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Developing injury prevention programmes for ladies Gaelic football: a Delphi study

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ABSTRACT

Background High injury rates are evident in the community sport of ladies Gaelic football, and the costs associated with these injuries have major implications for players and the governing body. Injury prevention programmes have been designed but are not being widely adopted. This study aimed to elicit the expert opinion of academics and practitioners on the content and format of injury prevention programmes for ladies Gaelic football.

Methods Twenty-four experts from the areas of coaching science, injury prevention, athletic therapy and physiotherapy took part in this three-round Delphi study. Each round contained multiple-choice, Likert scale and open-ended questions. For each question, consensus was defined as 67% or greater agreement among experts.

Results The experts agreed that 17 components (eg, agility, balance) should be included in injury prevention programmes for ladies Gaelic football, with 12 considered vital for inclusion in most or every session. Programmes should require minimal/no equipment, be 10–15 min in duration and contain 3–4 versions of each exercise for progression and variation purposes. Experts recommended when certain components should be completed but generally agreed that programmes should be capable of being delivered throughout sessions. There was consensus among experts for 13 items (eg, pictures, exercise volume) to be included in full versions of programmes and six in condensed versions.

Conclusions The outcomes of this study provide the foundation for the development of future injury prevention programmes for ladies Gaelic football. Combining these findings with the preferences of end-users throughout programme development may enhance the efficacy of future injury prevention programmes.

INTRODUCTION

Ladies Gaelic football (LGF) is an invasion-based community team sport in which two teams of 15 players compete across two 30-min halves to outscore their opposition.¹ LGF participation poses an inherent risk of injury, with reported match and training injury rates of 42.5 and 7.9 injuries per 1000 hours, respectively.² The costs associated with these injuries can have major implications for players and the governing body.³ A recent injury claim analysis in LGF found the inflation-adjusted mean claim cost increased by 72% from €519.09 in 2012 to €892.11 in 2020.³ In 2022, the total cost of injury claims amounted to €1.3 million, 21% of the Ladies Gaelic Football Association's (LGFA's) total expenditure.⁴ The high levels of injury in LGF continue to negatively affect the playing population.

WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Injury prevention programmes are effective in preventing sports injuries; however, adoption rates within community sports are low.
- ⇒ Qualitative research has offered insight into the opinions of ladies Gaelic football stakeholders towards injury prevention but the perspectives of experts are unknown.

WHAT THIS STUDY ADDS

- ⇒ The expert panel achieved consensus around many content and format elements of injury prevention programmes for ladies Gaelic football. Experts agreed on the overall composition of full and condensed programmes; they believed programmes should be designed flexibly so that they can be implemented throughout sessions, and they should feature 17 different components, should last 10–15 min and should have 3–4 progressions/variations of each exercise.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ This study provides detailed guidelines for the development of injury prevention programmes for the community sport of ladies Gaelic football.
- ⇒ Future research should examine whether programmes designed using these findings can effectively reduce injury risk and achieve long-term adoption.

Efforts must be made to reduce injury risk in LGF, to improve the lives of players and to maintain the financial standing of the association.³

The majority of injuries in LGF involve the lower limb (67.1%) with injuries to the hamstring (21.5%), knee (12.7%), quadriceps (11.4%) and ankle (10.3%) being most common.² A recent summary of systematic reviews revealed that implementing an injury prevention (IP) programme broadly targeting lower-extremity injuries resulted in an injury risk reduction of 31%–42%, while approaches specifically targeting the hamstring, knee or ankle have resulted in reductions of 27%–62%.⁵ The GAA15⁶ and Activate GAA warm-up⁷ are neuromuscular IP exercise programmes specific to Gaelic games that are designed to be implemented as part of a warm-up. These programmes have existed for over 10 years and during this time injury rates in LGF have remained unchanged.³ One observational cohort study indicates that the GAA15 can reduce injury incidence by as much as 66%⁸; however, this



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study experienced a high drop-out rate of 42%, used a non-randomised, non-blinded convenience sample and ultimately presented a 16% higher match injury rate per 1000 hours in the intervention group. As such randomised control trials (RCTs) are required to confirm the GAA15's effectiveness. Currently, 27.8% of LGF players report regularly using IP programmes, with only 12.7% of players completing the GAA15; however, research on both men's and women's Gaelic games players shows that 74.7% of players do consistently warm-up, 53.8% implement stretching, 36.2% complete a cooldown and 25% perform muscle activation exercises.⁹ A thorough understanding of the implementation context and the barriers and facilitators that impact end-users is fundamental to the development of appropriate IP strategies.¹⁰ Qualitative research has explored the barriers and facilitators to adoption, as well as the preferences of adult and youth LGF players and coaches towards IP strategies.^{11–13} LGF stakeholders believe that existing IP programmes (such as the GAA15 and Activate GAA warm-up) are not LGF-specific and can be time-consuming, difficult to implement and boring.^{11–13} LGF players and coaches have called for fun, user-friendly programmes that require minimal equipment.^{11–12} They also want programmes to be mostly team based, no longer than 10–15 min, and based on the best available evidence/expert opinion.¹² Therefore, current IP programmes may be inadequate and new solutions are required to improve adoption. By involving players and coaches, as well as academic experts and healthcare professionals working in the sport in the development of IP programmes, it is believed that programme use can be enhanced.¹⁴ The aim of this study was to attain the perspectives of practitioners and academic experts on the content and format of IP programmes for the community sport of LGF via the systematic approach of the Delphi method. These perspectives, along with previous research and the views of end-users, can then be used to inform the development of comprehensive and evidence-based IP programmes for LGF.

METHODS

The Delphi method is a flexible approach which has been used across multiple disciplines to address issues that require the experience and knowledge of experts.¹⁵ It is an iterative process that involves obtaining and correlating the opinions of experts around a particular topic.¹⁶ As part of this technique, experts complete multiple questionnaires with controlled feedback until some form of consensus is achieved.¹⁶

Participants

Participants were considered experts if they were (1) an academic with five or more peer-reviewed publications in the fields of IP or coaching science (CS), or (2) a certified athletic therapist or chartered physiotherapist that is a member of a governing body (eg, Athletic Rehabilitation Therapy Ireland) and has a minimum of 3 years' experience working in LGF. While no standard criteria exist for the definition of expert in Delphi studies,¹⁷ previous studies have similarly used years of experience and number of publications as defining criteria.¹⁸ Potential academic experts were chosen by searching Google Scholar to identify academics who have authored relevant journal articles. This search included the keywords 'injury prevention programmes' and 'coaching science'. Potential practitioner experts were recruited through our research team's network and with the LGFA's assistance. Thirty invitations were sent via email to potential experts, of which 24 agreed to participate (table 1).

Table 1 Demographic information of Delphi study experts

Demographics					
	Mean	SD	Minimum	Maximum	Frequency
Age (years)	38.2	8.9	24	60	24 (100%)
Women	36.6	8.8	24	51	14 (58.3%)
Men	40.3	9.6	29	60	10 (41.7%)
Injury prevention experience					
	Mean	SD	Minimum	Maximum	Sum (years)
Experience (years)	11.3	7.4	3	25	271
Academic degree					
	Frequency				
Doctorate	14 (58.3%)				
Master	7 (29.2%)				
Bachelor	3 (12.5%)				
Expert type					
Academic	13 (54.2%)				
Practitioner	11 (45.8%)				
Country					
Ireland	16 (66.7%)				
Australia	4 (16.7%)				
UK	3 (12.5%)				
Norway	1 (4.2%)				

Delphi procedure and data analysis

This Delphi study took place between August and November 2023 and consisted of three rounds of questions, distributed using survey software Qualtrics (SAP America, Seattle, Washington). Both open-ended and closed-ended questions were asked on the format and content of IP programmes for LGF and all questions were reviewed by the research team who have clinical and research experience within IP. Expert responses in each round remained anonymous to other experts. Following each round, qualitative content analyses were completed on the experts' responses to open-ended questions. This involved identifying meaningful information, developing codes and organising these codes into categories.¹⁹ These categories were then added to the subsequent clarification round to assess for consensus. A clarification questionnaire was sent to experts via email shortly after each round to ensure responses were accurately represented prior to developing the subsequent round. The clarification questions were more closed-ended, specific or gave fewer options than the questions in the original questionnaire for that round. Achieving unanimous agreement for each question in this Delphi study was not deemed feasible. Therefore, consensus was considered to be achieved if 67% or more of experts were in agreement. This consensus threshold was chosen as it was previously shown to be the median consensus threshold used across a number of Delphi studies in the health sciences.¹⁹ Thus, if 67% or more of the experts rated a Likert-scale question as either 'Agree' or 'Strongly agree', or a single item was selected by 67% or more of experts in a multiple choice question, consensus was deemed to have been reached. Any response which scored between 50% and 67% in the initial questionnaire each round was included in the following clarification round, where it was required to achieve 67% or greater to confirm consensus. The questions in each round of this Delphi study are available in online supplemental file 1.

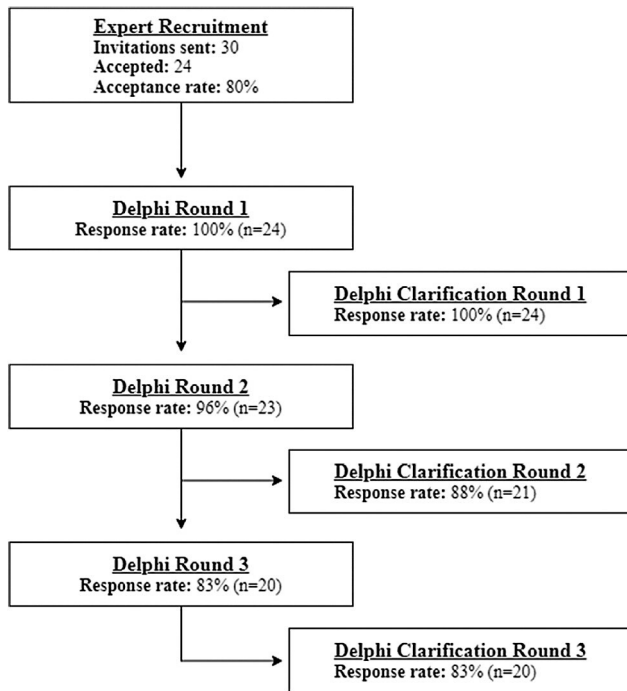


Figure 1 Flow chart representing the response rate of participants throughout the Delphi study.

Patient and public involvement

Players and coaches, the intended end-users of future interventions, were not represented in this Delphi study as their perspective has already been garnered in recent qualitative studies.^{11–13}

RESULTS

The response rates for each round of this study are presented in figure 1. The response rates were above 70%, which is the recommended minimum for Delphi findings to be considered valid.²⁰

Round 1

The expert panel achieved consensus on the following content and format elements of IP programmes for LGF. Seventeen components were considered important to include in programmes (table 2) although not all components need to be addressed in every session (92%), only those that are most vital (75%). It was agreed that multiple components can be combined into a single activity/exercise (92%). Experts recommended that IP programmes should be designed to require no/minimal equipment (71%) but should also contain options for those with gym access (75%). IP programmes for under-16s should consider players' training age, physical characteristics and development (100%), while also having a focus on fun and basic technique/movement patterns (75%).

IP programmes should be capable of being delivered at any time throughout sessions, including the warm-up, main body, or cool down (75%) and should be divided into different sections with different aims (79%). Experts believed IP programmes 10–15 min in length are optimal for training (67%) and pregame (83%) scenarios. Differences should exist between programmes completed during training and those completed during pregame (75%), but consensus was not reached on how these should differ. Programmes should contain at least basic progressions (eg, easy to hard) (92%). Programmes should change, progress

Table 2 Components to be included in injury prevention programmes for ladies Gaelic football and in most or all sessions

Component	Expert agreement for inclusion in IP programmes (%)	Expert agreement for inclusion in most or all sessions (%)
Plyometrics	100	87
Basic movement patterns	96	83
Change of direction technique	96	91
Collision preparation	96	83
Deceleration training	96	83
Jumping/landing technique	96	87
Strength	96	48*
Agility	92	70
Balance	92	67
Dynamic flexibility	92	70
Mobility	88	65*
Sprinting	83	65*
Running technique	79	74
Aerobic fitness	75	61*
Muscle activation	71	74
Reaction drills	71	57*
Sport-specific skills	71	83

*Denotes did not reach consensus.

or vary throughout the season (71%), considering the stage of the season and players' current workload (79%).

Round 2

In round 2, experts agreed on 12 IP programme components to include in most or all sessions (table 2). Sprinting (87%) and strength (87%) exercises were believed to be important in only some or most sessions. No consensus was established around how frequently aerobic fitness, mobility and reaction drills should be implemented. Recommendations should be provided to teams around how to adapt IP programmes (86%). These recommendations should explain how loading and programme components can be modified throughout the season (68%). Experts also believed that six different groups of components could be combined together into single activities (table 3).

Experts agreed on when certain components should be covered within sessions (table 4). However, no consensus was reached around when the following should be completed within sessions: balance, jumping/landing technique, plyometrics and strength.

Round 3

In round 3, there was consensus among experts for 3–4 variations of each exercise to be included in IP programmes for LGF (83%). Experts believed that all players should start with basic versions of each exercise first before progressing (95%), and that recommendations around how to progress/regress should be provided (84%). Regarding the layout of LGF IP programmes, experts agreed that 13 items should be included in full versions and six items should be included in condensed versions (table 5). Consensus was not achieved on the number of exercises to be included in IP programmes completed at training sessions or pregame. At the end of round 3, experts were satisfied that all major topics of IP programme development were addressed during this Delphi study (95%).

Table 3 Components which can be combined into single activities

Group	Components	Expert agreement %
Group 1	Aerobic fitness, running technique, sprinting, deceleration	95
Group 2	Change of direction technique, agility, reaction drills	91
Group 3	Muscle activation, strength	91
Group 4	Plyometrics, jumping/landing technique	82
Group 5	Mobility, dynamic flexibility	77
Group 6	Balance, collision preparation	77

DISCUSSION

While two previous Delphi studies have investigated IP in elite sports,^{21 22} this is the first Delphi study to examine IP programme development in a community sport setting. This study elicited the opinions of international academics and practitioners and reached consensus around numerous content and format elements of IP programmes for LGF. Experts believed IP programmes should be designed with a flexible format and recommended a duration of 10–15 min to balance effectiveness and feasibility. The experts agreed on the general layout of full and condensed IP programmes as well as the key components to include in programmes for LGF. Experts also made specific recommendations around variety and progression as well as emphasising the importance of minimal resource use to maximise accessibility. Many of these findings, but particularly the format-related findings such as the implementation approach, duration and layout are likely applicable to other sports in community or low socioeconomic settings.

Format

The consensus among experts was that IP programmes for LGF should be constructed in a flexible manner so they can be implemented at any time throughout sessions. However, experts did recommend when different components should be implemented, with the majority being during the warm-up or main body of sessions (table 4). Experts in a previous Delphi study similarly agreed that IP programmes should be mainly implemented during the warm-up, but also called for dedicated IP sessions.²² LGF coaches have indicated they want an accessible IP programme that can fit conveniently into sessions.¹¹ While the most prominent IP programmes in Gaelic games^{6 7 23} target implementation during the warm-up, some IP programmes are conducted throughout sessions.²⁴ Research in Camogie

Table 4 When components should be implemented in sessions

Component	Stage of session	Expert agreement %
Agility	Warm-up or main body	90
Muscle activation	Warm-up	86
Sprinting	Main body	82
Mobility	Warm-up or cooldown	81
Deceleration training	Main body	77
Reaction drills	Main body	77
Aerobic fitness	Main body	73
Dynamic flexibility	Warm-up	73
Running technique	Warm-up	73
Change of direction technique	Warm-up or main body	67
Collision preparation	Warm-up or main body	67
Sport-specific skills	Any	67

Table 5 Items to be included in injury prevention programme material for ladies Gaelic football

Item	Expert agreement %
Full version	
How to do each exercise	100
Link(s) to video	94
How not to do each exercise	89
Benefits of the programme	83
Component(s) that each exercise targets	83
Key coaching cues	83
Purpose of each exercise	83
The set-up required	83
Variation/progression/regression details	83
Exercise summary list	78
Picture(s)	78
Exercise volume	72
Time required for each section	67
Condensed version	
Picture(s)	90
Exercise volume	90
Exercise summary list	78
Time required for each section	72
Variation/progression/regression details	70
Key coaching cues	67

indicates that removing prescriptive rules around implementation and allowing coaches to complete programmes when they deem appropriate can enhance coach motivation, confidence and compliance.²⁵ Furthermore, research on the FIFA11+ demonstrated that manipulating the delivery of the programme enhances compliance and still significantly reduces injury burden and severity.²⁶ Some caution is warranted around introducing total flexibility into IP programmes in community sports as stakeholders do value consistency and structure,^{11 12} and IP programmes struggle in real-world settings to achieve high utilisation fidelity (all exercises being completed as prescribed),^{24 27} therefore fully removing structure may exacerbate issues with partial completion and compromise the programme's preventative effect. For these reasons, taking a semistructured approach when implementing IP programmes in community sports may be best. This semistructured approach would encourage the completion of IP throughout sessions when convenient but would also provide a basic framework and recommendations around programme implementation. End-users then have the flexibility to either follow guidelines or tailor implementation to suit their needs. However, further investigation is required to determine the optimal balance between structure and flexibility that maximises both the adoption of the IP programme as well as its preventative effect.

The experts believed that IP programmes completed in training sessions and prior to games should be 10–15 min in duration. They also agreed that pregame IP should differ from IP in training, and several experts suggested that anything strength based or potentially fatiguing be removed; however, this did not achieve consensus. LGF coaches and players want IP to be incorporated into existing sessions and last 10–15 min.¹² Integrating IP programmes into sessions can facilitate superior adoption,²⁴ and regularly completing 10–15 min of IP over a prolonged period can achieve injury risk reductions of as much as 45%, with longer durations of 30 min not showing significant additional benefit.²⁸ Time is a key barrier to IP programme implementation

in LGF,^{11–13} and thus agreement between experts and stakeholders with regards to programme duration, as well as strong evidence for the efficacy of this dosage, is important from a feasibility perspective. That being said, addressing a large number of IP components in 10–15 min is difficult. One suggested solution is combining several components into single activities.¹⁹ In this study, experts agreed on six groups of components that could be combined together into single activities (table 3). By developing programmes based on these groups, IP programmes can be more time-efficient and still contain each of the components deemed important.¹⁹

Experts determined that IP programmes for LGF should feature 3–4 variations of each exercise. For this study, a variation was defined as a change in the number of repetitions, a more difficult version of the same exercise, or a different exercise targeting the same component(s). Adult and youth LGF stakeholders have declared that variety is crucial within IP programmes for preventing boredom and promoting engagement.^{11–13} However, both variety and consistency within IP programmes are believed to facilitate IP adoption.^{11–24} Consistency can lead to habit formation over time, but too much repetition can negatively affect adherence.²⁴ Both experts in the current study and LGF stakeholders in previous studies^{11–13} have stated that IP programmes should feature progression. Research among soccer coaches and practitioners highlighted that existing programmes (ie, FIFA11+) do not contain enough progression and suggested that programmes could be more enjoyable and challenging for end-users by adding greater variety and progression.²⁹ Giving coaches the autonomy to make decisions around how IP programmes are implemented can motivate them to continue conducting programmes long term.²⁵ By providing coaches with numerous variations, education on the importance of variety as well as how to implement said variations, and the freedom to determine when change is needed, it is hoped that sustained buy-in can be achieved.

Experts agreed on 13 format items for the full versions of LGF IP programmes and six items for condensed versions (table 5). The use of pictures and videos (ie, in full programmes) is believed to facilitate improved end-user understanding, accuracy in performance and ease of implementation.³⁰ Previous research has also highlighted that a lack of explanation around the purpose of exercises, what injuries/components they target, and their benefits negatively impacts coach/player buy-in, as end-users require clear reasons to invest their time in IP.³⁰ LGF players and coaches have called for the LGFA to produce IP programmes and actively promote their importance to facilitate adoption.¹¹ Producing both full and condensed versions of IP programmes allows end-users to obtain a thorough understanding of programmes and possess a shortened version better suited for use during sessions.²⁵

Content

It was established that IP programmes for LGF should contain 17 different components but only the most vital IP components need to be implemented in every session (table 2). While the majority of these components are present in existing LGF IP programmes,^{6,23} deceleration training and reaction drills are only included in the Activate GAA warm-up.⁷ LGF stakeholders also concluded that aerobic fitness, agility, basic movement patterns, flexibility, plyometrics and strength exercises should be included in IP programmes.¹² Logically, focusing on the most vital IP components regularly is optimal, but programme deliverers must try to avoid excessive repetition in the implementation

of these components as LGF players have stated this causes tedium and non-compliance.¹¹ At the same time, the concept of core programme components is well established, and research shows that if core components are completed consistently, then some variety, modification and other components can exist without jeopardising the injury risk reduction provided by the IP programme.³¹ Determining the minimum dosage of core components needed for a prophylactic effect as well as the extent of modification and variety that can be implemented while still maintaining programme effectiveness is a vital step in optimising the real-world efficacy of IP programmes. Previous research has made a strong case that low doses of an IP exercise completed consistently can significantly alter injury risk,³² but it is also clear that a significant number of coaches implementing IP programmes make modifications.³³ This underscores the need for further research to better understand these factors.

Experts in the current study and a previous Delphi study²² believed that IP programmes should contain minimal equipment. Previous research showed that LGF coaches are in support of minimal equipment use,¹² adult players' views are mixed,¹² while youth players believe that equipment can encourage participation.¹³ Due to the lack of resources within community sports like LGF, providing teams with equipment on a national scale may not be feasible. However, limiting the amount of equipment required may be beneficial, as exercise complexity and the overall cost to the end-user are then reduced,¹² thus enhancing accessibility, a key issue within community sports. The LGFA should then focus its resources on the development of educational materials to accompany IP programmes instead of equipment. Research in LGF¹¹ and soccer³⁴ has identified a lack of coach education as a barrier to implementing IP programmes and suggested that integrating IP education into existing coach education would significantly improve programme adoption. LGF coaches and players have requested in-person practical IP workshops that are backed by online resources and support.¹² Educating end-users on the importance and effectiveness of IP³⁵ and including practical components in education³⁶ can help them feel more confident in their abilities to execute IP programmes and enhance their willingness to complete IP in the future.

If the preventative effect of IP programmes is to be maximised, they should be accompanied by non-exercise-based IP strategies.²¹ While these are beyond the remit of the current study, a previous Delphi study in sports IP found that load management, previous injury adaptations, teamwork, communication and recovery strategies were important non-programme-related IP considerations.²¹ Ultimately, the injury reductions that prophylactic approaches achieve are a function of both their efficacy and their implementation.³⁷ In real-world settings, approaches relying exclusively on IP programmes have attained limited success as they struggle to achieve widespread uptake.³⁸ IP programmes need to be integrated into a broader IP strategy to maximise their efficiency; this strategy should consider the role of education,³⁴ non-exercise-based approaches,²¹ sex-specific factors³⁹ and should engage key stakeholders at multiple ecological levels (organisations, coaches, players) to consider their needs, their context and to drive the implementation of IP.³⁸

Experts indicated IP programmes aimed at youth players must take steps to be age appropriate. They should focus on fun and technique while also considering training age, physical characteristics and development. Consensus was not reached on how these factors should be considered but experts suggested they were important in relation to loading, progressions and exercise selection. LGF stakeholders also requested that IP programmes specific to players' age and development be implemented once

they start playing LGF.^{11–13} By making IP programmes more relevant to end-users, programme effectiveness and adherence should be enhanced.⁴⁰ Introducing IP from an early age can make it a regular part of the sport's culture and making IP fun allows stakeholders to develop positive attitudes towards IP which are crucial for establishing long-term behaviours.⁴¹

Limitations

While the practitioners included in this Delphi study were based in Ireland and all had many years of experience working in LGF, the backgrounds of IP and CS academics varied significantly. Several of the academics are actively researching in LGF; however, as there are a limited number of researchers within LGF, assembling a sizeable panel required recruiting international experts whose work is focused on other team sports. By including those with backgrounds in other sports, academics with vast experience of successful IP programme development and implementation were involved but some specificity may have been lost. To counter this, efforts were made throughout this study to provide participants with context of LGF to support them in their responses. The inclusion criteria in this Delphi study were based on similar previous research,¹⁸ but the exact cut-offs were subjectively determined and thus could have influenced findings. Furthermore, while those included in this study all possessed invaluable expertise, potentially recruiting different experts from the same or similar fields may yield different results and future research using the Delphi approach should consider involving experts from other disciplines. As there is a dearth of research in LGF, synthesising expert opinion and consensus via a Delphi study is valuable, however the results of this study in isolation should be interpreted with caution when developing IP programmes as this is a low form of evidence and further studies such as RCTs and interview studies are needed to confirm its findings and develop comprehensive programmes. This study employed a 67% consensus threshold as this was reported to be the median across numerous Delphi studies in the health sciences.¹⁹ However, the use of a higher consensus threshold (eg, 80%) would enhance the credibility and reliability of the findings. By using a lower threshold, recommendations that lack strong consensus may be included, which could have negative implications for end-users.

CONCLUSIONS

This Delphi study presents a framework for the development of IP programmes that is most applicable to youth and adult LGF but may also be relevant to community sports on a larger scale. Consensus was achieved among experts around the programme components, structure, duration, progressions/variations, implementation approach and the broad layout of full and condensed programmes. To ensure future IP programmes have the best chances at success, their development should incorporate both the preferences of end-users detailed in qualitative research^{11–13} and the experts' consensus presented in this study. Future research should then focus on ensuring that these programmes can effectively reduce injury risk and achieve long-term adoption.

Contributors All authors were involved in the conception and design of the study. JC obtained the data and conducted data analysis. All authors contributed to the interpretation of the data analysis. JC drafted the manuscript, which was subsequently revised by EW, SO'K and SO'C. All authors reviewed and approved the final manuscript. JC is the guarantor.

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REFERENCES

- Ladies Gaelic Football Association. About us. 2018. Available: <https://ladiesgaelic.ie/the-lgfa/about-us> [Accessed 24 Nov 2023].
- O'Connor S, Bruce C, Teahan C, et al. Injuries in Collegiate Ladies Gaelic Footballers: A 2-Season Prospective Cohort Study. *J Sport Rehabil* 2020;30:261–6.
- O'Connor S, Whyte E, Fortington L, et al. The cost of injury in Ladies Gaelic football: A nine-year analysis (2012–2020) of the LGFA's Injury Fund. *J Sci Med Sport* 2023;26:31–6.
- LGFA. LGFA congress 2023 - national reports. Knightsbrook Hotel, Meath LGFA; 2023. Available: <https://ladiesgaelic.ie/wp-content/uploads/2023/03/Congress-2023-National-Reports.pdf> [accessed 24 Nov 2023].
- Stephenson SD, Kocan JW, Vinod AV, et al. A Comprehensive Summary of Systematic Reviews on Sports Injury Prevention Strategies. *Orthop J Sports Med* 2021;9:23259671211035776.
- GAA. GAA 15: Injury Prevention Programme/Warm Up, 2022. Available: <https://learning.gaa.ie/gaa15> [Accessed 24 Nov 2023].
- Ulster GAA, SINI. Activate GAA Warm-Up. 2022. Available: <https://ulster.gaa.ie/activate/>
- Schlingermann BE, Lodge CA, Gissane C, et al. Effects of the Gaelic Athletic Association 15 on Lower Extremity Injury Incidence and Neuromuscular Functional Outcomes in Collegiate Gaelic Games. *J Strength Cond Res* 2018;32:1993–2001.
- Teahan C, Whyte EF, O'Connor S. Gaelic games players' awareness and use of, and attitudes towards injury prevention exercise programmes. *Phys Ther Sport* 2023;64:17–26.
- Donaldson A, Finch CF. Applying implementation science to sports injury prevention. *Br J Sports Med* 2013;47:473–5.
- Corrigan J, O'Keefe S, O'Connor S. Barriers and facilitators to injury prevention in ladies Gaelic football: A qualitative study. *Phys Ther Sport* 2023;59:151–61.
- Corrigan J, O'Keefe S, Whyte E, et al. A qualitative examination of injury prevention strategy and education in Ladies Gaelic football: Understanding the preferences of players and coaches. *PLoS One* 2023;18:e0281825.
- Corrigan J, O'Keefe S, Whyte E, et al. n.d. Exploring the Perspectives of Adolescent Ladies Gaelic Football Players towards Injury Prevention: A Qualitative Study. *Ann Med*.
- Bruder AM, Donaldson A, Mosler AB, et al. Creating Prep to Play PRO for women playing elite Australian football: A how-to guide for developing injury-prevention programs. *J Sport Health Sci* 2023;12:130–8.
- Rowe G, Wright G. The Delphi technique: Past, present, and future prospects — Introduction to the special issue. *Technol Forecast Soc Change* 2011;78:1487–90.
- Alarabiat A, Ramos I. The Delphi Method in Information Systems Research (2004-2017). *EJBRM* 2019;17.
- Nasa P, Jain R, Juneja D. Delphi methodology in healthcare research: How to decide its appropriateness. *World J Methodol* 2021;11:116–29.

- 18 Robertson S, Kremer P, Aisbett B, *et al.* Consensus on measurement properties and feasibility of performance tests for the exercise and sport sciences: a Delphi study. *Sports Med Open* 2017;3:2.
- 19 Gavigan N, Belton S, Whyte E, *et al.* Design of a new movement competence assessment for children aged 8–12: A Delphi poll study. *Eur Phy Educ Rev* 2022;28:985–1005.
- 20 Walker A, Sefle J. The Delphi method: a useful tool for the allied health researcher. *Br J Ther Rehabil* 1996;3:677–81.
- 21 McCall A, Pruna R, Van der Horst N, *et al.* Exercise-Based Strategies to Prevent Muscle Injury in Male Elite Footballers: An Expert-Led Delphi Survey of 21 Practitioners Belonging to 18 Teams from the Big-5 European Leagues. *Sports Med* 2020;50:1667–81.
- 22 Mendonça LDM, Schuermans J, Denolf S, *et al.* Sports injury prevention programmes from the sports physical therapist's perspective: An international expert Delphi approach. *Phys Ther Sport* 2022;55:146–54.
- 23 LGFA. The athletic development and injury prevention warm-up program. 2018. Available: <https://ladiesgaelic.ie/wp-content/uploads/2018/04/The-Athletic-Development-and-Injury-Prevention-Warm-Up-Program-1.pdf>
- 24 Moesch K, Bunke S, Linnell J, *et al.* "Yeah, I Mean, You're Going to Handball, so You Want to Use Balls as Much as Possible at Training": End-Users' Perspectives of Injury Prevention Training for Youth Handball Players. *IJERPH* 2022;19:3402.
- 25 O'Connor S, O'Brien W, Lacey P. The Implementation of a National Strategy to Encourage Injury Prevention Program Uptake in a Community Female Sport in Ireland: A Camogie Case Study. *Int Sport Coach J* 2021;1–8.
- 26 Whalan M, Lovell R, Steele JR, *et al.* Rescheduling Part 2 of the 11+ reduces injury burden and increases compliance in semi-professional football. *Scandinavian Med Sci Sports* 2019;29:1941–51.
- 27 Perera NKP, Häggglund M. We have the injury prevention exercise programme, but how well do youth follow it? *J Sci Med Sport* 2020;23:463–8.
- 28 Steib S, Rahlf AL, Pfeifer K, *et al.* Dose-Response Relationship of Neuromuscular Training for Injury Prevention in Youth Athletes: A Meta-Analysis. *Front Physiol* 2017;8:920.
- 29 O'Brien J, Finch CF. Injury prevention exercise programmes in professional youth soccer: understanding the perceptions of programme deliverers. *BMJ Open Sport Exerc Med* 2016;2:e000075.
- 30 Mącznik AK, Mehta P, Kaur M. Can We Go Online for Sports Injury Prevention? A Systematic Review of English-Language Websites with Exercise-Based Sports Injury Risk Reduction Programmes. *Sports Med Open* 2021;7:80.
- 31 O'Brien J, Young W, Finch CF. The use and modification of injury prevention exercises by professional youth soccer teams. *Scand J Med Sci Sports* 2017;27:1337–46.
- 32 de Oliveira NT, Medeiros TM, Vianna KB, *et al.* A FOUR-WEEK TRAINING PROGRAM WITH THE NORDIC HAMSTRING EXERCISE DURING PRESEASON INCREASES ECCENTRIC STRENGTH OF MALE SOCCER PLAYERS. *Int J Sports Phys Ther* 2020;15:571–8.
- 33 Ross AG, McKay MJ, Pappas E, *et al.* The FIFA 11+: Why is adherence so challenging? Insights from a cross-sectional study of stakeholders in Australian amateur football (soccer). *Int J Sports Sci Coach* 2024;19:735–44.
- 34 Donaldson A, Callaghan A, Bizzini M, *et al.* A concept mapping approach to identifying the barriers to implementing an evidence-based sports injury prevention programme. *Inj Prev* 2019;25:244–51.
- 35 Minnig MC, Hawkinson L, Root HJ, *et al.* Barriers and facilitators to the adoption and implementation of evidence-based injury prevention training programmes: a narrative review. *BMJ Open Sport Exerc Med* 2022;8:e001374.
- 36 O'Connor S, Lacey P. Can we improve coaches' injury prevention views and implementation practices in the community female Gaelic sport of camogie? *BMJ Open Sport Exerc Med* 2020;6:e000732.
- 37 Donaldson A, Lloyd DG, Gabbe BJ, *et al.* We have the programme, what next? Planning the implementation of an injury prevention programme. *Inj Prev* 2017;23:273–80.
- 38 Zhang ZX, Lai J, Shen L, *et al.* Effectiveness of exercise-based sports injury prevention programmes in reducing injury rates in adolescents and their implementation in the community: a mixed-methods systematic review. *Br J Sports Med* 2024;58:674–84.
- 39 Martinez JC, Mazerolle SM, Denegar CR, *et al.* Female adolescent athletes' attitudes and perspectives on injury prevention programs. *J Sci Med Sport* 2017;20:146–51.
- 40 Edouard P, Caumeil B, Verhagen E, *et al.* Maximising individualisation of sports injury risk reduction approach to reach success. *Braz J Phys Ther* 2022;26:100394.
- 41 Andersson SH, Bahr R, Olsen MJ, *et al.* Attitudes, beliefs, and behavior toward shoulder injury prevention in elite handball: Fertile ground for implementation. *Scand J Med Sci Sports* 2019;29:1996–2009.