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Abstract

Objectives: To establish agreement in National team contexts when players transition from club to National team about (i) what medical and physical information to collect, (ii) how to use information (iii) identify challenges to collection and (iv) collection methods.

Design: Delphi Survey

Methods: A series of sequential online questionnaires were sent to heads of medical and performance of the 32 National teams following the FIFA 2018 World Cup. Two separate Delphi's; 'Medical' and 'Physical' were administered. 'Medical' respondent was the person responsible for player health. 'Physical' referred to the person responsible for physical performance. Content analyses were performed on each round, with subsequent rounds designed according to responses of the previous. Agreement was considered at ≥70%.

Results: Twenty-three Medical (72%) and 14 (44%) Physical heads participated in Round 1 (3 rounds total). Seventeen Medical and 12 Physical respondents completed all rounds. Medical information agreed upon were injury epidemiology, screening and injury treatment strategies. Physical information included training/match-loads, fatigue, wellness and current exercise programmes. Both Medical and Performance agreed that information be used to plan and individualise players programmes. Additionally medical information should guide coaches national team selection. Communication, willingness to share and quality/completeness of information were agreed as main challenges. Medical and Physical respondents agreed standardised reporting form and electronic shared database are the best option to collect information.

Conclusion: Our findings highlight the importance of health and performance information exchange between national and club teams. Further, this exchange should be cooperative, symbiotic and a two-way process to assist with improving player health.

Key Words: Science, Monitoring, Testing, Soccer

Introduction

The transition between club and national teams is a challenge to the protection of player welfare and performance.[1, 2] Information exchange between club and national teams has been reported to be a key requirement to inform decision-making for the mitigation of injury risk and training programme development in a range of male and female senior and junior teams competing in the FIFA World Cups between 2015 and 2018 [1, 2]. There is, however, a distinct lack of published research concerning the protection of player health and optimisation of performance following the transition between club and national team.

Of the limited published national team research, a case study from the 2014 FIFA World Cup reported that players who incurred a non-contact injury accumulated significantly less internal training load (session-RPE) prior to the national team training camp, which was compounded by a concomitant increase in national team training camp associated internal training load.[3] Interestingly, the increased training load resulted from increased session count, rather than intensity within sessions, which is indicative of a different training microcycle structure between clubs and national teams. The aggregated team-level data in this study resulted in an association between spikes in training load and injury, though these relationships were considered spurious. Further, they do not account for the underlying issue related to the change in training structure with limited integration or translation by players.[1, 2] Similarly, a study over 3 consecutive FIFA tournaments (2014 FIFA World Cup, 2015 Asian Cup and the 2018 FIFA World Cup) demonstrated that increased internal training loads are common during the transition from club to national team training camps and international competition/tournaments.[4] These observed training load increases in national teams resulted from the camp or tournament circumstances changing how training count, session and intensity is prescribed.[3, 4] Whilst representing only case studies of one national team, they highlight the possibility for altered training structure following transition between club and national teams.

In the absence of high-level evidence, practitioner led consensus approaches such as a 'Delphi survey' can be used to to advance knowledge and practical applications.[5] Delphi surveys, while representing a level 5 expert opinion, are performed in a scientific manner to limit bias in the final outcomes.[5] The results from Delphi surveys can be a powerful tool for strategic management to develop and implement policies, and programs.[6] Such an approach

in the national team setting could guide better understanding of player health and performance during transition into and out of clubs.

The purpose of this study was to establish agreement in the National team context when players transition from club team to National team regarding (i) what medical and physical information to collect, (ii) how to use the information collected (iii) identify challenges to collecting information and (iv) how to ideally collect the information.

Methods

A Delphi consensus process was used as a structured method of obtaining opinions and finding consensus among a group of experts.[7] The Delphi survey was created by a 4-member steering committee consisting two sport scientists (AM and RD), one sports physiotherapist (MB) and one communication and organisational design specialist (MD) all working in elite football and research.

The expert panels consisted of the heads of medical and performance of the 32 National teams following their participation at the FIFA 2018 World Cup. Two separate Delphi's; (i) Medical, (ii) Physical were administered. Crtieria for inclusion as an 'expert' meant having been primarily responsible for the player health/care programme (medical) or the physical performance programme and proficient in English. Participation as an expert panellist in the study was solicited via email, sent to the head of medical and head of physical performance in each federation. Altogether two persons in each national team were contacted (n=64 in total).

An initial questionnaire was prepared for Round 1 for both the medical and physical respondents. The results of each round of a Delphi survey inform the design of any sequential rounds. We expected the Delphi to include 2 to 3 rounds, however this was not capped a priori. Questionnaires were prepared on commercially available survey software (SurveyMonkey, California, USA) .Responses were analysed by two members of the steering committee, and a feedback report of the main findings then sent to the expert panel with the subsequent questionnaire. Each questionnaire was completed anonymously and blinded from other participants in the survey rounds. Additionally, respondents agreeing to

participate did so under the knowledge that their identities would be anonymous and National teams that participated are not disclosed. Supplementary Table 1 outlines the detail and focus of each round.

Responses were downloaded to Microsoft excel with a content analysis subsequently performed. A content analysis is a qualitative research approach to analyse texts and examine patterns in a replicable and systematic manner.[7] For open ended questions and answers, a two-step analysis and interpretation as recommended by Côté et al.[8] was followed. The first step was to tag meaningful text to produce a set of concepts representing the information received. The second step was to create categories listing and comparing the previously created tags to produce clusters of similar tags serving as an organising system. Agreement was achieved if ≥70% of Delphi respondents agreed and that item was then removed from further rounds.[9-11] If no agreement was found after two rounds that item was considered as 'no agreement' and also removed from any further round.[9-11] Two of the steering committee members (AM, MB) performed content analyses. A third investigator (RD) was consulted whenever there were any disagreements/ambiguity around the tagging, categorising and interpreting of the responses.

Results

Three rounds of questionnaires were administered to both heads of medical and physical performance.The Medical Delphi surveys were opened and closed as follows; Round 1: 31st March 2019 / 31st May 2019, Round 2; 25th August 2019 / 17th October 2019, Round 3: 18th January 2020 / 11th February 2020. The following dates represent the opening and closing of the Physical Delphi surveys; Round 1: 15th April 2019 / 27th May 2019, Round 2; 28th August 2019 / 28th November 2019, Round 3: 18th January 2020 / 11th February 2020.
The response rate for the heads of medical were; 23/32 – 72% (Round one), 20/23 – 87% (Round two) and 17/20 – 85% (Round 3). While the response rate for the heads of physical performance were; 14/32 – (Round one), 12/14 -86% (Round two) and12/12 – 100% (Round three).

Regarding 'what information to collect', the Medical Delphi respondents agreed that general injury epidemiology information for both time-loss and non-time-loss injuries (number of injuries sustained, injury mechanism, type and location) should ideally be collected. Additionally, it was agreed that specific injury screening information (biomechanical and

functional lower limb tests and radiological scans where applicable) and information about injury treatment the player has received (manual, electrical, exercise and injections) should be collected (see Table 1)

The Physical Performance Delphi respondents agreed that information related to players' fatigue and wellness status, training and match loads, exercise prevention programmes and restrictions to normal football training should ideally be collected from club teams (Table 2. Of note, while fitness capacity was deemed as important information to collect, respondents outlined that given the lack of any practical maximal test in national teams it is not worth collecting.

*** insert table 1***

*** insert table 2***

Regarding our objective concerning 'how to use the information', both groups agreed that it guides the planning and individualisation of player health care and training programmes. Further, the Medical Delphi respondents (but not Physical Performance respondents), reported that the information should also be used to inform the coaches' player selection strategy (see figure 1).

insert figure 1

Regarding 'challenges', Medical and Physical Performance Delphi respondents (independently) agreed the main challenges in collecting information from club teams were (i) communication (Medical=16/16(100%)- introduced Round 2, consensus achieved Round 2; Physical=10/12(83%)- introduced Round 3, consensus achieved Round 3), (ii) willingness to share (Medical=15/16(94%)- introduced Round 2, consensus achieved Round 2; Physical=9/12(75%)- introduced Round 3, consensus achieved Round 3) and (iii) quality/completeness (Medical=15/16(94%)- introduced Round 2, consensus achieved Round 2; Physical=9/12(75%)- introduced Round 3, consensus achieved Round 3).

Findings about 'how to ideally collect the data' revealed that Medical Delphi respondents agreed that information should be collected via (i) a standardised report form (introduced in Round 2, and consensus achieved in Round 3, with 14/17; 82% agreeing) and (ii) using a shared database (introduced in Round 2, and consensus achieved in Round 3, with 15/17; 88% agreeing). Regarding the Physical Performance repondents, it was also agreed that information should be collected via (i) a standardised report form (introduced in Round 2, and consensus achieved in Round 2, with 8/9 (89%) agreeing) and (ii) using a shared database (introduced in Round 1, and consensus achieved in Round 1, with 11/14; 79% agreeing). While in Round 1 we asked respondents to specify 'ideal time/period' to collect the information, the responses were highly variable and respondents were informed that we would aim to include this question back into a later round. However, given the number of information sources to be collected it became evident that adding this question would be too complex and outwith the scope of the current Delphi. Respondents were informed of this decision.

Discussion

This study reported on a Delphi survey of the Heads of Medical and Physical Performance Departments on the transition between club to national teams. The Medical experts agreed that pre-transition information should include data related to epidemiology, screening tests and current injury treatment. For the Physical Performance experts, they agreed that information on the physical status of players (fatigue, wellness, fitness, training and match loads), in addition to their current exercise programme and any training (gym-based and field-based) restrictions should be exchanged. It was agreed that the information collected should be used to assist the head coach in player selection strategy, and to individualise both medical (rehabilitation and treatment) and physical training programmes. Three main challenges to collecting information were (i) communicating with club staff, (ii) willingness of club staff to want to share information and (iii) quality and compeleteness of information sent. A standardised reporting form and sharing information via a centralised, shared database were agreed as key solutions to a successful exchange of player information.

From the Medical experts part of the Delphi, Injury epidemiology was a key response item as information to be shared by Medical teams, and fits with the perceived importance of this data within respective national[1, 2] and club teams.[12, 13] The six key components of epidemiology data included: injury location, type (contact/non-contact), mechanism,

number of injuries incurred and amount of days/matches lost for both time-loss and non-time-loss injuries (table 1. This concurs with recent reports of the need for well-designed injury surveillance programmes across sports[14], and may serve as a template for future information exchange. Consistent, accurate and high quality sharing of medical information between National and club teams could positively impact injury risk mitigation strategies and consequently, player care.

The reported desire for sharing of medical screening test data confirms previous unpublished surveys from national teams, which highlight the need for injury risk mitigation strategies during the transition from club to national teams .[2] However, out of eight potential screening tests initially identified here, only three reached agreement (Table 2; including, biomechanical assessments, lower limb function tests and radiological imaging tests. The lack of agreement on screening test use may be explained by concerns raised on lack of uniformity of testing procedures and the clinical evaluation of individual practitioners, making interpretation difficult and outweighing benefits in national teams. Recent debates on the questionable use of screening tests to predict injury,[15] in addition to potential issues with consistent equipment, technologies, inter-rater reliability etc, may explain why the results of many screening tests were not identified as useful during club to national team transition.

The final type of information agreed by Medical Delphi experts related to 'injury treatment'. This information was separated into four main cateogries: manual therapies , electro-therapy, gym-based exercise therapy and surgical interventions/injections. Previous recommendations suggest active progressive functional exercises are the optimal treatment modalities.[16] However, other relatively passive modalities (e.g. manual, electro-therapy, injections) should be included in an athletes rehabilitation programme when moving towards independent and functional exercise participation.[16] Overall, the list agreed by the Medical experts provides some insight as to the types of treatment undertaken between club and national teams.

Measures of training load and fatigue (internal and external proxies) were agreed as the information that should be collected to inform the physical training programme. Specifically, information related to training/match external load (GPS), internal training load responses (RPE) and measures of fatigue (with subjective markers and GPS) and wellness. These

findings confirm the perceived importance of training/match loads and fatigue for player's performance and injury risk outlined in previous surveys in national[1, 2] and club teams.[12, 13, 17] These perceptions mimic previous case study reports on national team player preparation and injury risk mitigation, and reaffirm the need to guide prescribed training on shared volume or intensity data.[3, 4]

While various fatigue markers were suggested, only subjective and GPS measures found agreement to be collected from club teams. There are various tools suggested as markers of subjective fatigue. These are typically monitored as single 'wellness' items (e.g. sleep, fatigue, energy, muscle soreness).[18] Despite their popularity in contemporary sports (including football), recent reviews have questioned their validity[19] and clinical application/utility[20]. Interestingly, GPS was agreed as a marker of fatigue, suggesting practitioners use GPS as a proxy for fatigue. However, this is problematic as GPS data represents an external load encountered and not an internal measure of fatigue accrued. Additionally, muscle or neuromuscular force were suggested by some experts as markers of fatigue; however, these did not reach agreement and were highlighted as logistically difficult to quantify/measure given inconsistencies in technologies, availability and transportability of equipment in the national team context. It was agreed that the physical fitness of players should be collected, however it was also agreed that this would not be feasible in the national team context. This was specified given the lack of opportunities for maximal testing in club and national teams including limited time in training camp, staggered arrival of players, lack of standardised tests between multiple club teams and national teams.

Finally, the Physical Performance experts agreed on collection of information about the players current/typical exercise programme and restrictions to gym and field-based training (including technical and tactical exercises and specific drills). Establishing individual player profiles is important to guide training prescription[21]. Hence, information specific to current exercise programmes and a method to share that information alongside training/match loads, fatigue and wellness, provides a comprehensive overview of individual players on arrival into national teams.

A key agreement of both Delphi groups on how to use the information from club teams was to individualise the rehabilitation and treatment (medical) or training programmes (physical)

(Figure 1). This agreement highlights the the perception that continuity of health treatment is important for successful player outcomes.[22] Appropriate individualisation of athlete training plans from a multi-dimensional perspective (medical, physiological, psycholollgical and nutritional) can be influential in minimising the risk of underperformance in major competitions[23, 24] Hence, the agreement noted here confirms conceptual understandings of how an allied health and performance department should collect, share and use data to implement plans for individuals with the aim to reduce injury risk and increase physical performance. As conceptual evidence, the Medical Delphi experts agreed that the information collected is key to informing the head coach about player selection strategies for the national team. This is not surprising given that a higher player availability (as a result of lower inury incidence) has been linked with club teams success.[25] Unfortunately, it was outwith the scope of the current Delphi survey to go deeper into how specifc pieces of information individually or collectively should be used in the actual design of player care and performance programmes as well as coach selection strategies. We do however, outline how important this information can be to inform these purposes in addition to providing a platform for future investigation into this topic.

Three main challenges were agreed by both Delphi expert groups; *communication, willingness to share information, quality and completeness of information.* Communication within respective club[13] and national team staff (support staff and coaches)[1, 2] has been highlighted by practitioners as important risk factors for injury in these populations. Poor internal communication *within* UEFA club teams has been correlated with higher injury rates as well as reduced training attendance and match availability.[26] However, knowledge on the role of communication *between* teams for injury and performance outcomes remains to be investigated. It is feasible that effective communication between respective parties can improve the sharing and quality/completeness of information that is exchanged between medical and physical performance staff of club and national teams – as is reported in health care organisations to reduce resource usage and improve quality of patient care.[27] Hence, further investigation and engineering of robust and trustworthy systems to increase transfer of health and performance data is required.[28]

Two key solutions to address the abovementioned challenges were agreed by both Delphi expert groups to allow effective information exchange, inlcuding; *(i) access to a standardised reporting of information* and *(ii) access to an electronic shared database*. While not common

in sports science or medicine, research on 'information exchange' are prevalent in public health, business and national defense. For example, in public health, general practitioners have been using health information exchange successfully for decades.[29, 30] These recommendations highlight that health information exchange should be viewed as a continuous journey towards a future data rich envirionment that supports the provision of safe, high quality and efficient care.[29] While an information exchange system may seem simple i.e. implement a shared database with standardised information report form; research in other areas shows us that this is not an easy process and requires careful consideration, planning and trust. In support, well defined and established strategies are outlined in scientific research that can guide development of information exchange hardware and software to support data sharing between club and national team medicine and physical performance practitioners.

Despite the novelty of these findings, some limitations need acknowledgment in this Delphi survey. First, the sample is limited only to senior men's national teams competing at the 2018 FIFA World Cup and not representative of the wider men's or women's senior national teams, nor accounting for the needs of junior teams. Second, the agreements are focused on the national team perspective, which may not reflect those of the club teams. Third, we encounterd some dropout throughout each of the three Delphi rounds (table 1) and had all / higher number of national team respondents remained, the agreements may have differed. Fourth, the response rate in the phsycial Delphi was low from Round 1 (14/32 responses) and therefore may not be representative of the teams from the 2018 World Cup. Despite these limitations, our Delphi survey represents an initial step to address the challenges encountered between players transitioning from club to national teams.

We report national team Medical and Physical Performance practitioners perspectives on key aspects of player information required prior to transitioning from club to national team. Specifically, thse include injury epidemiology, screening tests, injury treatment strategies (Medical) and training/match-loads, fatigue, wellness and current exercise programmes and restrictions (Physical Performance) The three main challenges faced in information exchange from club to national team are communication between teams, willingness to share and the quality and completeness of information. A standardised reporting form and electronic shared database were agreed as solutions to address these challenges.

Practical Implications

- Football governing bodies and/or national federations can use the current findings to develop health and performance nformation exchange systems
- Key types of information are highlighted as ideal to be collected by national teams to guide the design and individualisation of player care and training programmes.
- Our findings suggest that facilitating the exchange of key information may overcome current barriers between club and national teams.

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