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Original article

Scientific evidence is just the starting point: A generalizable process for developing sports injury prevention interventions

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Abstract

Background: The 2 most cited sports injury prevention research frameworks incorporate intervention development, yet little guidance is available in the sports science literature on how to undertake this complex process. This paper presents a generalizable process for developing implementable sports injury prevention interventions, including a case study applying the process to develop a lower limb injury prevention exercise training program (FootyFirst) for community Australian football.

Methods: The intervention development process is underpinned by 2 complementary premises: (1) that evidence-based practice integrates the best available scientific evidence with practitioner expertise and end user values and (2) that research evidence alone is insufficient to develop implementable interventions.

Results: The generalizable 6-step intervention development process involves (1) compiling research evidence, clinical experience, and knowledge of the implementation context; (2) consulting with experts; (3) engaging with end users; (4) testing the intervention; (5) using theory; and (6) obtaining feedback from early implementers. Following each step, intervention content and presentation should be revised to ensure that the final intervention includes evidence-informed content that is likely to be adopted, properly implemented, and sustained over time by the targeted intervention deliverers. For FootyFirst, this process involved establishing a multidisciplinary intervention development group, conducting 2 targeted literature reviews, undertaking an online expert consensus process, conducting focus groups with program end users, testing the program multiple times in different contexts, and obtaining feedback from early implementers of the program.

Conclusion: This systematic yet pragmatic and iterative intervention development process is potentially applicable to any injury prevention topic across all sports settings and levels. It will guide researchers wishing to undertake intervention development.

Keywords: Australian football; Implementation; Intervention development; Lower limb injuries; Research-to-practice; Sports injury prevention; Translation

1. Introduction

Evidence-based sports injury prevention interventions are not well implemented in real-world settings,[1–3] often because the interventions are not directly relevant to specific implementation contexts.[4,5] Interventions should be informed by research evidence and be widely adopted, properly implemented, and sustained over time.[4,6]

Both the Translating Research into Injury Prevention Practice framework[4] and the Sequence of Prevention of Sports Injuries model[7] require practitioners and researchers to identify potential injury prevention solutions and develop appropriate prevention measures guided by high-quality epidemiologic and etiologic studies. Most research remains in the early stages of these models and frameworks,[8,9] and this limits the potential for injuries to be prevented. In practice, preventive measures are often based on anecdotal experience or current practice,[4] and the scientific literature rarely provides insights into the complex process of intervention development in real-world settings.[10] Although systematic reviews and meta-analyses can identify promising interventions,

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their conclusions are rarely directly applicable to specific real-world settings, and translation into effective practice is challenging.[11]

Australian football (AF) is a popular sport at the community level in Australia. It is a dynamic sport that incorporates running, rapid acceleration and deceleration, changing direction, jumping and landing, full body contact including tackling and bumping, and kicking and marking (catching) a ball. As in many other sports, preventing lower limb injuries (LLIs) is a priority in community AF.[12] Although several evidence-based LLI prevention programs exist,[13–15] how they were developed is largely unreported, and only 1 targeting selected LLIs is specific to community AF.[16] For example, the only published information available on the development of the well-known and widely used Fédération Internationale de Football Association (FIFA) "FIFA 11+" program states that it was developed by an expert group, and tested by 1 club, before it was implemented in trials.[17]

This paper presents a generalizable process for developing evidence-informed sports injury prevention interventions that need to be widely and sustainably implemented in real-world settings. An example application of the process is provided based on the development of an exercise training program (called FootyFirst) to prevent LLIs in community AF. This paper serves as a guide to researchers wishing to progress their research through the intervention development process.

2. Methods

Two complementary ideas underpin the process described in this paper: (1) evidence-based practice integrates the best available scientific evidence with practitioner expertise and end user values,[18] and (2) research evidence alone is insufficient to develop implementable interventions.[2] This process addresses the criticism that evidence-based practice devalues practitioner expertise, ignores community values, and promotes a "one-size-fits-all" approach.[19] It also acknowledges that unless intervention design considers the implementation context, the end user's perspectives, and long-term sustainability, injury prevention programs are unlikely to be widely used and will therefore have limited impact.[4,5]

Three methods underpinned the application of the intervention development process to FootyFirst: (1) literature search to identify published research evidence, (2) use of clinical expertise and expert opinion via a Delphi process, and (3) focus groups to identify end user preferences, capacities, and values (Table 1). The specific methods used to establish LLIs as a priority,[12] compile and assess the quality of exercise protocols aimed at reducing LLIs in similar sports,[20] and achieve expert consensus on the contents of FootyFirst[21] are described elsewhere. Federation University Australia (E13-004) Human Research Ethics Committee approved the study protocol.

3. Results

The intervention development process can be encapsulated in 6 steps (Fig. 1). The application of these steps and the outcomes of each step when developing FootyFirst are summarized in Fig. 2 and Table 2.

As recommended in Translating Research into Injury Prevention Practice Stage 3,[4] a multidisciplinary FootyFirst Development Group (FFDG) was established, consisting of 2 sports physiotherapists (authors JC and BJG), 1 biomechanist (author DGL), 1 sports scientist (author WY), and their research teams. Alongside their clinical and research experience, the FFDG had considerable exercise and rehabilitation experience in community and elite sport as well as involvement in previous community AF LLI prevention research.[16]

3.1. Step 1: use the research evidence and clinical experience

This initial step is necessary to maximize the likelihood that the developed intervention will "work" by ensuring firm

Table 1
Summary of the primary methods used to develop FootyFirst.

Evidence-based practice element	Aims	Contribution to the development of FootyFirst
Compilation and quality assessment of research evidence	To ensure that the best available research evidence relevant to the specific problem was identified and applied in the development of the intervention	• Compilation of published and previously unpublished community AF injury data (Fig. 1, Step 1)[12] • Review of the scientific literature to systematically evaluate the evidence about the benefits of lower limb injury prevention protocols aimed at reducing the most common, severe lower limb injuries in community AF (Fig. 1, Step 1).[20]
Incorporation of clinical expertise and practitioner knowledge and views	To fill in the gaps where there was limited information in the literature or where no successful intervention for a specific injury was identified To fit the available evidence to the specific circumstances, populations, and needs	• Application of health promotion, implementation science, physiotherapy, biomechanical, and sports science clinical and research expertise to develop the exercise training program (Fig. 1, Step 1) • Delphi consultation to achieve expert consensus on the specific content of the exercise training program (Step 2)[21]
Consideration of end user preference, capacity, and values	To ensure that the intervention is appropriate for, and reflects the capacity of the implementation context	• Focus groups, following standard focus group methods,[34] with community AF senior coaches, strength and conditioning/fitness/high-performance coaches, players, sports trainers, and administrators (Fig. 1, Step 3) • Testing of the exercise training program with delivery agent representatives and conducting a "train-the-trainer" session (Fig. 1, Step 4) • Evaluation of the program against the attributes of innovations from the diffusion of innovations theory (Fig. 1, Step 5)[25] • Feedback from early implementers on the content and presentation of the program (Fig. 1, Step 6)

Abbreviation: AF = Australian football.