment, especially the technology of hockey helmet design could further dissipate the kinetic energy transmitted to the brain. Engineers, biomechanics experts and equipment standards committee members on the faculty agreed that hockey helmets currently perform well in preventing focal injuries to the skull. However, contemporary helmets are not designed to manage linear and rotational accelerations that are linked to brain tissue deformation and concussive injury. Nonetheless, all agree that players should wear a properly fitted, certified helmet to protect from focal injury. The helmet must be well secured to maintain proper position on the head and to prevent it from falling off. Players should also wear a custom-fitted mouth guard that remains in place during play to protect the mouth, teeth and jaw, even though there is no current strong evidence that mouth guards decrease the risk of concussion.³⁸ Elbow and shoulder equipment should have sufficient padding since contact of the hard plastic shell to the head may result in an increased force transmission.³⁰ In addition to improving the protection offered by helmets, concussion prevention must also be achieved via rule changes and enforcement, educational programs and behavioral modification. When a concussion is suspected, accurate detection, removal from play, individualized management, and a monitored physical and cognitive

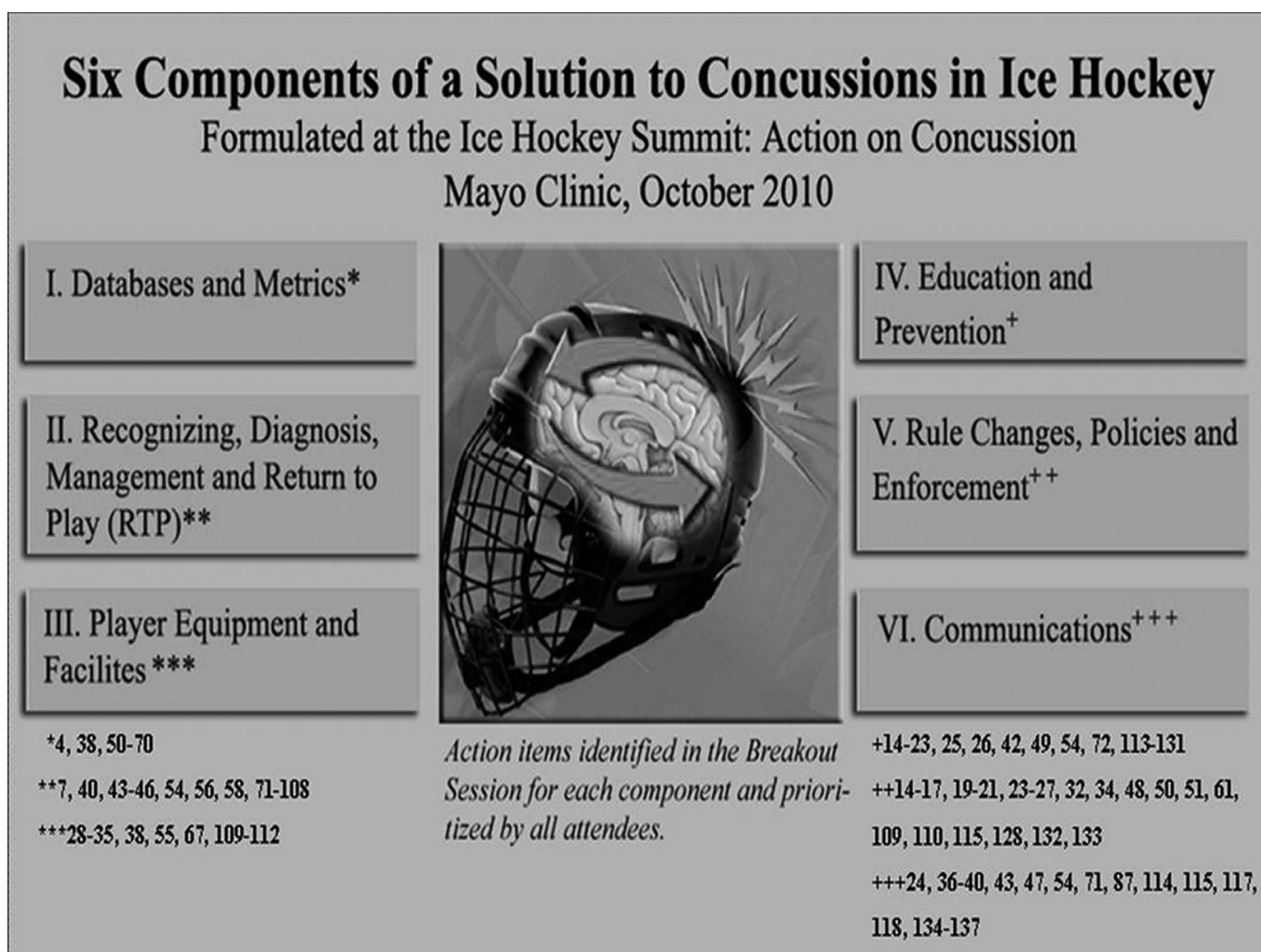


FIGURE. Six priority action areas. Adapted from a figure prepared by Anne Braatas, Mayo Clinic-Rochester, published in the Mayo Clinic Orthopedic Update, 2011. The symbol in each box is depicted below adjacent to the reference numbers appropriate to each component of the solution.

progression protocol must be followed. A qualified health care provider should evaluate and manage the concussed player and guide the Return To Play (RTP) decision-making.

POST SUMMIT ACTION TAKEN

Some concerns not included in the prioritized action items are being addressed by the Post-Summit Implementation Committees. For example, an important focus of future research is prevention of concussion in female athletes, particularly in contact sports, such as hockey. Preliminary studies suggest that female hockey players sustain more concussions than males,³⁹ acknowledge more baseline symptoms on the Sport Concussion Assessment Tool,⁴⁰ may self report more frequently,⁴¹ and activate neck musculature earlier than males, yet have a reduced neck muscle mass.⁴² These and other factors may increase their risks.

The need to ensure consistency of the definition of concussion was prioritized by the Data Base/Metrics breakout session. Furthermore, since concussions are under-reported at all levels of participation, players who admit symptoms and

those who are observed to sustain a mechanism of injury that may have caused a concussion should be removed from play and promptly evaluated. This observational strategy has been used in both youth⁴ and Junior A⁴³⁻⁴⁶ studies to gather more accurate concussion incidence data. A diligent approach to concussion identification is already practiced by many rink side athletic trainers/therapists and physicians, but more emphasis is needed.

It was determined at the Summit that concussion prevention and stakeholder instruction requires mandatory education of coaches, parents and athletes. The educational content to meet these needs is currently available. Dissemination of programs such as the Hockey Education Program (HEP) that includes Fair Play, Play it Cool (PIC), and ThinkFirst's Smart Hockey video requires engagement of national governing bodies. Minor modifications to the content of the video and the educational programs are currently underway so that unified, multi-modal messages on concussion are disseminated. Part of the dissemination process under discussion includes the development of a web site to serve as a repository for all

concussion education materials suited to players, coaches, parents and healthcare providers. In addition to mandatory education of hockey coaches, players and parents, there is a need for universal education of healthcare providers. The curriculum and web-based E-learning programs are being addressed by national organizations. Rule changes to eliminate all head contact, delay legal body checking in games until age 13 (Bantam level) and abolish fighting requires the support of district, state, and provincial leadership. Thus, the implementation process has been initiated with USA Hockey, Hockey Canada and the International Ice Hockey Federation (IIHF).

CONCLUSIONS

Recently, the authors of a thoughtful paper⁴⁷ discussed the failure of sports medicine healthcare professionals and sports scientists to engage in injury prevention for youth athletes. They hypothesized that tension exists at the interface between sport and medicine based on differences in core values. Sport values competition and success; whereas, medicine values wellness and prevention. The author stated that one exception pertained to an investigation of the use of Fair Play rules in a hockey tournament.⁴⁸ Suffice to say that injuries and penalties related to rough play were four times less frequent in hockey games using Fair Play rules.^{21,48} National governing bodies continue to explore strategies to recruit youth hockey players and grow the sport. In Minnesota, where Fair Play has been in place since 2004, youth hockey (boys and girls combined) grew by 14.9% between 2005 and 2007,⁴⁹ a positive trend that continues.

The evidence-based action items, prioritized at the Ice Hockey Summit: Action on Concussion described in this Proceedings, are clear, hockey-specific and appropriate. These actions include rule changes and education of all players, coaches and parents using available educational and behavioral modification content to reduce major penalties and reward sportsmanship. Implementation efforts are underway as a collaborative effort from individuals, national governing bodies, and the media to grow the game and make hockey safer for all participants. To reduce the risk of concussion in ice hockey, we must all respond to this "Call for Action!"

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APPENDIX

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