

A two year case study of injury prevention in elite youth badminton players

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Introduction

A weekly on-site physiotherapy clinic was established in February 2013 at Glasgow School of Sport (GSOS) to allow a close working relationship between physiotherapists and GSOS coaches that would enable a more effective system to monitor the epidemiology of injuries and the rehabilitation process of injured pupils. This allowed the four stage injury prevention system by van Mechelen et al, (1992) to be implemented.

Step 1: Identification of the magnitude of injury problems

After the initial six month operating period of the physiotherapy clinic, it was highlighted that the badminton programme was the only sport to have **significantly more** ($p=0.03$, $d=1.8$) pupils attending the physiotherapy clinic than another sport at GSOS, with 71% of badminton pupils requiring at least one physiotherapy appointment (Figure 1). The non-significant difference in injury rate between badminton and gymnastics was purported to be due to the high-risk nature of the sport. The difference in the number of appointments required for dysfunctional versus acute injuries was also monitored with 93% of badminton injuries sustained due to dysfunctional movement or muscle imbalance and 7% due to acute causes such as trauma (Figure 2).

Figure 1: Percentage of each sport programme requiring at least one physio appointment February - July 2013

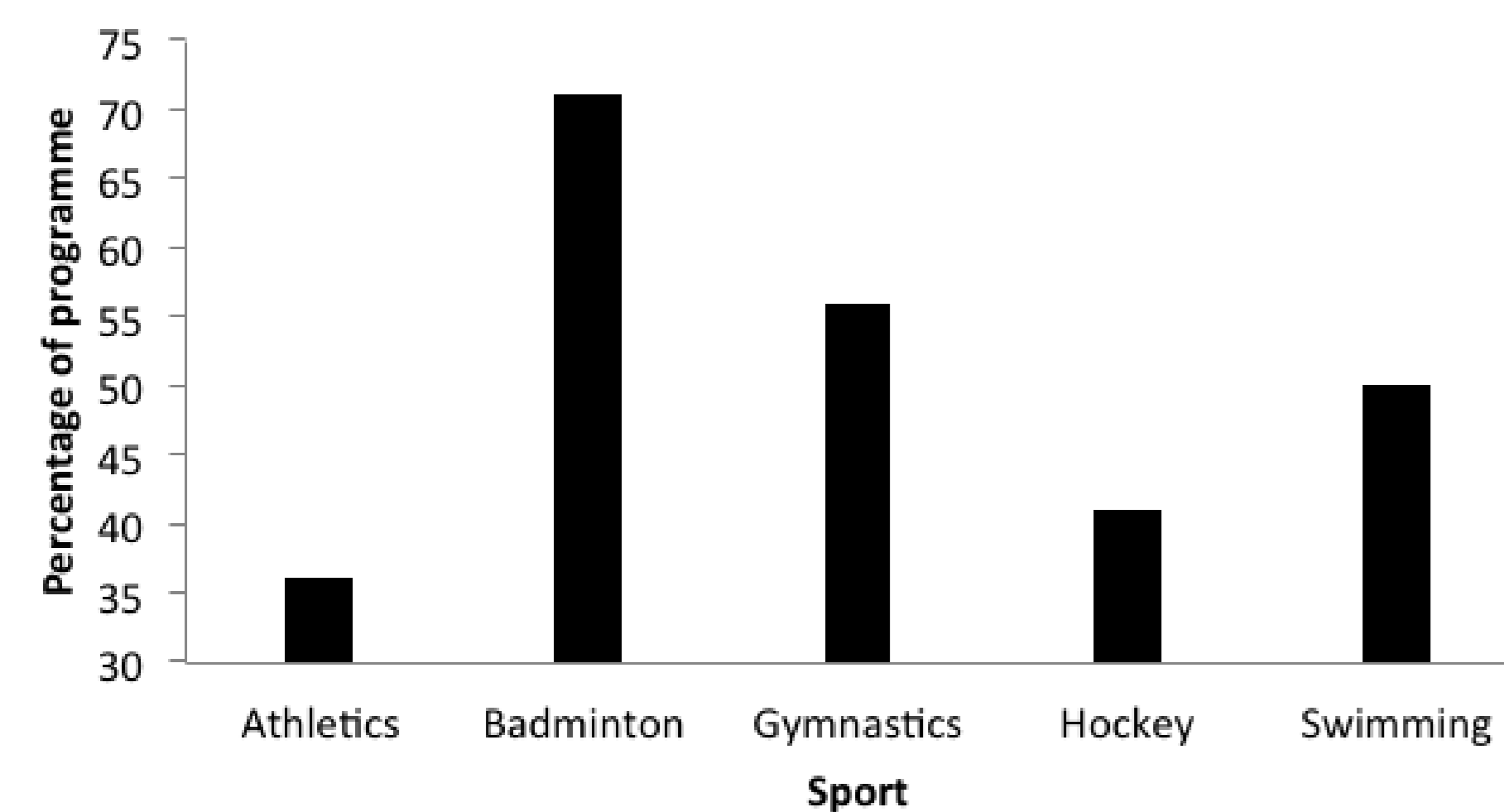
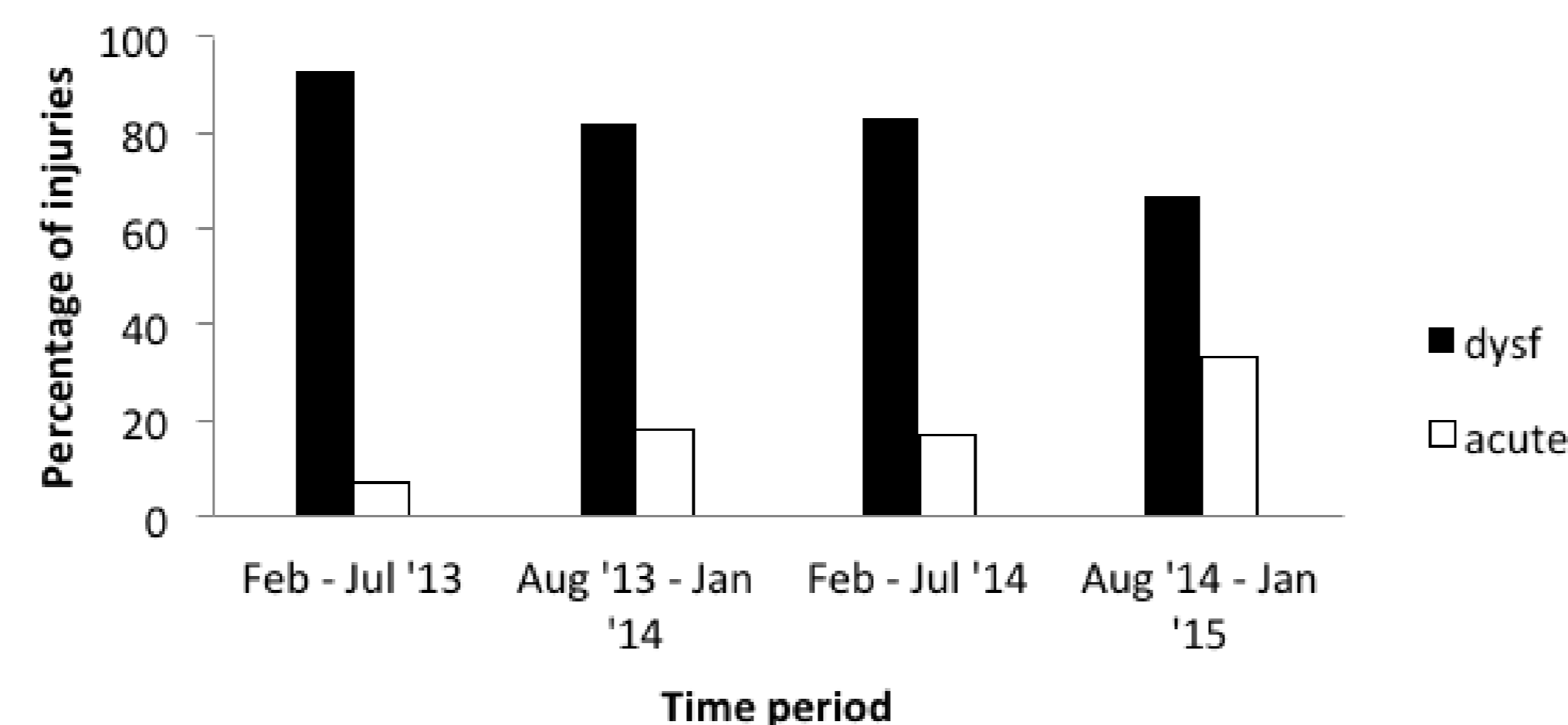


Figure 2: Percentage of dysfunctional vs acute injuries in badminton players



Step 2: Identification of causes and mechanisms of injury (risk factors)

Badminton pupils at the school (11-18 years old) specialise in their sport by undertaking 12-15 hours of training per week (Figure 3). Intensive, high volume, sport-specific training at an early age (with the exclusion of other sports) can be associated with increased risk of injury (Di Fiori et al, 2014). Therefore, alongside the unilateral nature of racquet sports (Jayanthi and Esser, 2013), the adopted training modality may account for any injuries identified, with the most common being sustained to the knee, lower back and shoulder (Figure 4).

Figure 3: Average training hours per pupil per week compared with number of physio app's required per 1000 training hours

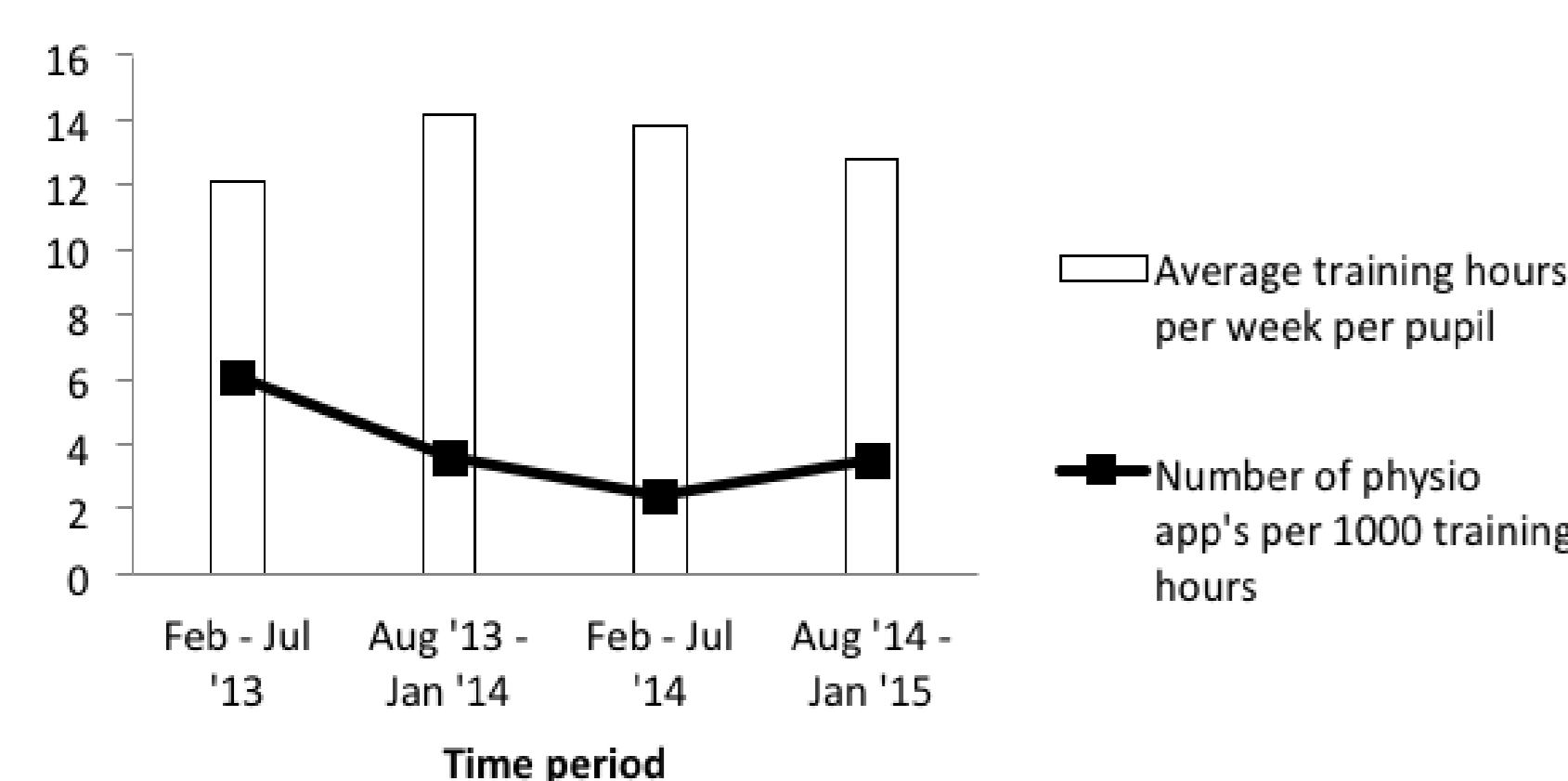
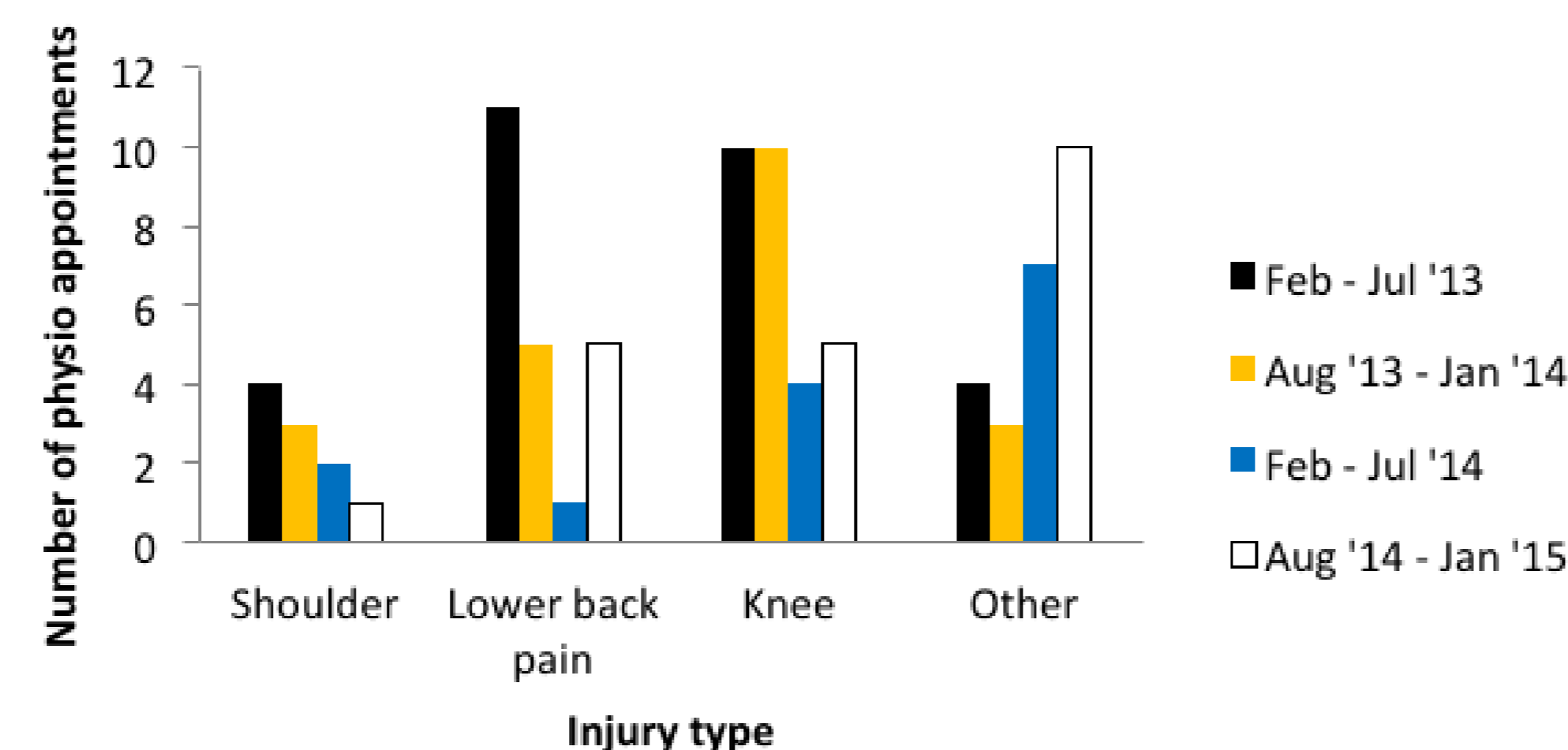


Figure 4: Number of physiotherapy appointments required for each injury type



Step 3: Development and implementation of an injury prevention strategy

An injury prevention strategy was then developed which included: reduced S&C conditioning volume; flexibility work targeting the shoulder, hip and knee joints; shoulder stabilisation exercises; trunk rotation exercises; mobility based movements and control exercises to improve knee tracking and reduce valgus (Table 1). This was designed specifically to target the high percentage of dysfunctional injuries and the three most common injury sites.

Injury Type	Example of injury prevention intervention
Shoulder	<ul style="list-style-type: none"> All exercises completed on both sides of the body during both S&C and sport specific physical sessions Rotator cuff external rotation, overhead theraband pulldown exercises Stretches targeting pectoralis, deltoids, trapezius
Lower back pain	<ul style="list-style-type: none"> Additional core and glute activation exercises Stretches targeting hip and upper leg musculature (glutes, hip flexors, hamstrings) Simple rotation exercises such as med-ball chops Additional on court feedback from sport specific coaches when flexing/extending from spine
Knee	<ul style="list-style-type: none"> Volume of endurance based sessions reduced for S3-6 pupils (aged 14-18) Weekly endurance based session replaced with mobility and core session for S1-2 (aged 11-13) All bounding and hopping plyometric exercises for S1-2 removed and replaced with controlled landing mechanics, knee tracking and glute activation exercises.

Table 1: Injury Prevention Strategy

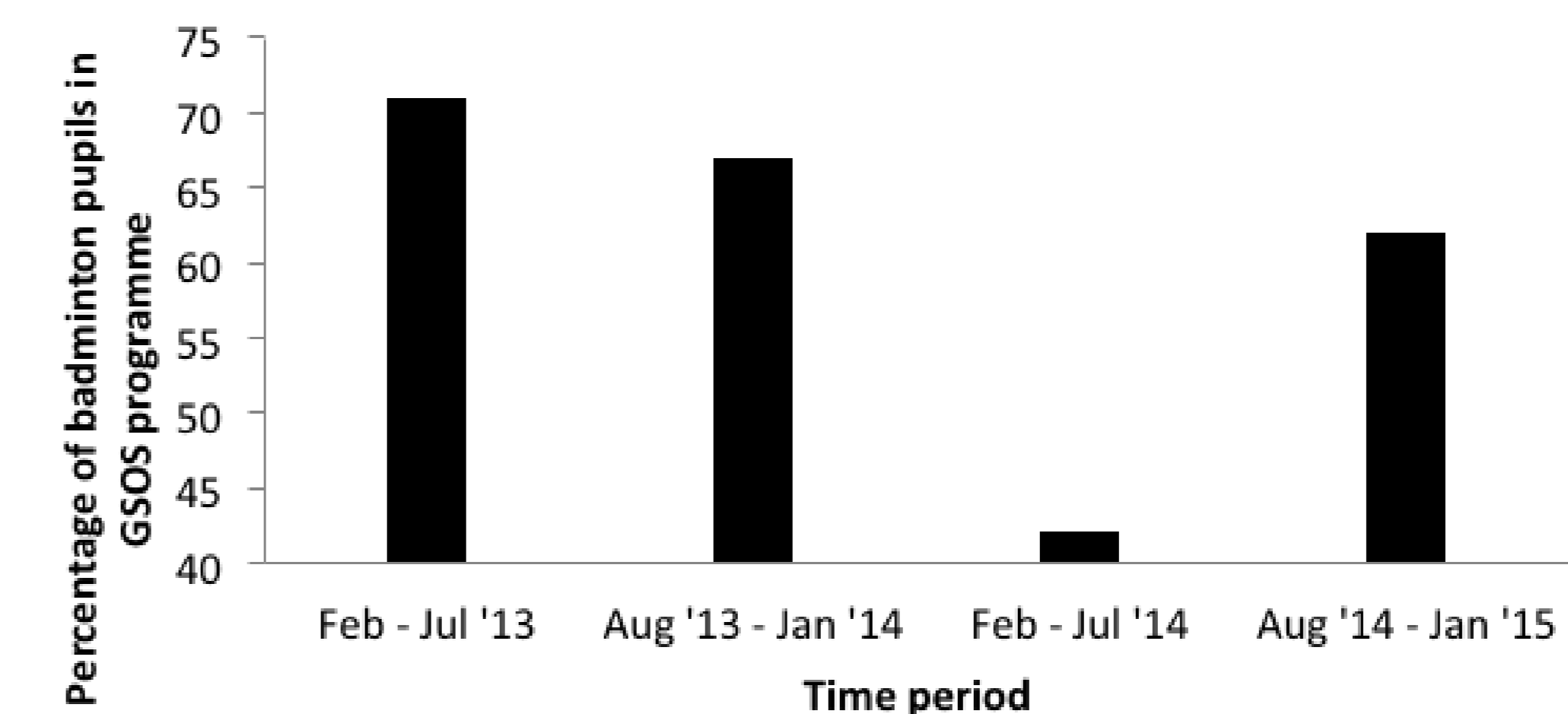
Step 4 : Assessment of the effectiveness of the injury prevention measures

The number of physiotherapy appointments for shoulder, knee and lower back injuries **significantly reduced** pre and post injury prevention strategy ($p=0.02$, $d=0.6$), (Figure 4). Other injuries, which are mainly acute in nature, have increased due to several injuries requiring long-term treatment. Figure 2 confirms this trend with **significantly reduced** ($p=0.05$, $d=0.9$; $p=0.01$, $d=2.3$; $p=0.03$, $d=1.8$) dysfunctional injuries during each six-month period following implementation of the injury prevention strategy.

The number of physiotherapy appointments required per 1000 training hours **significantly reduced** ($p=0.01$, $d=2.0$; $p=0.01$, $d=3.0$; $p=0.01$, $d=2.5$) following introduction of the injury prevention strategy in each 6 month period (Figure 3). Figure 5 also shows a **significant decrease** ($p=0.03$, $d=1.7$) in the percentage of pupils in the badminton programme requiring a physiotherapy appointment during February - July 2014.

This evidence all supports a positive impact of the injury prevention strategy. As the average number of training hours per pupil per week remained stable (Figure 2), the content of training i.e. the injury prevention strategy, is theorised to be responsible for significant decreases observed in; the number of physiotherapy appointments required per 1000 training hours; the number of appointments required per high risk injury; the percentage of dysfunctional injuries; and the overall percentage of badminton pupils requiring physiotherapy appointments.

Figure 5: Percentage of badminton programme requiring physio appointments over each six month time period



Future Developments

To further the understanding of injuries in elite youth badminton players a comparison of training and competition, and in-season and out of season injuries would provide additional insight to injury risk. Such an approach would allow comparison of GSOS data with other long-term injury studies (e.g. Hootman et al. 2007), re-assessment of high risk injury sites, and ultimately aid in producing targeted and evidence-based injury prevention and rehabilitation strategies. Comparison of injury data in relation to peak height velocity (PHV) may also be valuable as anecdotal evidence from the GSOS physiotherapy clinic has suggested appointments for knee injuries in badminton players increase around PHV.

References

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