

Dramatic impact of using protective equipment on the level of hurling-related head injuries: an ultimately successful 27-year programme

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ABSTRACT

Background Major head injuries are not uncommon in the Irish national game of hurling. Historically, helmets were not worn.

Methods We report a multistage campaign to facilitate and encourage the use of appropriate headgear among the estimated 100 000 hurling players in Ireland. This campaign lasted for 27 years between 1985 and 2012, and involved a number of different stages including: (1) facilitating the establishment of a business dedicated to developing head protection equipment suitable for hurling, (2) placing a particular emphasis on continual product enhancement to the highest industrial standards, (3) engaging continually with the game's controlling body, the Gaelic Athletic Association (GAA), with the ultimate objective of securing a mandatory usage policy for protective helmets and faceguards, (4) longitudinal research to monitor hurling injury, equipment usage and players' attitudes and (5) widely communicating key research findings to GAA leaders and members, as well as to 1000 clubs and schools.

Results One of our three relevant studies included 798 patients and identified a dramatic association between the type of head protection used by a player, if any, and the site of the injury requiring treatment. While 51% of the injured players without head protection suffered head trauma, this rate was only 35% among the players wearing helmets and 5% among players who were wearing full head protection (both a helmet and faceguard).

Conclusion The GAA responded in three stages to the accumulating evidence: (1) they introduced a mandatory regulation for those aged less than 18 years in 2005; (2) this ruling was extended to all players under 21 years in 2007 and (3) finally extended to all players irrespective of age, gender or grade from January 2010. The latter ruling applied to both games and organised training sessions.

INTRODUCTION

Hurling, the national game of Ireland, is one of the fastest field sports in the world. The name camogie is used when there are only female participants. The game, usually of 60 or 70 min duration, is played on a field approximately 140 m long, and 100 m wide. Usually contestants are organised into two teams of 15 players each, who use 1-m long ash sticks to strike a hard leather covered ball called a sliothar (figure 1). The unrestricted nature of the stick swing, the weight of the stick (0.6 kg) and the nature of the ball (cricket-like) combine to imbue hurling with an ever present risk of injury. Insight into the variety and intensity of clashes in hurling

is best gained through attending a contest; video examples include this link.¹

Two personal experiences motivated one of us (PJC) to initiate and maintain a 27-year campaign to reduce the level of head injury suffered by hurling and camogie players. These experiences were (1) personally suffering a serious head injury while playing hurling as a medical student in 1968 and (2) working in North America as a newly qualified general practitioner, and observing a dramatic reduction in serious head injuries among ice hockey players when the use of protective headgear was introduced.² The addition of a faceguard to the helmet was shown to be particularly important.

MAIN STAGES

Developing equipment

The early 1980s preceded the present-day eminence of research stratagems such as systematic reviews, evidence-based medicines and 'focus groups'. Rather, the first objective in the campaign discussed here was to source appropriate helmets and faceguards. Available equipment developed for sports such as ice hockey or activities such as cycling did not seem suitable. On his return from North America in 1979 to establish a general practice, PJC focused on developing handmade prototypes during the period 1979–1983. He then approached both the national industrial authority (IDA) and the GAA with a proposal to establish an enterprise to produce protective helmets and faceguards for hurlers. The former organisation requested a feasibility study including the provision of reliable epidemiological information regarding the scale and nature of hurling injuries requiring A&E care. The findings of this study suggested that custom-designed protective headgear was likely to prove most effective in the prevention of hurling injuries while simultaneously being more acceptable to players. Thus, a commercial enterprise (MYCRO) was established in 1985 using rented premises at Ballincollig, Co. Cork, to develop both a suitable protective helmet and a complementary faceguard (figure 2). An ethos of adopting the highest available standards of design, materials, testing and manufacturing was a central feature of this enterprise from its origin. Consequently, the products have evolved through five generations to date (figure 3). This incremental developmental process has had continual enhancement of the equipment's protective capabilities, with parallel ergonomic improvements at its core. MYCRO continually provided all available device research information to the national body with responsibility for

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Figure 1 Stick and ball: baseball, ice hockey, hurling (left to right).

maintaining the highest manufacturing standards, namely the National Standards Authority of Ireland (NSAI). This collaborative process reached an important milestone in 2006 when standard I.S. 355 was enacted.³

Obtaining surveillance data to help persuade policy makers and players

A series of three epidemiological studies were undertaken in order to longitudinally assess the level of hurling-related



Figure 2 The Mycro type 1 head protector.



Figure 3 The Mycro type 5 head protector.

injuries. Each such study was population-based using an A&E department setting; all hurling-related injuries were included in each instance irrespective of the anatomical site of injury. Over the 27-year study period, there was only 1 other equivalent A&E study carried out on hurling injuries.⁴ This was based at the emergency department of St. Luke's Hospital, Kilkenny during 1987/1988.

A number of key findings emerged from these studies:

- ▶ In 1984, there were 817 hurling injuries treated at what is now the emergency department of Cork University Hospital; 28% involved facial/head morbidity with 33% consisting of hand injuries.⁵ Players' head protection status was not noted in this study due to the very low usage of such equipment at that time.
- ▶ The 1987/1988 Kilkenny study reported 350 hurling injuries. The distribution of the site of these injuries was roughly similar to that noted in the 1984 study; 40% affected the head/neck/face while 35% involved the hand/wrist. An increasing uptake of helmets was noted by the authors (45%). However, only 1 of the 350 injured hurlers was wearing both a helmet and a faceguard.
- ▶ Our study was repeated in the same Cork A&E department again for a 1-year period during 1992/1993.⁶ We noted 413 hurling injuries—approximately half the number of injuries (817 players) that presented 8 years earlier. The overall proportion of head injuries had reduced to 20% while the level of hand trauma had increased to 56%. The rapidly increasing voluntary uptake of protective headgear was confirmed by this study. It was estimated that 64% of injured players were wearing helmets while 44% of these helmeted players also wore a faceguard.

However, it was other analyses of the 1992/1993 study that led one of the authors (MJC) to strongly urge that a further study be immediately organised using an extended population base. These analyses consisted of figures 3 and 4 that inter alia reported the following findings⁶:

1. Around 41% of non-helmeted injured players suffered head injuries compared to just 13% of their helmeted counterparts ($p < 0.001$);
2. Within the helmeted injured players, 21% of those not wearing faceguards suffered head injuries compared to just 3% of those wearing a faceguard ($p < 0.001$).

Clearly, if these estimates were a true reflection of the impact of wearing a helmet and faceguard on reducing the risk of head injury, then it would be virtually obligatory on the GAA to immediately adopt a policy of mandatory usage of such equipment.

Despite the short interval of 18 months between the second and third population studies, and the resource implications of carrying out another investigation (this time) involving all three Cork City emergency departments with approximately double the patient throughput of Cork University Hospital, the recommended third study was carried out throughout the year 1995.

The turning point

The findings of the 1995 Cork study were decisive. In line with the approximate doubling of the population base through extension of the study to the A&E departments of the Mercy and South Infirmary acute hospitals in Cork City, the total number of injured hurlers seen almost doubled from 413 to 798 players. There were three substantial cohorts of patients that required to be examined for the impact of wearing protective headgear on the site of hurling-related injuries presenting for A&E care: (i) 347 (43.5% of the total group) players who were not wearing a helmet, (ii) 179 (22.4%) who were using a helmet only at the time of injury and (iii) 272 (34.1%) hurlers who were wearing both a helmet and a faceguard. The three distributions of sites of injury were as follows:

1. Players not wearing any head protection: head (51%), hand (26%);
2. Players wearing a helmet only: head (35%), hand (36%);
3. Players wearing both helmet and faceguard: head (5%), hand (64%).

The sequential examination of head protection usage levels showed that 95% of under-age players wore full head protection compared to 29% of adult championship players.

Campaign of persuasion with GAA leaders

Thus, the findings of the 1995 study strongly reinforced the trends seen as a result of the 1992/1993 investigation. Consequently, the only question remaining related to the manner in which this decisive information would be used.

For a number of reasons, it was decided to pursue a campaign of persuasion with GAA leaders with the sole objective of securing a mandatory ruling on the matter. This campaign initially focused on dialogue with different leaders within the organisation.

Our usage statistics indicated that the use of full head protection was already de facto in place for underage players on a voluntary basis, most likely due to the influence of parents and teachers as well as the players themselves.

Thus, it was extremely welcome, if not surprising, when the GAA ruled that the use of full protective headgear was mandatory for all players under 18 years of age from January 2005 onwards. The age limit was then further increased to 21 years from April 2007.

Being aware from the usage survey results of the reluctance of the majority of adult players to use protective headgear, a wall chart was prepared with the assistance of a graphics artist to strongly convey the huge increase in the risk of head injury in the absence of protective equipment. This wall chart was prepared in 2005, and circulated to approximately 1000 hurling clubs and schools as a final stage of persuasion.

To widespread relief and satisfaction, the ultimate goal of the programme—a mandatory usage policy for all players—was eventually achieved during 2008, and it has been enforced since 1 January 2010. On that date, the GAA implemented Rule 4.2 (i) of Part 2 of the Official Guide stating inter alia that “In all Hurling Games and Hurling Practice sessions, it is mandatory for all players to wear a helmet with a facial guard.”⁷

Possible adverse event

An unanticipated consequence of the research programme has been to identify a probable increase in the level of hand injuries, in association with the use of full head protection. Initial consideration of this observation suggests the possible combination of (1) an increased sense of ‘invincibility’ due to the substantial risk reduction of head injury and (2) some degree of temporary visual impedance due to the use of full protective equipment. Consequently, a protective glove has been developed, and it is now available.

DISCUSSION

Four observations seem appropriate. These are:

1. With persistence, a major sports injury preventive programme can be successfully pursued with minimal resources. As reflected to varying degrees elsewhere,^{8,9} an underlying, and frequently iterative, process of innovation and associated scientific measure seems fundamentally necessary.
2. There is clearly a significant potential, indeed duty, for leadership on the part of sports organisations themselves in the field of injury prevention. As well as indicating a highly responsible stance on the part of such associations, active involvement in injury prevention endeavours can only improve the overall success of the sport in terms of player recruitment and retention.
3. For various reasons, a substantial expansion in the population-based epidemiological assessment of sports injuries seems vitally important. These reasons include societal factors,^{10,11} public health^{12–14} and trends in morbidity levels.^{15–17} Otherwise, the profound lack of denominator information underlying the scale, aetiology and precise nature of significant sporting injuries will persist to the ultimate detriment of players’ well-being across an ever widening range of sporting and recreational codes.
4. Minimally, each significant sporting organisation should maintain an anonymised database containing a suitable entry for each competitive event taking place under its jurisdiction each day of the year. Access to such an information resource would be of great assistance in providing vital denominator data to any researcher investigating related sport injuries (particularly when doing so on a population basis).

In conclusion, the relatively small and narrow published literature dealing with hurling injuries has (understandably perhaps) often focused on head trauma.^{18–23} Implementation of the new mandatory rule, and its likely consequence in terms of drastically reducing head injury rates, should facilitate the emergence of a fuller and more diverse profile of hurling injuries in the near future.²⁴

What are the new findings

- ▶ The proportion of hurling-related head injuries among A&E treated players are reduced 10-fold when full head protection is availed of by wearing both a helmet and faceguard.
- ▶ Vital rule change has been achieved through the completion of appropriate population-based research.
- ▶ Evidence was discovered of iatrogenic-like consequences in terms of hand injuries when full head protective equipment was used.

How might it impact on clinical practice in the near future

- ▶ All medical interaction with patients who play hurling or camogie should convey the importance of wearing full head protection in non-formalised settings.
- ▶ Similarly, the probably increased risk of hand injury should be stressed.
- ▶ The non-trivial risk of inflicting hand injuries in particular on opponents should be conveyed, in addition to the concomitant need to avoid any element of reckless play in this regard.

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Contributors All data collection was carried out by PJC while analyses and epidemiological interpretations were mainly the responsibility of MJC. Both authors contributed to both the literature review and overall commentary.

Competing interests None.

Ethics approval The study consists of the analysis of population-based anonymised data only. The data are of an observational non-intrusive nature only.

Provenance and peer review Not commissioned; internally peer reviewed.

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