Understanding sport participation and athlete development: The Exposure to Sport Scale

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ABSTRACT

The purpose of this two-part paper was to conceptualize and validate a new method for measuring youth sport exposure. In part one, different disciplines were used to guide the creation of the Exposure to Sport Scale. Using references from epidemiology and the previously validated Developmental History of Athletes Questionnaire, an original version of the scale was proposed. Sections include measures of practice, play and competition throughout an athlete's sport development journey. In part two the content and face validity of the Exposure to Sport Scale was investigated. Using a modified Delphi approach, 16 experts in the field completed three rounds of feedback. By the final round all items had achieved consensus for clarity and relevance. The proposed Exposure to Sport Scale has significant implications for those working in early athlete settings.

Keywords

sport, athlete, development pathways, expertise

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Introduction

Discussions about youth sport participation increasingly focus on the costs and benefits of specialized versus diversified training during early development (e.g., Baker et al., 2021; Ford & Williams, 2017; Myer et al., 2016). Despite growing interest in this topic, the defining characteristics of specialization and diversification remain unclear, with researchers noting inconsistencies in definitions and measurement (Baker et al., 2021; Kliethermes et al., 2021; Larson et al., 2019;

Mosher et al., 2020; Ramsay et al., 2023). Specialization is often simply defined as "intentional and focused participation in a single sport for a majority of the year that restricts opportunities for engagement in other sports and activities" (Bell et al., 2021, p. 1241). In contrast, diversification has been more crudely described as 'multi-sport participation' with little consideration of when multiple sports are occurring (i.e., simultaneously, over the course of a year or over the lifetime) (Ramsay et al., 2023). These inconsistent definitions can complicate the classification of athletes as specializers or diversifiers (Mosher et al., 2020).

While specialization is often linked to negative psychological outcomes, evidence for this relationship remains limited (Kliethermes et al., 2021). Research on injury risk and specialization has yielded mixed results: some studies find associations (Ahlquist et al., 2020; Jayanthi et al., 2020), others find none (Frome et al., 2019; Ross et al., 2021), and some note sport specific risks (Post et al., 2021). These inconsistencies have prompted a more nuanced exploration of sport participation pathways. Emerging models offer strategies for training specialized athletes (Jayanthi et al., 2022; Mosher et al., 2021), and researchers seem to be questioning the value of treating specialization and diversification as a strict dichotomy (Baker et al., 2021; Güllich et al., 2021).

Currently, there is no method for measuring diversification and, arguably, too many methods for measuring specialization, of which none have been shown to have appropriate reliability and validity (Mosher et al., 2020; Pasulka et al., 2017). It is difficult to provide evidence for or against specialization when the same athletes could be classified differently depending on the method researchers choose to use (Mosher et al., 2022). Because of this measurement imprecision, researchers have suggested measuring specialization using a set of continuous variables would provide a more accurate representation of the phenomena (Baker et al., 2021; Güllich et al., 2021), and that it may be more important to focus on the mechanism(s) driving any negative consequences of specialization (Baker et al., 2021; Mosher et al., 2021).

Emerging research (e.g., Jayanthi et al., 2020) highlights limitations in current methods for measuring specialization and diversification, which overlook key factors like training intensity and volume. Without measuring intensity, recreational athletes may be grouped with advanced level athletes. Similarly, failing to measure training volume, could group athletes training for two hours a week with those training twenty, making it impossible to assess whether overtraining drives the risks or benefits of specialization. Participation and engagement do not occur in isolation; athletes in multiple sports may dedicate more time overall than specializers in a single sport. Current methods lack data on *total* sport participation, preventing analysis of risks linked to excessive participation across multiple sports.

Developing a scale to measure specialization and diversification can improve our understanding of their effects on health, development, and performance. We explore the creation of this scale in this paper. Part 1 provides a rationale behind and description of the proposed "Exposure to Sport Scale" (ESS). Part 2 uses a Delphi approach to examine the preliminary validation of the scale. The ESS will provide a uniform method for measuring sport exposure that can then be used to better investigate potential benefits or negative outcomes associated with different types and amounts of sport participation.

Part 1: Conceptualizing and Creating the Exposure to Sport Scale (ESS)

Building on prior research on athlete development, this study aimed to improve the clarity and precision of measuring sport participation, addressing gaps in how early specialization and diversified training are considered (Coutinho et al., 2015; Mosher et al., 2021; Smith et al., 2017). To this end, we considered approaches from various sub-domains of sport science to explore ways participation has been considered. For instance, approaches from health and injury epidemiology were considered since this research generally emphasizes clarity and ease of data collection, and large, repre-

sentative samples, two criticisms of prior work in this area (Wild, 2009). Similarly, approaches from exercise physiology were explored because of the long history of quantifying load in this field (e.g., for periodization of training, Turner, 2011).

Epidemiological methods consider the relationship between causal or predictive variables as risk factors, generally as they relate to 'exposure' (White et al., 2008). Given the types of outcomes at the forefront of discussions of athlete development (i.e., risks or costs of different forms of participation), positioning the relationships between variables from the perspective of 'risk' seemed useful. Measuring exposure requires determining the active agent (i.e., the component that causes the outcome); However there is no particular 'element' associated with sport participation and outcomes the same way that there would be with a medication. Given prior discussions and the evidence presented above from the research in this and related areas, this scale was grounded in the assumption that the most likely mechanism is related to *load*.

Examining and Measuring Sport Participation Load

Much of the research on early athlete development assumes load is the driving factor in injury or improved athletic performance (Gabbett et al., 2016), inadvertently positioning it as the active agent in sport participation. Load management is a key factor in injury prevention (Bourdon et al., 2017) as well as for maximizing training-based adaptations (Baker et al., 2005; Hughes et al., 2018). Monitoring training load can be done broadly by measuring facets of training intensity, frequency, and duration (e.g., Gabbett, 2004; Gabbett et al., 2016). However, load has not been looked at across sports or from the perspective of overall exposure, mainly because most studies have focused on load management in samples of elite athletes who participate in one sport and have highly regimented training programs.

As discussed above, one of the biggest gaps in our understanding of specialization and diversification comes from positioning these variables as opposites, rather than exploring them as separate, continuous variables. Risks associated with specialization, for instance, may be related to more than single sport participation (i.e., load would reflect the *quantity of engagement*). Similarly, diversification is generally measured via number of sports; however, more information is needed to fully understand the mechanisms underlying participation in these sports. For instance, it would be important to understand whether (a) overlapping sport seasons (i.e., engaging in three sports simultaneously) in a non-specialized athlete is better for health, development and performance than engaging in only one sport, (b) there is a linear relationship between number of sports and risk/reward (e.g., does the potential for negative or positive effects increase with each additional sport?), and perhaps most importantly, (c) there is a threshold of overall engagement after which the risk of negative outcomes increases. Adding nuance to the way we measure sport participation will allow researchers to answer these and other questions.

In athlete development, exposure encompasses several dimensions and can be quantified using measures such as cumulative dose, average dose and dose rate. While these variables are calculated differently and may vary in usefulness to researchers, they generally involve three key elements: duration, frequency, and intensity of participation. Duration, or the length of time the exposure lasts, is often weighted highest as it is closely linked to the likelihood of negative outcomes (White et al., 2008). Frequency refers to how often an athlete engages in a specific activity or training session (White et al., 2008), requiring detailed records of participation patterns. Intensity, on the other hand, reflects the dose of the active agent per episode, and is critical for distinguishing the *magnitude* of the training load. Assessing these magnitudes is essential, especially if the increased risks are associated with exceeding certain intensity thresholds.

Current versus Historical Training Load

Athlete development relies on the principles of long-term adaptation to training stress (Cunanan et al.,

2018). Thus, it is crucial to assess both current (e.g., in the past seven days) and past sport exposure as an athlete's capacity to manage current training levels is shaped by previous patterns. The scale collects both historical and current data to account for chronic (historical) and acute (current) training loads (Gabbett et al., 2016). Understanding these loads enables us to determine load changes over time and the acute – chronic workload ratio, which helps identify risks such as high acute loads without progressive preparation (Hulin et al., 2016). Research suggests acute workload increases injury risk, while chronic workloads may be protective (Gabbett et al., 2016; Hulin et al., 2014, 2016). The appropriate timeframe for measuring acute load is usually limited to the past seven days, as this allows for comprehensive recall of recent training (Blair et al., 1985; Gabbett, 2016; Sallis et al., 1993).

Several researchers (e.g., Côté et al., 2005; Hendry & Hodges, 2018; Hopwood et al., 2010), have highlighted the challenge of collecting retrospective athlete participation data. To ensure psychometric rigor, items for the ESS were drawn, where possible, from the Developmental History of Athletes Questionnaire (DHAQ; Hopwood, 2013; Hopwood et al., 2010), a validated tool used in prior studies (Atefineya et al., 2021; Lemez et al., 2020; Wilson et al., 2019). However, the DHAQ lacked the specificity required to precisely calculate sport exposure and the sensitivity needed to assess athlete risk. For the ESS, DHAQ items related to duration, frequency, and intensity of participation in different forms of sport were adapted to capture both historical and current training loads. This process involved retaining some DHAQ items as-is and expanding others to meet the ESS's specific goals.

Exposure to Sport Scale (ESS) Items

Below, we outline ESS items aimed at collecting the duration, frequency, and intensity of (a) practice, (b) competition and (c) play, three primary forms of sport participation (Ford & Williams, 2008).

Practice

Historical. To capture historical involvement in practice (i.e., chronic load), items included number of sports participated in, level of participation (e.g., recreational, competitive), as well as months per year and days per week of each sport. Expanding on the relevant items from the DHAQ, the scale collected number of hours per session and training sessions per day for each sport, as athletes may participate in more than one training session each day and indicate which months during the year they practiced each sport (e.g., January to March in hockey). To gain a comprehensive understanding of historical engagement in practice, the above items were completed for every age of participation, indicating how long participation lasted at each level (e.g., 2 years recreationally followed by 4 years competitively in hockey).

Current. Using specific DHAQ questions as a guide, items to capture current practice (i.e., acute load) included measuring practice for the past seven days for each sport in which an athlete engaged. More specifically, the scale collected days and hours practiced for the week, days practice occurred and number of sessions per day. Collecting this information was important for determining whether training occurs in multiple sports on the same day, as well as the duration and frequency of training load. The scale also included a novel item asking whether this is a regular practice week and space to explain whether this differed from the normal schedule. Finally, to capture intensity the scale collected perceptions of effort during practice for the week via a continuum between 0% to 100% effort, a technique used by Côté and colleagues when collecting sport development history.

Competition

Historical. The scale also collected relevant data about competition history; however, this type of data, at least when collected retrospectively, was found to be unreliable in the original DHAQ . Based on this limitation in recall ability and the importance of collecting com-

petition data for determining exposure, and to establish if/when overlap occurs between sports, the scale included an item to indicate the months competition took place. Additionally, to get a general understanding of competition frequency, an item asking overall how often competitions occurred was included to gauge whether the competition exposure was consistent (e.g., weekly) or intermittent (e.g., once in a while).

Current. Similar to the recall of current information for training/practice and again adapting relevant DHAQ items, current competition was captured using items that measured number of events/matches within the competition, and hours of each event/match, for each sport over the most recent 7-day period. The scale also collected which specific days the event/matches took place to determine any potential overlap across sports. Additionally, an item that measured average time actively competing for each event/match for each sport, as time spent actively engaged (as opposed to sitting on the bench) was included. Like the measure of intensity of practice, an item collected information about the intensity of effort during competitions (0 to 100%).

Play

Historical. Due to the inconsistent and often spontaneous nature of participation no information on historical play was collected.

Current. Over the same 7-day period, the scale collected hours in, and which specific days respondents engaged in play. This allows researchers to determine whether play is occurring on the same days as practice and if there is a potential ratio of play to practice that relates to risk and/or benefit.

Advantages and Considerations of the Proposed Scale

Exposure measurement is complex but collecting enough information about individual variables permits examination of relationships between exposure and health, developmental, and performance outcomes, as well as allowing the exploration of potential interaction effects - an element of analysis that has not been possible in most prior work. Being able to run more complex analyses will lead to a better understanding of the mechanisms behind potential harmful or beneficial outcomes of both specialization and diversification, and the ability to create specific guidelines for policy makers on sport participation among youth.

Part 2: Validating the Exposure to Sport Scale

While there are several kinds of validity, each reflecting the degree of support for a measure, this study focused on establishing content validity and face validity using a modified Delphi approach (Vernon, 2009). In the case of the ESS content validity relates to whether the proposed items accurately measure exposure while face validity is reflected in whether the scale logically appears to measure overall exposure. While more advanced and robust elements of validity (e.g., criterion or predictive validity) can only be established through on-going research conducted over extensive time, if experts on the Delphi panel agreed that the proposed items are a comprehensive, accurate and logical measure of exposure, then preliminary validity of the ESS will have been established, justifying its use in further research.

Methods

Participants

Study participants included researchers currently active in the field of youth sport participation, to ensure scholars' area of work was aligned with the purpose of the proposed scale (Powell, 2003). To be included in the study, participants had to have published an article on sport specialization in a peer reviewed journal in the last 15 years (as determined by systematic review, Mosher et al., 2020). The first author of each publication was invited to participate. If the first author could not be contacted, then the second author was contacted; if the first author was

a graduate student, then the supervising author was contacted. After receiving ethics approval from the Institution Review Board, invitation emails were sent out to 74 researchers; 50 researchers did not respond, 5 declined due to time constraints, and 19 consented to be a part of the study. Of the 19 who consented to participate, 16 completed the study in full, 14 were PhDs and 2 were practicing medical doctors. Of the total, 6 were female.

Study Design

To test the validity of the proposed ESS (Appendix A), a modified Delphi approach was used. A Delphi is an iterative process designed to collect the opinion of experts on a topic that has little evidence or conflicting evidence and could benefit from the subjective judgements of individuals (Hsu & Sandford, 2007). This approach can also be used to investigate something that does not yet exist (Skulmoski et al., 2007) - as is the case of the ESS.

The Delphi method is comprised of four key elements: (a) anonymity between participants, (b) iteration, (c) controlled feedback, and (d) statistical aggregation of responses (Rowe & Wright, 1999). It allows participants to freely express and revise opinions based on controlled feedback and quantitative data interpretation. In sport science, the Delphi method has been used to define sport specialization (Bell et al., 2021), enhancing clarity and precision in measuring sport participation. This method captures collective expert knowledge in a collaborative manner, leading to more discussion and feedback than a traditional quantitative survey, systematic review, or other research synthesis method. A modified Delphi approach was conducted to achieve consensus on the ESS items. Modifications to the Delphi method depend on the research question, with no set rules for panel size or rounds of questions (Skulmoski et al., 2007). While some studies start with open-ended questions, it is equally valid to base the initial questionnaire on a thorough literature review (Hsu & Sandford, 2007). For the ESS systematic reviews (Mosher et al., 2020; Ramsay et al., 2023) and an extensive understanding of the literature informed the proposed scale items, which served as the first iteration of the Delphi study.

Procedure

Like a classic Delphi method, participants were asked to engage in three rounds of review and feedback after receiving ethics. Participants were given two weeks to complete each round as suggested by Delbecq and colleagues (1975). Consensus was determined *a priori* as when more than 70% of participants responding 3 or higher on a 4-point Likert scale (Hsu & Sandford, 2007). An item was modified if it did not receive this a priori consensus. If suggestions for improvement were made, items were also modified to improve clarity, even if consensus was reached in the first round.

During Round One, participants were given the proposed ESS to read in full. They were then asked to rate the clarity and relevance of each proposed item on a 4-point Likert-scale. Participants were also asked to provide comments for each item and any general comments on the scale as a whole. After participants completed Round One, responses were aggregated, and modifications were made. To begin Round Two, participants were shown the combined results of Round One and any common themes that arose in the comments. They were then asked to rate the modified items again on the same four-point Likert scale for clarity and relevance. Participants were also asked whether they felt modifications made after Round One improved the scale. Finally, open ended questions about how to improve the scale more generally and the potential uses of the finished product were added. Once again, scores were calculated, themes were discovered, and information was shared with participants. On the third and final round, participants were asked to rate any items that had still not achieved consensus on the same four-point-Likert scale for clarity and/or relevance. Open-ended questions about how to balance recall bias, participant burden, and how best to measure intensity were also included.

Results

Round One

Of the 38 items in the scale, all but 13 items achieved consensus for relevance (Table 1). Items that did not achieve consensus were not excluded from the scale; instead, participants were given a rationale in Round Two for why these items were included in the scale and then asked to rate the relevance again. The biggest concern for participants in Round One was clarity. Twenty-two items achieved consensus for clarity but only 9 were well above (more than 10% above) the 70% threshold. For this reason, every item in the scale was modified for clarity. Items were changed from short labels to question format (e.g., "Number of hours" was changed to "How many hours did you participate in practice?"). Some of the main themes of participants' comments noted the need for "more explanations of terms" or to "revise [the item] to reflect the statistics and analytical tools you wish to use". Therefore, all introduction items and instructions were modified and "select all" options were provided instead of open-ended answer blanks (e.g., select all, or Monday to Sunday, instead of 'which day did you practice?'). To shorten participant burden in Round One, only one example of the ESS was provided in each section, which left participants confused about the ability of multi-sport athletes to complete the scale. To address these concerns, a longer example of the ESS was provided in Round Two. Finally, there were questions around the intended audience and purpose of the tool, and, therefore, open-ended questions were added in Round Two to obtain information from the participants regarding who they thought the tool would be useful for.

Round Two

In Round Two (Table 2), all but one item reached consensus for relevance. However, comments suggested there were concerns around the validity of the item, not the relevance (i.e., is this the best way to measure intensity, as opposed to why are you measuring intensity). Given the importance of this item to the issue of exposure and load (i.e., it focused on the amount of 'effort' an athlete put into their training), rather than removing the item, in Round Three experts were asked how they would measure intensity. Participants reported the items were clearer in this round, with only three items not achieving consensus for clarity. Once again, items were amended based on suggestions to improve clarity. The biggest concern from participants in this round was related to participant burden, recall bias and the amount of time required to complete the scale.

Given the concerns raised by participants in Round Two, we asked open-ended questions about how to collect the information required by the scale while reducing participant burden and recall bias, in Round Three. Respondents agreed that changing the items to question format, adding definitions to the introduction, and adding "select all that apply" when applicable, improved the scale from the original version. Based on the open-ended questions, most respondents (n=10) felt the scale would be applicable for high school aged youth, and that it could capture the experiences of athletes in most sports, but that the scale could be simplified and was missing sections on time off and cross-training. Finally, participants found the reference timeframe confusing because the scale was organized by type of participation (i.e., practice, competition or play) rather than current or retrospective timing.

Round Three

The biggest change after feedback from Round Two was separating the ESS into two separate sections, one for historical participation and one for current participation. In Round 3 (Table 3), participants agreed that separating the scale into current and historical participation provided more clarity with three stating "I like this idea" and others stating, "good move" or "good idea". After the third round, all items achieved consensus for clarity. To address the concerns with validity on the item related to intensity that did not achieve consensus, we asked participants how to improve this measure. There was no consensus from respondents

on how to improve the question, but this element of exposure remained important to capture athletes' global patterns of participation, as a result, the item was retained.

In this round, we also asked additional open-ended questions to examine some of the bigger concerns participants noted with the scale. For instance, participants were concerned with recall bias, therefore we asked them for suggestions on how to collect the amount of precise data we needed while not succumbing to recall bias. Four suggested limiting the time frame in some way so that there are fewer years to complete the scale for, while three acknowledged the information was important and recall bias was an accepted limitation in retrospective data collection. Respondents were also concerned with participant burden in Round Two, four participants advised us to take advantage of online methods that can use autofill and logic to reduce the time, and two suggested providing more flexibility in which items needed to be used for each participant or research question.

The Final Scale

The three rounds resulted in a revised version of the ESS containing two sections that can be used together or separately, depending on researchers' needs. The "Historical" participation section contains 13 items that are to be repeated for each age of participation and each sport. The "Current" participation section contains 20 items to be repeated for each sport. See Appendix A for the scale's final version.

Discussion

The experts on the Delphi panel agreed the proposed items were a comprehensive, logical and reasonably accurate measure of sport exposure, establishing the preliminary validity of the scale. After experts' feedback in Round One, several changes were made to increase clarity, resulting in significant and comprehensive changes to the scale. In Round Two, consensus was achieved for both clarity and relevance on most items, indicating participants were satisfied with the individual items; however, there were still concerns about the scale. Round Three focused on gaining experts' thoughts on these larger concerns. The consistency in positive responses across the three rounds of feedback from the Delphi panel and the consensus at the end of the process provide evidence of both content and face validity. While some concerns remain (e.g., participant burden or recall bias), they do not relate to content or face validity and can only be addressed through future empirical testing.

In the final scale, all items reached consensus for clarity and relevance. However, there were differences of opinion regarding our question on intensity. There were concerns with the term used (i.e., 'intensity' - versus 'effort' or other suggestions), as well as concerns as to whether the question offered an appropriate measure of intensity. Given the key role of intensity of participation for determining an athlete's exposure or load, future research is needed to determine the most appropriate way to measure intensity of sport participation in a survey (i.e., using self-report). Future work should explore the predictive and criterion validity of the items proposed in the ESS as well, to determine their ultimate value for researchers.

Future Considerations for the ESS

Several times during the rounds of the Delphi, participants highlighted the need to collect information on supportive training activities such as strength and conditioning or cross-training activities. These types of activities are clearly important for athlete training, but after discussions amongst the research team, it was decided these would not be included for two reasons. First, an objective of the scale was to improve the precision of measurement of key aspects of specialized and diversified engagement in sport. It is difficult to capture *all* possible supportive training activities that athletes engage in (e.g., strength and conditioning or yoga) in one survey. Moreover, this would increase the participant burden significantly. Second, the scale was designed to improve our understanding of the mechanisms of positive and negative outcomes related to sport participation. Adding items related to supportive

training activities would shift the focus from isolating sport exposure as the underlying mechanism.

Other considerations pertain to practice and competition schedules not always being consistent; for example, some athletes may participate in two practices a day during some months and one practice per day during others. Moreover, the ways in which competitions are structured across a season may vary considerably between sports. While we included items in the current practice section to collect whether this was a regular week and/or how often competition occurs, we did not collect information for each week of each month of each year, which may have resulted in the loss of information regarding practice or competition amount. While capturing all variation in practice and competition may have obvious value for understanding the complexity of load management across athlete development, this level of precision is likely beyond the capacities of this type of instrument (i.e., a survey) and would be better collected using other methods (e.g., time-use diaries).

While our focus has been on overall sport exposure, future research should examine the influence of engagement in various supportive training activities to determine their association with specialization and potential negative or positive outcomes. This study represents an initial step in establishing the validity of the ESS, but further empirical testing is essential to confirm its value. The ESS can only contribute meaningfully to the discussion on sport participation if its validity and reliability are rigorously evaluated – an area where other measures of specialization and diversification have fallen short.

Conclusion

The ESS has potential value for researchers in several areas of sport science. Despite some expected limitations, this is the first scale in athlete development research that measures sport participation from an exposure perspective. By drawing items from previously validated measures and expanding on identified gaps in measurement, we proposed a comprehensive method to capture the nuances of youth sport participation. Once overall sport exposure can be more precisely and accurately measured, researchers will be better able to determine the relationships between this exposure, engagement in specialized versus diversified patterns of participation, and the effects of these participation patterns on health or development. This will advance our understanding of the mechanisms of both positive and negative effects and enhance our ability to design programs to promote or prevent these outcomes, respectively.

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A Appendix

A.1 Final version of the Exposure to Sport Scale

Note: This scale can be adjusted to account for the number of sports an athlete has participated in and the length of their historical engagement in each sport, measured in years.

The Exposure to Sport Scale: Historical

We are going to ask you a series of questions about your previous sport participation. We will be asking you about three types of participation:

Practice is *structured, coach-led, activities, designed to improve performance (e.g. basketball practice where a coach runs drills)*

Competition is *structured, coach present activities designed to test performance (e.g. tournaments, meets games, matches etc.)*

Play is *unorganized, peer-led sport activities designed for fun (e.g., pickup basketball or street hockey)*

Historical Practice

We want to understand the amount of organized sport practice you engaged in during your sport participation. *Remember, practice is structured, coach-led, activities, designed to improve performance (e.g. basketball practice where a coach runs drills)*

At what age did you begin your participation in organized sports? _____

Beginning at the above age, fill out the following section for every sport you participated in. For each subsequent year of age, up to and including your current age, complete the questions again, detailing each sport you participated in. Please, fill out every age you participated in organized sport and every sport you participated in.

Age ____

How many organized sports were you practicing in at this age_____

Sport 1 _____(e.g. Soccer)

Which months were you practicing in this sport? _____to_____(e.g., Jan to Dec)

How many days per week were you practicing? _____(e.g., 5 days/week)

How many practices did you have on average each day?_____

How many hours on average was each practice?_____

Notes to explain variation (e.g., 2-a-days for one month then 1 a day for the others)

Sport 2 _____(e.g. Basketball)

Which months were you practicing in this sport? _____to_____(e.g., Jan to Dec)

How many days per week were you practicing_____(e.g., 5 days/week)

How many practices did you have on average each day?_____

How many hours on average was each practice?_____

Notes to explain variation (e.g., 2-a-days for one month then 1 a day for the others)

…Continue for Sports 3+ as required

Historical Competition

We want to understand the amount of competition you have engaged in during your sport participation. *Remember, competition is structured, coach present activities designed to test performance (e.g. tournaments, meets games, matches etc.)*

Same as above, beginning with the first age you began participating in competitions in sport fill out the following section for every sport you participated in. For each subsequent year of age, up to and including your current age, complete the questions again, detailing each sport you were competing in. Please, fill out every age you participated in organized sport and every sport you participated in.

Age_____

Sport 1_____

What level were you competing at ?_____

Which months did you have competitions? _____to_____(e.g., Jan to Dec)

How often did you have competitions? Please choose from the options below:

Weekly Several times per month Monthly Less than once per month Once per year

Sport 2_____

Which months did you have competitions? _____to_____(e.g., Jan to Dec)

How often did you have competitions? Please choose from the options below:

Weekly Several times per month Monthly Less than once per month Once per year

…Continue for Sports 3+ as required

The Exposure to Sport Scale: Current

We are going to ask you a series of questions about your current sport participation. We will be asking you about three types of participation:

Practice is structured, coach-led, activities, designed to improve performance (e.g. basketball practice where a coach runs drills)

Competition is structured, coach present activities designed to test performance (e.g. tournaments, meets games, matches etc.)

Play is unstructured, peer-led sport activities designed for fun (e.g. pickup basketball or street hockey)

Current Practice

Think about more recent practice experiences you've had. *Remember, practice is structured, coach-led, activities, designed to improve performance (e.g. basketball practice where a coach runs drills)*

The following section refers to structured sport practices in the past 7 days. If you are currently playing multiple sports, please fill it out for each sport.

Sport 1 _____

Which days did you participate in this sport? _____(e.g., Monday to Sunday)

How many organized practices of this sport did you have per day?_____

How many hours on average was each practice of this sport? _____

How many hours total of structured practice did you do in this sport? _____

Is this a typical training week for you (select one) Yes /No

If 'No', was this week less or more than a typical week ? Less / More

Think of 100% as the most physical intensity you have ever put into any activity and think of 0% as no physical intensity

Rate your average physical intensity during practices in this sport over the past 7 days from 0% to 100%: _____%

Sport 2_____

Which days did you participate in this sport? Select all that apply (Monday to Sunday)

How many organized practices of this sport did you have per day?_____

How many hours on average was each practice of this sport? _____

How many hours total of structured practice did you do in this sport? _____

Is this a typical training week for you (select one) Yes /No

If 'No', was this week less or more than a typical week ? Less / More

Think of 100% as the most physical intensity you have ever put into any activity and think of 0% as no physical intensity

Rate your average physical intensity during practices in this sport over the past 7 days from 0% to 100%: _____%

...*Continue for Sports 3+ as required*

Current Competition

Now focus on your competitions in the past 7 days. *Remember, competition is structured, coach present activities designed to test performance (e.g. tournaments, meets games, matches etc.)*

Sport 1: _____

What level are you competing at?_____

How many tournaments/meets/competitions did you have in this sport in the last 7 days ?_____

Which days were your competitions in this sport? _____(e.g., Saturday to Sunday)

How many games, matches, races, or events did you participate in? _____

How much time on average were you actively competing? (e.g. playing time)_____

Think of 100% as the most physical intensity you have ever put into any activity and think of 0% as no physical intensity

Rate your average physical intensity during competitions in this sport over the past 7 days from 0% to 100%: _____%

Sport 2_____

What level are you competing at ?_____

How many tournaments/meets/competitions did you have in this sport in the last 7 days ?_____

Which days were your competitions in this sport? _____(e.g., Saturday to Sunday)

How many games, matches, races, or events did you participate in? _____

How much time on average were you actively competing? (e.g. playing time)_____

Think of 100% as the most physical intensity you have ever put into any activity and think of 0% as no physical intensity

Rate your average physical intensity during competitions in this sport over the past 7 days from 0% to 100%: _____%

…Continue for Sports 3+ as required

Current Play

Finally, I want you to focus on your participation in sport play in the past 7 days. Play is *unstructured, peer-led sport activities designed for fun (e.g. pickup basketball or street hockey)*

Sport 1 _____

Which days did you play this sport: _____ (e., Monday to Sunday)

How many hours did you play on average each day ?_____

How many total hours of this sport did you play in the past 7 days ?_____

Think of 100% as the most physical intensity you have ever put into any activity and think of 0% as no physical intensity

Rate your average physical intensity during play in this sport over the past 7 days from 0% to 100%: _____%

Sport 2 _____

Which days did you play this sport: _____ (e., Monday to Sunday)

How many hours did you play on average each day ?_____

How many total hours of this sport did you play in the past 7 days ?_____

Think of 100% as the most physical intensity you have ever put into any activity and think of 0% as no physical intensity

Rate your average physical intensity during play in this sport over the past 7 days from 0% to 100%: _____%

…Continue for Sports 3+ as required

Table 1

Round One scores for each item.

Item	% Clear or Very Clear (median score)	% Relevant or Very Relevant (median score)
Historical practice intro sentence	42.1% (2.0)	89.4% (4.0)
Number of total sports you were doing at this age	36.9% (2.0)	94.7% (4.0)
Sport 1	79.0% (3.5)	89.5% (4.0)
Level competed	5.3%(2.0)	84.2% (3.0)
Number of months per year	69.5% (3.0)	89.5% (4.0)
Specific months (e.g. March to June)	73.7% (3.0)	63.2% (3.5)
Number of sessions per day	52.7% (3.0)	68.5% (3.0)
Number of hours per session	**89.5% (3.0)**	84.2% (4.0)
Current practice intro sentence	78.9% (3.0)	73.6% (3.0)
Sport 1	73.7% (3.5)	84.2% (4.0)
Specific days (e.g. Monday and Wednesday)	**100%(4.0)**	52.6% (3.0)
Number of hours total	78.9% (3.0)	84.2% (4.0)
Number of sessions per day	**84.2% (3.0)**	79.0% (3.0)
Number of hours per session	**84.2% (3.0)**	73.7% (3.5)
Is this a typical training week for you: Y/N	**100.0%(4.0)**	79.0% (3.5)
If you answered “No” what’s the different about this week	**84.2% (3.0)**	84.2% (3.5)
Think of the most effortful activity you have ever done, this is 100%. Think of an activity where the effort level is non-existent this is 0%	52.7% (3.0)	52.6% (3.0)
Rate your effort during practice this past week from 0% to 100%	79.0% (3.0)	47.4% (3.0)
Comp intro	57.9% (3.0)	89.4% (4.0)
Sport 1	73.7% (3.5)	84.2% (4.0)
How many months were you in competition	79.0% (3.0)	84.2% (3.0)
In what months did you have competitions (e.g. March to June)	**84.2% (3.0)**	63.2% (3.0)
How often do you have competitions: weekly/Monthly/Less than one a month/once every so often	47.4% (3.0)	84.2% (3.0)
Comp current intro	78.9% (3.0)	84.2% (3.0)

Item	% Clear or Very Clear (median score)	% Relevant or Very Relevant (median score)
Sport 1	73.7% (3.5)	78.9% (4.0)
Number of competitions	68.5% (3.0)	79.0% (4.0)
Specific days (e.g. Saturday and Sunday)	**89.5% (3.5)**	57.9% (3.0)
Number of event/matches per competition	52.6% (3.0)	73.7% (3.0)
Average time of event/match	73.7% (3.0)	68.5% (3.0)
Average time actively competing (e.g. playing time)	68.4% (3.0)	79.0% (3.0)
Think of the most effortful activity you have ever done, this is 100%. Think of an activity where the effort level is non-existent this is 0%	63.1% (3.0)	63.1% (3.0)
Rate your effort during competitions this past week from 0% to 100%	63.2% (3.0)	63.2% (3.0)
Play intro	**84.2% (3.0)**	89.5% (4.0)
Sport 1	63.2% (3.0)	79.0% (3.5)
Number of hours per day	68.4% (3.0)	79.0% (3.5)
Specific days (e.g. ,Monday)	78.9% (3.0)	52.7% (3.0)
Think of the most effortful activity you have ever done, this is 100%. Think of an activity where the effort level is non-existent this is 0%	57.9% (3.0)	63.1% (3.0)
Rate your effort during play this past week from 0% to 100%	73.7% (3.0)	68.4% (3.0)

Bolded values indicate items more than 10% above the 70% threshold

Table 2

Round Two scores for each item

Item	% Clear or Very Clear (median)	% Relevant or Very Relevant (median)	% Agree-Improved Scale
Defining practice, competition and play			88.9
New instructions	66.6 (3.0)		61.1
Use “select all that apply”			94.4
Word items as a question			94.4
How many organized sports were you practicing in at this age?___	94.5 (3.0)		

Item	% Clear or Very Clear (median)	% Relevant or Very Relevant (median)	% Agree-Improved Scale
Which months were you practicing in this sport? Select all that apply (Jan to Dec)	100 (4.0)	94.4 (3.0)	
How many practices did you have on average each day?_____	94.4 (3.0)		
How many hours on average was each practice?_____	100 (4.0)		
Let's shift to more recent practice experiences you've had. The following section refers to organized sport practices in the last 7 days. Once again, if you are currently playing multiple sports, please fill it out for each sport.	94.4 (4.0)		
Which days did you participate in this sport? Select all that apply (Monday to Sunday)	94.4 (4.0)	77.8 (3.0)	
How many organized practices of this sport did you have per day?	94.5 (4.0)	88.9 (3.0)	
How many hours on average was each practice of this sport? _____	94.4 (4.0)		
How many hours of organized practice total did you do in this sport? _____	77.8 (3.0)		
If you answered "No" was this week less or more than a typical week ?Less / More	83.3(3.0)		
Think of 100% as the most effort you have ever put into an activity and 0% as no effort at all	88.9 (3.0)		

Item	% Clear or Very Clear (median)	% Relevant or Very Relevant (median)	% Agree-Improved Scale
Rate your average effort during practice in this sport this past 7 days from 100% to 0%*	77.8 (3.0)	66.6 (3.0)	
We want to understand the amount of organized sport competition (e.g. games, meets, tournaments, matches, etc.) you have engaged in during your sport participation. Same as above, complete the questions for every age from when you began competing up to and including now. Again, please answer for each sport at that age as well.	77.8 (3.0)		
Level competed:(Select one) Recreational or Competitive	55.6 (3.0)		
How often did you have competitions? Weekly/ Several times per month/Monthly/Less than once per month/Once per year	83.3 (3.0)		
How many competitions did you have in this sport in the last 7 days?(e.g. tournaments or meets) ___	88.9 (3.0)		
How many games, matches, races, or events were in each competition in this sport?	55.6 (3.0)		
Finally, I want you to focus on your participation in unorganized youth-led sport play (e.g., pick-up basketball or street hockey) in the past 7 days:	83.4 (3.0)		
How many hours on average was each event/ match?_____		72.3 (3.0)	

*This item did not reach consensus, but was retained as it was important to capture athletes' global patterns of participation

Table 3

Round Three scores for each item that had not achieved consensus.

Item	% Clear or Very Clear (median)	% Relevant or Very Relevant (median)
New instructions	94.1 (3)	
What level were you competing at?	76.5 (3)	
How many games, matches, races, or events were in each competition in this sport?		Item removed
Rate your average effort during practice in this sport this past 7 days from 100% to 0%:		Open-ended question asked*

* There was no consensus from respondents on how to improve the question; however, this item remained important to capture athletes' sport participation and was, therefore, retained