Original Article

A survey of player monitoring approaches and microsensor use in basketball

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ABSTRACT

The purpose of this study was to examine player monitoring approaches used by basketball practitioners with a specific focus on the use of microsensors. An online survey was disseminated to basketball practitioners via international basketball-related organisations and social media channels. Multiple response, Likert-scale level of agreement, and open-ended questions captured data regarding if, and how player monitoring was performed, as well as barriers and facilitators to player monitoring, with an emphasis on the use of microsensors. Forty-four basketball practitioners completed the survey. Twenty-seven respondents (61%) implement player monitoring and thirteen (30%) use microsensors. Despite implementing player monitoring, over 85% of practitioners modify training based on their own observation. Respondents not currently monitoring players (39%) would commence monitoring if the tools or equipment were provided. 74% of respondents agree that microsensors are expensive. Only 56% of practitioners who use microsensors feel they have support for using the technology and analysing/interpreting the data. These findings suggest a low uptake of microsensors for player monitoring in basketball. Coaches and practitioners perceive player monitoring approaches to be cost-prohibitive and appear unsure of how player monitoring data should be used to optimise training outcomes for players. **Keywords:** Training load; Coach; Team sport; Training prescription; Accelerometer.

Cite this article as:
Fox, J.L., Scanlan, A., Sargent, C., & Stanton, R. (2019). A survey of player monitoring approaches and microsensor use in basketball. *Journal of Human Sport and Exercise*, *in press*. doi:https://doi.org/10.14198/jhse.2020.151.20

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Submitted for publication February 2019
Accepted for publication April 2019
Published *in press* May 2019
JOURNAL OF HUMAN SPORT & EXERCISE ISSN 1988-5202

doi:10.14198/jhse.2020.151.20

INTRODUCTION

Player monitoring in basketball can be implemented to quantify a range of variables such as training and competition loads (Fox, Scanlan, & Stanton, 2017), recovery status (Edwards et al., 2018), and wellness (Edwards et al., 2018). These parameters are important to monitor as they are closely aligned with performance-related outcomes such as fitness (Fox et al., 2017), fatigue (Edwards et al., 2018), and injury risk (Weiss, Allen, McGuigan, & Whattman, 2017). Player monitoring in basketball can provide large datasets to inform player management strategies. However, quantifying workloads is the primary application of player monitoring in basketball (Fox et al., 2017; Weiss et al., 2017; Schelling & Torres, 2016; Fox, Stanton, & Scanlan, 2018). Workload monitoring in basketball involves quantifying external and internal load. External and internal loads represent the dose-response relationship between the training or competition stimulus imposed (external load) and the physiological reactions of players (internal load) (Fox et al., 2017). This narrow focus within the literature is likely due to the paucity of studies examining other potential uses for player monitoring in basketball such as optimising recovery strategies (Fullagar et al., 2015; Montgomery et al., 2008; Nunes et al., 2014) or guiding return to play after injury (Blanch & Gabbett, 2016).

In basketball, monitoring external load presents unique challenges due to the cost and accessibility of commonly-used methods in other team sports (Fox et al., 2017). For instance, global positioning systems (GPS) are typically implemented to quantify external load variables such as speed and distance in field-based team sports. Since GPS units are not viable for indoor use, kinematic parameters such as distance, speed, acceleration, and jumps have historically been determined using video-based time-motion analysis (TMA). A key limitation with using TMA is the time-intensive nature of data processing. In turn, local positioning systems (LPS) have been developed to provide GPS variables in indoor environments; however, LPS are often cost-prohibitive. In addition, while the indoor nodes used in LPS are removable, it is likely not feasible to relocate these when playing at alternate venues such as during away games due to the need to transport equipment and the time required for set up prior to games.

Given the limitations of the aforementioned approaches to monitor external load in basketball, there is increasing interest in the use of microsensor technologies (Fox et al., 2017). Tri-axial accelerometers are the most common microsensor for monitoring external load in basketball (Schelling & Torres, 2016; Fox et al., 2018; Coe & Pivarnik, 2001; Manzi et al., 2010; Montgomery, Pyne, & Minihan, 2010; Scanlan, Wen, Tucker, & Dalbo, 2014). Accelerometers are suited to basketball as they require no satellite-based signal transfer and produce data that can be quickly analysed using proprietary software. Many commercial microsensors can also be integrated with chest-worn heart rate monitors to record external and internal loads simultaneously, thereby minimising the burden of coordinating multiple systems (Fox et al., 2017).

In outdoor sports such as soccer, there appears to be a widespread uptake of microsensor use (Weston, 2018). However, in indoor sports such as basketball, where microsensors offer significant advantages compared to other player monitoring systems such as TMA and GPS, the extent of implementation and the attitudes of practitioners (e.g. coaches, strength and conditioning coaches, exercise/sports scientists, and sports/athletic trainers) towards microsensor use have yet to be examined. Understanding how player monitoring is implemented, as well as the barriers and facilitators to player monitoring and the use of microsensors has the possibility of maximising the potential benefits associated with monitoring including the use of microsensors in basketball. Consequently, an online survey was delivered to basketball practitioners to examine the: 1) prevalence and purpose of player monitoring in basketball, 2) barriers and facilitators to player monitoring in basketball, and 3) barriers and facilitators to using microsensors for player monitoring in basketball.

MATERIALS AND METHODOLOGY

Since no survey-based research has examined player monitoring in basketball, a new instrument comprising three sections was developed. The first section contained questions about respondent demographics; however, to minimise the likelihood of re-identification of respondents, characteristics such as age, sex, and location were not included. The second section contained questions identifying which, if any, player monitoring practices were adopted and perceived barriers and facilitators to implementing player monitoring. Where respondents indicated that player monitoring was not implemented but had been previously, further questions regarding reasons for no longer being implemented were asked. However, due to the limited responses obtained within this section (N = 3) this data has not been reported as part of this study. The third section contained questions identifying barriers and facilitators to the use of microsensors for player monitoring. Prior to dissemination, the survey was assessed for content validity via expert consensus (Burns et al., 2008; Stanton, Happell, & Reaburn, 2014]. Ten reviewers including researchers at tertiary institutions and sports scientists working in team sports with experience in survey development, player monitoring, and the use of microsensor technologies were invited to provide feedback on survey design, readability, and understanding. Feedback was received from five of the ten invited reviewers. Reviewer recommendations were pooled and changes to wording and grammar were included in a revision of the survey instrument. Since suggested changes were minor, only one opportunity for feedback was given to reviewers prior to survey dissemination. A schematic of the survey structure for the reported questions is presented in Figure 1. The final survey comprised multiple-choice, Likert scale (level of agreement), and open-ended questions. For some multiple-choice questions, an option for a text-based response was offered where respondents could provide additional information. Piloting of the final survey instrument was conducted with five respondents to determine response time and feasibility. The average response time based on piloting was approximately 16 minutes and no additional concerns regarding wording or clarity of the survey questions were identified. The final version of the survey is available as supplementary online content.

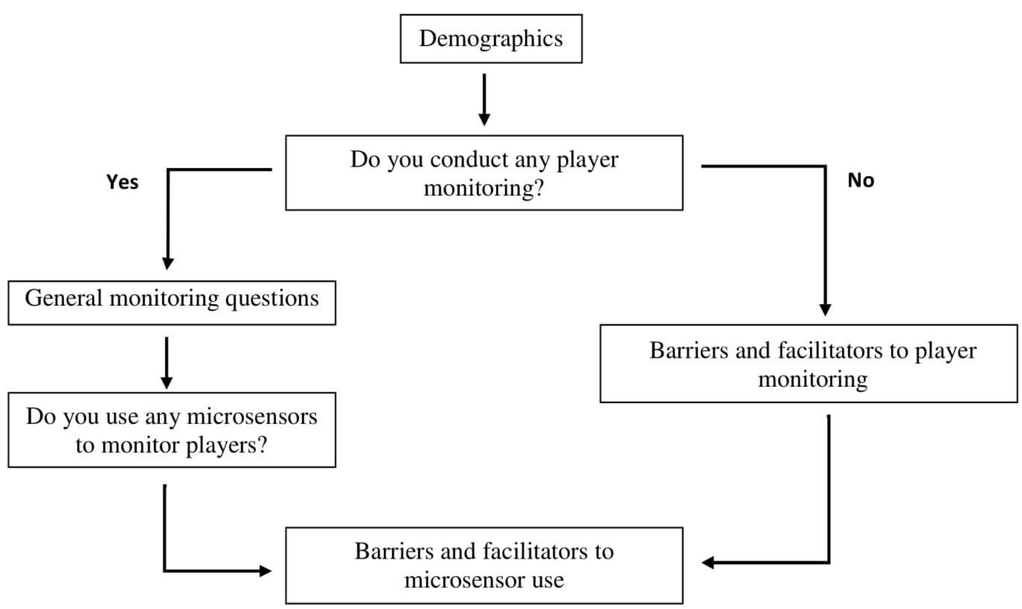

Figure 1. Structure of the online survey

The survey was hosted using the online survey platform, SurveyMonkey (Palo Alto, California, USA, www.surveymonkey.com). The first page of the online survey outlined the nature of the study, and potential risks and benefits of participation. Respondents were advised that (1) they could withdraw from the study at any time by closing the browser window, (2) withdrawal of responses following submission was not possible due to the anonymous nature of the survey, and (3) consent to participate was provided by submission of the survey responses. No incentive was offered to participants. The study protocol was approved by an Institutional Human Research Ethics Committee. Data were collected from June 2017 to April 2018.

Survey dissemination

Invitations to complete the survey occurred in two ways. Initially, basketball-related organisations from various countries were contacted and requested to distribute survey information including a link to the online survey via their organisational mailing lists. Due to a low initial response rate, a link to the survey was promoted using social media channels (Twitter, LinkedIn, and ResearchGate). Twitter users were encouraged to re-post the content to extend the sampling scope. No restrictions were placed on the respondent demographics (e.g. level or experience with basketball coaching, role in the team coaching structure).

Statistical analysis

Data were analysed using descriptive statistics. Multiple-choice questions and open-ended questions requiring a numerical response are reported using means and standard deviations ($\bar{x}$±SD) or proportions (N, %). Where questions allowed multiple responses, the total percentage for responses may exceed 100%. For questions that were answered using a Likert scale (level of agreement), responses are collapsed into 'agree', 'neutral', or 'disagree' for simplicity. This approach is acceptable if new categories are not created and interpretation of the findings is not altered (Stanton, Happell, & Reaburn, 2015, Starling & Lambert, 2017).

RESULTS

Forty-four respondents completed the online survey with 61% of respondents indicating player monitoring is conducted in the team in which they work and 30% of respondents indicating microsensors are used for player monitoring. For the purpose of the survey, player monitoring was defined as any data obtained on players with the aim of quantifying any health or performance-related outcomes relevant to basketball.

Respondents' professions were identified as a Strength and Conditioning Coach (52%), Coach (34%), Exercise or Sports Scientist (7%), and Sports or Athletic trainer (5%). One respondent (2%) reported holding multiple roles (Coach and Strength and Conditioning Coach). Respondents worked with collegiate/university athletes (36%), club level (amateur and grass roots levels) athletes (36%), professional (full-time, contracted athletes) athletes (25%), elite (trained athletes selected into a representative team) athletes (23%), semi-professional (some athletes are full-time/ contracted) athletes (18%), or high school athletes (5%). Years of experience at each level of sporting experience was as follows: 10.3 ± 3.9 years at the professional level, 13.6 ± 9.0 years at the semi-professional level, 10.1 ± 8.5 years at the elite level, 15.4 ± 10.1 years at the collegiate level, 12.8 ± 9.5 years at the club level, and 18.0 ± 14.1 years at the high school level. Fewer than half of respondents reported holding a Master's Degree (41%), while just over one third reported holding a University undergraduate degree (36%). Only 9% reported holding a Doctoral degree. For other respondents, the highest reported level of education was a High school certificate (7%), Diploma or equivalent (5%), or Vocational education certificate (2%). Respondents also held a range of sport-related qualifications, including Strength and Conditioning Coach (66%), Certified Coach (43%), Exercise Scientist (9%), Sports Scientist (9%), or others (e.g. Certified Strength and Conditioning Specialist and Athletic Trainer) (11%). Three respondents (7%) held no current sports related qualifications. Respondents access information regarding player monitoring via professional development activities (85%), other practitioners (74%), online sources (67%), academic journals (59%), and textbooks (30%).

Responses indicate player monitoring is conducted by the strength and conditioning coach (56%), coach/assistant coach (48%), exercise/sports scientist (11%), sports/athletic trainer (4%), or other personnel (analytics fellow, medical staff, or physiotherapist) (11%). Respondents spend 6.10±6.23 hours collecting player monitoring data, 4.57±4.07 hours analysing player monitoring data, and 1.73±2.06 hours communicating player monitoring data each week.

Among respondents who implement player monitoring, almost all (89%) agree player monitoring is important for each of the following applications: determining whether player fitness is improving, comparing training and competition demands and comparing demands between different types of training, safeguarding against injury, and prescribing appropriate recovery strategies. Most respondents who implement player monitoring provide feedback to players (85%), with 87% of those providing feedback within 3 days. Similarly, 89% of respondents who implement player monitoring provide feedback to other staff, with all providing feedback within 3 days.

The majority of respondents (78%) who implement player monitoring report outcomes on a group and individual basis. Where player monitoring data indicate training needs to be modified, training is most commonly modified on a case-by-case basis (for the group or individual as deemed necessary) (67%). Reasons for modifying training for the group include personal observation of the practitioner (95%), performance changes of the players (81%), player feedback (81%), fatigue (67%), or training load targets being reached (57%). Reasons for modifying training for an individual include fatigue (90%), personal observation (86%), player feedback (86%), performance changes of the player (81%), training load targets being reached (52%), or if the player is injured or in physical discomfort/pain (5%).

Respondents who do not monitor players (39%) indicate they would commence player monitoring if the team/club purchased the tools or equipment (59%), if they were shown how to use the data (59%), if they were shown how to collect the data (47%), if a sponsor or manufacturer provided the tools or equipment (35%), if they understood how it might benefit the team (35%), or if someone else was responsible for player monitoring (18%). Preferred tools for respondents who do not monitor included heart rate monitors (76%) perceptual measures (71%), or microsensors (65%). Respondents who do not monitor report interest in monitoring fatigue (82%), accelerations/decelerations (65%), heart rate (53%), distance (47%), speed (47%), perceived exertion (41%), perceived wellness (35%), and hydration status (6%). Respondents reported an intention to use these data to manage injury risk (94%), fatigue (88%), performance (65%), fitness (59%), and sleep (18%). Respondents' understanding of microsensors for player monitoring are presented in Table 1. Respondents who indicated they had never heard of microsensors (12%) were not required to answer any further questions.

Among respondents who monitor players without microsensors (25%), 36% would use microsensors if the opportunity arose, 27% would only use microsensors if they became freely available, 9% would only use microsensors if they were taught how to use them, 9% would only use microsensors if someone else analysed the data, 9% would only use microsensors if accuracy improved, and 9% would not use microsensors. Respondents who do not monitor players (39%) indicated they would use microsensors if the opportunity arose (47%), if they became freely available (24%), or if they were taught how to use them (18%). Of the 25% of respondents who monitor players without microsensors, 27% indicated there were no additional devices they were interested in using, while others specified (text-based responses) an interest in using heart rate monitors (64%), accelerometers (36%), and GPS devices (27%). The level of agreement regarding the suitability of microsensors for player monitoring among respondents are presented in Figure 2.

Table 1. Statement which best describes respondents' understanding of microsensors

Statement	Respondents who monitor without microsensors (N, %)	Respondents who do not monitor (N, %)
I understand microsensors and how to use them	5, 36%	0, 0%
I am familiar with what microsensors are used for but I do not know how to use them	2, 14%	8, 47%
I have heard of microsensors but I do not understand what they are used for	4, 29%	7, 41%
I have never heard of microsensors and have no understanding of what they are used for.	3, 21%	2, 12%

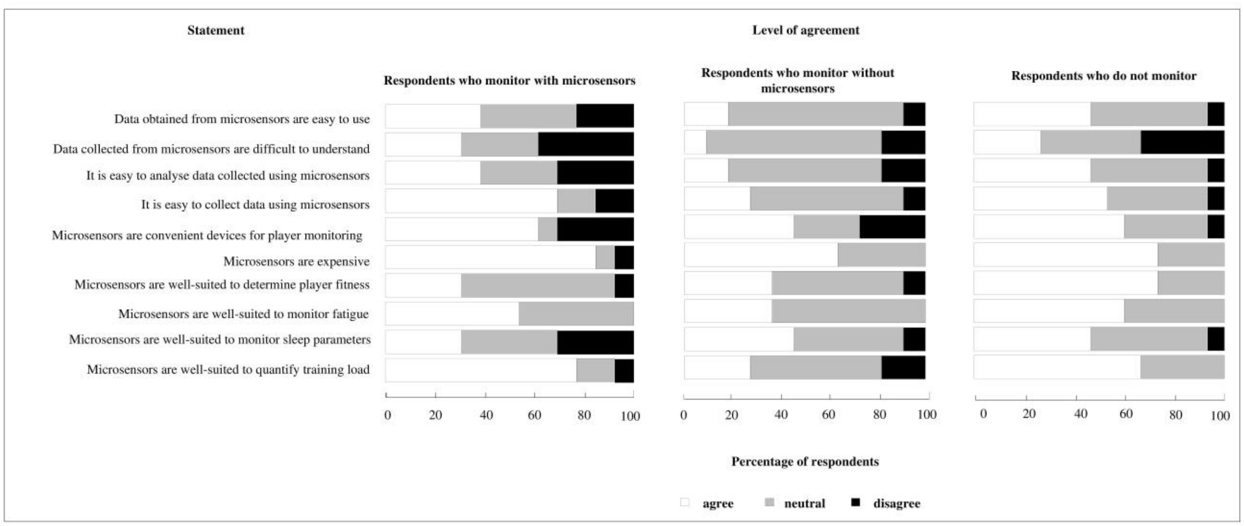

Figure 2. Respondents level of agreement regarding the use of microsensors for player monitoring

Most respondents (54%) who use microsensors feel they are accessible only to teams who receive funding, with around one-quarter of respondents indicating they are accessible across all playing levels and teams. Of the respondents who monitor without microsensors or do not monitor, 61% feel microsensors are only accessible to teams who receive funding and the remaining 39% feel microsensors are only accessible to professional teams. The majority of respondents who use microsensors feel they have support for using the technology and analysing/interpreting the data (54%), while fewer respondents feel they only have support for using the technology (23%) or analysing/interpreting the data (8%), or have no support (15%). When respondents who use microsensors were asked to identify other player monitoring tools that they would use but do not currently have access to, most (54%) indicated there were no additional devices of interest.

DISCUSSION

The effective implementation of player monitoring in basketball can support the decision-making process within teams and clubs by facilitating the management of fatigue (Edwards et al., 2018), injury risk (Gabbett, 2016), and performance-related outcomes (Fox et al., 2017). To ensure these benefits are achieved, it is important to understand how practitioners implement player monitoring and use the acquired data. In addition, it is pertinent to determine what barriers impede the adoption of monitoring in basketball for practical solutions to be developed that facilitate the monitoring needs of practitioners. Consequently, the present study is the first to investigate the use of player monitoring and microsensors in basketball from the perspective of practitioners.

Almost two thirds of respondents (61%) indicated player monitoring is conducted in the team in which they work. Of these respondents, over 89% agree that monitoring is important for determining fitness improvements, comparing the demands of different training types and competition, safeguarding against injury, and prescribing appropriate recovery. These practical applications of monitoring are considered important and have been advocated in recent research (Fox et al., 2018; Montgomery et al., 2010; Bourdon et al., 2017). However, while the ability of practitioners to recognise important applications of monitoring might suggest effective integration of research into practice, it is not clear whether practitioners are using monitoring data for evidence-based decision-making. For example, most respondents indicated that training is modified based on practitioner observation (95% at group level and 86% at individual level), and not informed by data. Since 43% of respondents who do not monitor using microsensors indicate they do not know how to use them or what they are used for, it seems plausible that this is driven by a lack of understanding of the data. Therefore, the development of more specific guidelines regarding how player monitoring data should be used to optimise performance or recovery-related outcomes may encourage more effective use of player monitoring data to compliment practitioner observation. Alternatively, 36% of respondents who monitor without microsensors feel they understand microsensors and how to use them. Consequently, effective dissemination surrounding the use of microsensors for player monitoring may also support practitioners to effectively implement player monitoring. Based on our findings, targeting professional development activities, mentoring networks, and academic journals appear to be valuable avenues for disseminating information and practical recommendations regarding the implementation of player monitoring and microsensor use in basketball.

For respondents who do not currently conduct player monitoring, it is necessary to identify barriers that may hinder adoption of monitoring practices. In this regard, all respondents indicated they would monitor players given the opportunity. However, most respondents indicated that for player monitoring to be implemented the tools and equipment would need to be purchased or they would need to be shown how to collect the data. Financial barriers or a lack of expertise may restrict monitoring practices for these basketball practitioners. In contrast, the large number of respondents indicating a preferred use of perceptual measures (71%) could be interpreted as a strategy to overcome the financial barriers to monitoring with tools that are freely available. However, as with any approach, the advantages and limitations of perceptual measures need to be understood (Fox et al., 2017; Fox et al., 2018). Perceptual measures that require players to self-report fatigue, sleep quality, stress, mood, or muscle soreness appear to be related to fatigue and player readiness to train (Edwards et al., 2018). Such information is useful for practitioners as it may identify fatigue-related outcomes indicative of maladaptive responses to training as a consequence of excessive training stimuli or insufficient recovery. A large number of respondents (76%) who do not monitor reported an interest in using heart rate monitors for player monitoring. Heart rate-derived training load models such as the summated-heart rate-zones model (Edwards, 1993) has been deemed a suitable method for determining exercise intensity in basketball (Fox et al., 2017) and if utilised in addition to perceptual measures may allow practitioners to obtain a deeper understanding of training and competition demands. It is important to note however, that perceptual workload measures and HR are considered measures of internal load. As such, the use of these measures in isolation does not allow for quantification of the training or competition stimulus imposed (external load). External and internal loads provide different information and therefore, it is advocated that both be monitored concurrently (Fox et al., 2018; Scanlan et al., 2014). In basketball, external load is typically quantified using objective measures obtained from microsensors, which as identified in the survey findings, may be cost-prohibitive. With evidence supporting the collection of external and internal load measures using a combination of objective and subjective measures (Bourdon et al., 2017), strategies to make monitoring approaches more accessible, in particular microsensors, should be considered.

Despite a large proportion of respondents implementing player monitoring, less than half (48%) reported using microsensors for player monitoring. All respondents who do not monitor players and 77% of respondents who monitor without microsensors would use them given the opportunity. Given respondents perceived microsensors to be accessible only to professional teams or teams that receiving funding, adoption of this monitoring technology may be cost-prohibitive. To facilitate ongoing support for software use, many companies are now moving towards subscription-based software licensing which creates significant ongoing costs for teams. Based on our study findings it is not possible to determine whether financial barriers to using microsensors are primarily due to purchasing the devices or affording ongoing costs (e.g. maintenance, subscription-based software licenses). Nonetheless, this shift toward ongoing subscriptions, in addition to device costs, may further restrict access to microsensors.

Aside from financial restrictions, having relevant expertise and understanding how to apply monitoring data appears to restrict implementation of player monitoring in basketball. Some respondents, despite using microsensors, felt that they had support only to use microsensors (23%), whereas others felt they had support to only analyse the data (8%), with some having no support available (15%). Interestingly, those who do not use microsensors perceive them to be more valuable. For example, 77% of respondents who do not monitor players feel that microsensors are well suited to determine player fitness compared to only 31% of respondents who use microsensors. Similarly, given respondents primarily modify training based on their own observation despite having access to player monitoring data, the data collected from microsensors may be difficult to interpret or apply in practical scenarios. In many sports, player monitoring data appears to support practitioner's decision-making regarding whether players are being exposed to insufficient or excessive training or competition stimuli (Gabbett et al., 2017; Robertson, Bartlett, & Gastin, 2017); however, there appears to be a lack of equivalent systems reported in basketball.

While our survey uncovered some important findings regarding player monitoring and the use of microsensors in basketball, limitations must be considered when interpreting the results. The present study contained only a small sample size (N = 44). The low response rate, despite the various distribution channels used and the survey being available for 10 months, possibly reflects a lack of interest or knowledge regarding player monitoring in basketball practitioners and perhaps the limited implementation of player monitoring in practice. Alternatively, the low response rate might be due to a false interpretation by potential respondents that if they did not implement player monitoring the survey would not be applicable to them. Given the small sample size in the present study, it was therefore not feasible to analyse results based on factors such as playing level respondents are involved with. It is likely that teams at different levels would experience different barriers to monitoring such as varied amounts of funding available for player monitoring tools and this should be considered when interpreting the findings of this survey.

CONCLUSION

This study is the first to survey basketball practitioners regarding player monitoring, including the specific use of microsensors. Almost two thirds of respondents implement player monitoring and less than half of these use microsensors. Player monitoring appears to be a cost-prohibitive practice, irrespective of whether microsensors are used or not. Furthermore, it appears that regardless of whether monitoring is implemented, practitioners appear unsure of how to interpret and apply player monitoring data in basketball. To facilitate the implementation of player monitoring, more work is needed to develop guidelines on the use and application of player monitoring data in basketball. Developers and manufacturers of microsensors also need to consider strategies to make devices more financially accessible to teams.

ACKNOWLEDGEMENTS

This research was supported under the Commonwealth Government's Research Training Program. The lead author gratefully acknowledge the financial support provided by the Australian Government. No funding was sought for this research. All authors declare they have no conflicts of interest.

REFERENCES

Blanch, P., & Gabbett, T.J. (2016). Has the athlete trained enough to return to play safely? The acute:chronic workload ratio permits clinicians to quantify a player's risk of subsequent injury. British Journal of Sports Medicine, 50, 471-475. https://doi.org/10.1136/bjsports-2015-095445

Bourdon, P. C., Cardinale, M., Murray, A., Gastin, P., Kellmann, M., Varley, M. C., Gabbett, T. J., Coutts, A. J., Burgess, D. J., Gregson, W., & Cable, T. (2017). Monitoring athlete training loads: Consensus statement. International Journal of Sports Physiology and Performance, 12(Suppl 2), S2-161-S2-170. https://doi.org/10.1123/ijspp.2017-0208

Burns, K. E. A., Duffett, M., Kho, M. E., Meade, M. O., Adhikari, N. K. J., Sinuff, T., Cook, D. J., & Academy Group. (2008). A guide for the design and conduct of self-administered surveys of clinicians. Canadian Medical Association Journal, 179(3), 245-252. https://doi.org/10.1503/cmaj.080372

Coe, D., & Pivarnik, J. M. (2001). Validation of the CSA accelerometer in adolescent boys during basketball practice. Pediatric Exercise Science, 13(4), 373-379. https://doi.org/10.1123/pes.13.4.373

Edwards, S. (1993). The heart rate monitor book. Sacramento, CA: Fleet Street Press.

Edwards, T., Spiteri, T., Piggott, B., Bonhotal, J., Haff, G., & Joyce, C. (2018). Monitoring and managing fatigue in basketball. Sports 6(19). https://doi.org/10.3390/sports6010019

Fox, J. L., Scanlan, A. T., & Stanton, R. (2017). A review of player monitoring approaches in basketball: Current trends and future directions. Journal of Strength and Conditioning Research, 31(7), 2021-2029. https://doi.org/10.1519/jsc.0000000000001964

Fox, J. L., Stanton, R., & Scanlan, A. T. (2018). A Comparison of training and competition demands in semiprofessional male basketball players. Research Quarterly for Exercise and Sport, 89(1), 103-111. https://doi.org/10.1080/02701367.2017.1410693

Fullagar, H. H. K., Duffield, R., Skorski, S., Coutts, A.J., Ross, J., & Meyer. T. (2015). Sleep and recovery in team sport: Current sleep-related issues facing professional team-sport athletes. International

Journal of Sports Physiology and Performance, 10(8), 950-957. https://doi.org/10.1123/ijspp.2014-0565

Gabbett, T. J. (2016). The training—injury prevention paradox: Should athletes be training smarter and harder? British Journal of Sports Medicine, 50(5), 273-280. https://doi.org/10.1136/bjsports-2015-095788

Gabbett, T. J., Nassis, G. P., Oetter, E., Pretorius, J., Johnston, N., Medina, D., Rodas, G., Myslinki, T., Howells, D., Beard, A., & Ryan, A. (2017). The athlete monitoring cycle: A practical guide to interpreting and applying training monitoring data. British Journal of Sports Medicine, 51, 1451-1452. https://doi.org/10.1136/bjsports-2016-097298

Manzi, V., D'Ottavio, S., Impellizzeri, F. M., Chaouachi, A., Chamari, K., & Castagna, C. (2010). Profile of weekly training load in elite male professional basketball players. Journal of Strength and Conditioning Research, 24(5), 1399-1406. https://doi.org/10.1519/jsc.0b013e3181d7552a

Montgomery, P. G., Pyne, D. B., Hopkins, W. G., Dorman, J. C., Cook, K., & Minahan, C. L. (2008). The effect of recovery strategies on physical performance and cumulative fatigue in competitive basketball. Journal of Sports Science, 26(11), 1135-1145. https://doi.org/10.1080/02640410802104912

Montgomery, P. G., Pyne, D. B., & Minahan, C. L. (2010). The physical and physiological demands of basketball training and competition. International Journal of Sports Physiology and Performance, 5(1), 75-86.

Nunes, J. A., Moreira, A., Crewther, B. T., Nosaka, K., Viveiros, L., & Aoki, M. S. (2014). Monitoring training load, recovery-stress state, immune-endocrine responses, and physical performance in elite female basketball players during a periodized training program. Journal of Strength and Conditioning Research, 28(10), 2973-2980. https://doi.org/10.1519/jsc.0000000000000499

Robertson, S., Bartlett, J. D, & Gastin, P. B. (2017). Red, amber, or green? Athlete monitoring in team sport: The need for decision support systems. International Journal of Sports Physiology and Performance, 12(Suppl 2), S2-73-S2-79. https://doi.org/10.1123/ijspp.2016-0541

Scanlan, A. T., Wen, N., Tucker, P. S., & Dalbo, V. J. (2014). The relationships between internal and external training load models during basketball training. Journal of Strength and Conditioning Research, 28(9), 2397-2405. https://doi.org/10.1519/jsc.0000000000000458

Schelling, X., & Torres, L. (2016). Accelerometer load profiles for basketball-specific drills in elite players. Journal of Sports Science and Medicine, 15(4), 585-591. https://doi.org/10.1249/01.mss.0000487540.00343.1a

Stanton, R., Happell, B., & Reaburn, P. (2014). The development, validation and reliability of a questionnaire to investigate the views of health professionals regarding exercise for the treatment of mental illness. Mental Health and Physical Activity, 7(3), 177-182. https://doi.org/10.1016/j.mhpa.2014.06.001

Stanton, R., Reaburn, P., & Happell, B. (2015). Barriers to exercise prescription and participation in people with mental illness: the perspectives of nurses working in mental health. Journal of Psychiatry and Mental Health Nursing, 22(6), 440-448. https://doi.org/10.1111/jpm.12205

Starling, L. T., & Lambert, M. I. (2017). Monitoring rugby players for fitness and fatigue: What do coaches want? International Journal of Sports Physiology and Performance, 13(6), 777-782. https://doi.org/10.1123/ijspp.2017-0416

Weiss, K. J., Allen, S. V., McGuigan, M. R., & Whattman, C. (2017). The relationship between training load and injury in men's professional basketball players. International Journal of Sports Physiology and Performance, 12(9), 1238-1242. https://doi.org/10.1123/ijspp.2016-0726

Weston, M. (2018). Training load monitoring in elite English soccer: A comparison of practices and perceptions between coaches and practitioners. Science and Medicine in Football, 2(3), 216-224. https://doi.org/10.1080/24733938.2018.1427883