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An exploration of stakeholder perceptions to inform the development of an evidence-based classification system in para dressage

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ABSTRACT

In dressage, horse-rider combinations must demonstrate harmony whilst performing a test of gaits and movements, scored by judge(s) using predetermined criteria. The para dressage governing body is working towards compliance with the International Paralympic Committee's mandate for evidence-based classification, which requires a comprehensive understanding of key performance determinants. This study aimed to explore stakeholder perceptions surrounding the key determinants of, and impact of impairment on, para dressage performance. Semi-structured interviews with 30 para dressage stakeholders (athletes, classifiers, judges, coach) were analysed using the Framework method. Themes relating to the equine and human athlete were associated with overall dressage performance and discussed within the context of impairment and horse-rider partnership. Key performance determinants were summarised as the athlete's ability to maintain dynamic postural control for absorbing the horse's movement and coordinating leg, hand, and seat aids, which directly influence the horse's quality and accuracy of movements during dressage. Thus, muscular coordination, joint mobility that influences rider posture, and personality traits that influence the horse-rider partnership were considered performance determinants. These themes will inform the development of an evidence-based classification system, through the establishment of standardised, sport-specific performance measures for assessing the relationship between impairment and activity limitation in para dressage.

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Paralympic; performance; physical impairment; rider; equine

Introduction

The sport of para dressage

Para dressage is a Paralympic sport where athletes with eligible physical and visual impairments compete in the equestrian discipline of dressage. Dressage, a French term, refers to the ultimate expression of the horse's training (FEI, 2020a), demonstrated as a harmonious relationship between horse and rider and the horse's willingness to perform. In a dressage competition, horse-rider combinations perform a test, consisting of a series of predetermined gaits and movements that are evaluated by a judge(s), using predefined scoring criteria. Scores are awarded for the horse's performance of specified movements, and a final percentage score is calculated to determine competition placings.

Para dressage became recognised as a Paralympic sport in 1996 (Dashper, 2010; FEI (Fédération Equestre Internationale), 2020c; De Haan, 2015; De Hann & Winfield, 2008) and remains the only Paralympic equestrian discipline. In 2006, the Fédération Equestre Internationale (FEI) became the governing body for para dressage (Dashper, 2010; FEI (Fédération Equestre Internationale), 2020c; De Haan, 2015; De Hann & Winfield, 2008) and is therefore responsible for the development and regulation of the sport-specific classification system, which groups athletes into sports classes based on the impact of their impairment on sports performance. According to the

International Paralympic Committee (IPC), classification aims to create equitable competition by grouping together athletes with similar degrees of "activity limitations" resulting from an impairment(s) (IPC (International Paralympic Committee), 2015a, IPC (International Paralympic Committee), 2020a; Tweedy & Vanlandewijck, 2011).

In para dressage, athletes are classified across five sports classes, referred to as grades. Grade 1 includes athletes with the most severe activity limitations, with higher grades including athletes with less severe activity limitations (IPC (International Paralympic Committee), 2020b, IPC (International Paralympic Committee), 2015b, and FEI (Fédération Equestre Internationale), 2020d). The level of difficulty of dressage tests is relative to the allocated grade (IPC (International Paralympic Committee), 2020b) with difficulty defined by the gaits and movements that athletes are required to execute. For example, Grade 1 athletes compete tests in only walk, while grade 5 athletes compete in tests that include walk, trot, and canter gaits.

Prior to the 2004 Paralympic Games in Athens, all para dressage athletes competed on "borrowed" horses, or horses provided for the purposes of competition, with the athlete having no previous experience riding the horse (De Haan, 2015; De Hann & Winfield, 2008). Borrowed horses were selected based on their abilities in able-bodied dressage and the individual needs or grade of the para athlete (De Haan,

2015; De Hann & Winfield, 2008). This was largely related to promoting inclusivity for para athletes or nations with limited resources for sourcing, providing, or transporting horses for competition (De Haan, 2015; De Hann & Winfield, 2008). However, as the sport matured, the trend for athletes competing on their own horses became more common and is now the norm in para dressage.

Classification in para dressage

The classification system for para dressage was introduced prior to its inclusion in the 1996 Paralympic Games. It was, and still is, based on the Meaden Profile System, developed in the early 1990's by Dr Christine Meaden to provide a standard method for illustrating and describing functional profiles, based on impairment for sports classification (FEI (Fédération Equestre Internationale), 2020d; Meaden, 1991). There are nine eligible impairments for para dressage: impaired muscle power, impaired passive range of movement, limb deficiency, leg length difference, short stature, hypertonia, ataxia, athetosis, and visual impairment (FEI (Fédération Equestre Internationale), 2020d; IPC (International Paralympic Committee), 2015a). The current FEI classification system includes a physical assessment of eligible impairments and an observation assessment to evaluate the athlete during riding. Physical assessment of an athlete's impairment is mainly conducted in a seated position (to reflect a riding position) using tests of balance, coordination, joint range of motion and muscle power, each of which are scored using predefined criteria. These scores provide a basis for allocating a functional profile from the Meaden Profiling system, which is then used to determine an athlete's grade for competition.

In 2015, the IPC published the updated Classification Code, which mandated the development of evidence-based systems of classification across all Paralympic sports (IPC (International Paralympic Committee), 2015b; Tweedy & Vanlandewijck, 2011). An evidence-based classification system must exhibit transparent and defensible methods for classifying eligible impairments according to the extent of activity limitation caused (Tweedy et al., 2014, 2016; Tweedy & Vanlandewijck, 2011). The current para dressage classification system focusses on the assessment of impairment, but, as with many other Paralympic sports, the system requires greater emphasis on objective measures that quantify the extent of activity limitation caused (FEI (Fédération Equestre Internationale), 2017). In recognition of this and the need to comply with the IPC's Classification Code, the FEI is, like many Paralympic sports, currently prioritising the development of a strong scientific evidence base for its classification system.

Development of an evidenced-based system for para dressage

Revision of the current para dressage classification system requires an empirical examination of the relative strength of association between impairment and activity limitation, defined using standardised, sport-specific measures of performance (Tweedy et al., 2014, 2016; Tweedy & Vanlandewijck, 2011). As a first step in developing sport-specific performance

measures, a comprehensive understanding of the key activities that an athlete must perform, as well as the factors that facilitate elite performance of these activities is required (Tweedy et al., 2016). Defining key performance determinants for dressage is particularly complex given the unique consideration of both an equine and human athlete, each with differing performance requirements, but working together to achieve higher dressage scores. This was addressed for the sport of dressage in a recent scoping review by Hobbs et al. (2020), which identified, from the scientific literature, objective measurements of horse performance and the functional abilities of the rider that can predict elite performance. These principally include trunk and pelvic posture and coordination measures that quantify horse-rider harmony when performing walk, trot, and canter gaits (Hobbs et al., 2020). It is important to note that these objective measurements are generally complex, requiring costly specialist equipment and training to collect, analyse and interpret the data, which has implications for their translation from research to the practical assessment of para athletes.

The performance measures defined by Hobbs et al. (2020) represent a foundation for systematically understanding factors that are most important for elite performance in dressage. However, findings from Hobbs et al. (2020) confirm that the assessment of performance in dressage is complex due to the unique consideration of including both horse and rider performance, which does not lend itself to the definition of a single, quantifiable performance determinant. To refine key determinants of performance, Tweedy et al. (2016) state that qualitative methods can be invaluable for obtaining athlete and stakeholder input, as well as for developing valid, standardised, and safe measures of performance.

Dashper (2010) claims that the experiences of para athletes are unexplainably absent from research on disability, sport, and leisure, with very few studies examining classification processes from the perspectives of para stakeholders. The opinions and experiences of stakeholders regarding the classification systems for wheelchair basketball and para swimming have been explored using surveys and interviews, respectively (Dornick & Spencer, 2020; Molik et al., 2017). In both studies, stakeholders suggested improvements for classification systems and advocated their inclusion in processes to evaluate, and potentially modify, classification systems (Dornick & Spencer, 2020; Molik et al., 2017). In accordance with the IPC's Classification Code (IPC (International Paralympic Committee), 2015b), the FEI also mandates that "athlete input is solicited to assist in research and improvement in classification systems for para equestrian sport" (FEI (Fédération Equestre Internationale), 2017). However, no known studies have explored these themes in relation to para dressage classification.

Purpose of the study

The aim of this study was to explore the opinions and experiences of para dressage stakeholders in relation to perceived key determinants of, and impact of impairment on, sports performance in para dressage. Semi-structured interviews were conducted to fulfil the following study objectives

- (1) To explore the perceived key determinants of performance for both the horse and human athlete in para dressage and the level of agreement between these findings and Hobbs et al. (2020);
- (2) To explore the perceived impact of impairment on key performance determinants in para dressage.

Methods

Ethical approval for the study was obtained through the University of Central Lancashire's ethics committee (approval reference: STEMH 910).

Research methodology

A qualitative semi-structured interview approach was employed to assess the views of participants and to ensure that the aims of the study were achieved, whilst allowing participants to raise unexpected experiences or opinions (Flick, 2009; Silverman, 2011). An inductive approach using the Framework method (Ritchie & Spencer, 1994) was employed to analyse interview data, as it lends itself to research with *a priori* objectives that are informed by existing knowledge and/or the information requirements of a funding body (Pope, Ziebland, and Mays 2000; Ritchie & Spencer, 1994). Furthermore, the systematic nature of the analytical process and the structured outputs of summarised data, allows the findings to be accessible and transparent to other researchers and external stakeholders (Pope, Ziebland, and Mays 2000; Gale et al., 2013; Smith & Firth, 2011).

Interviews were conducted by (LSG), a researcher with a background in equine science and biomechanics and over 20 years horse riding experience. As an able-bodied person, the researcher's personal experiences with para dressage were limited. However, as part of the wider research project, the researcher had familiarised herself with stakeholders and current affairs within the sport. Thus, the researcher's academic and equestrian experience allowed her to build rapport and encourage fluent conversations with participants through mutual understanding of equestrian sport. The interpretation of data was positively influenced by the researcher's deep understanding of equestrian language and theory and lack of personal involvement in para dressage.

Participants

Thirty participants were recruited for the study using a maximum variation purposive sampling strategy (Patton, 2014). An international sample of para dressage stakeholders aged 18 years or older, with varying roles and experience within para dressage were targeted to ensure multiple perspectives were obtained. Participants were recruited through the FEI, who distributed information about the study to all national equestrian federations for dissemination to stakeholders via email. Details of the study and a call for participants was also included during a presentation on the larger research project, which was delivered by one of the researchers (LSG) at the FEI-hosted Para Equestrian Forum in May 2019 (FEI (Fédération Equestre Internationale), 2019). Participants

expressed interest in the study verbally (in person at the Para Equestrian Forum) or via email and were then contacted by the researcher to arrange the interview. Written or verbal informed consent were obtained from all participants prior to interviews.

Participant demographics are presented in Supplemental Table S1. Female athletes are known to dominate para dressage (De Haan, 2015) and the gender ratio of our sample reflected this (66.6% female, $n = 10$: 33.3% male, $n = 5$) and was consistent with the gender ratio of all currently FEI-classified para athletes (approx. 80.6% female, 19.4% male) (FEI (Fédération Equestre Internationale), 2020b). Athletes ($n = 15$) across all five grades with various eligible impairments, took part in the study. The sample included multiple medallists and representatives at the Paralympic Games, World Equestrian Games and European Championships, as well as fully qualified and trainee international and national Classifiers ($n = 11$), a para dressage coach ($n = 1$), and 5* judges ($n = 3$) for both dressage and para dressage. Thus, the proportions and variation in characteristics within our sample roughly reflects the international para dressage population.

Data collection

Interview schedule

Interview schedules were developed through discussions between four of the researchers (LSG, CT, SJH, RS) and shaped by the aims and objectives of the research and pre-existing literature describing the requirements for an evidence-based classification system (Tweedy et al., 2014, 2016; Tweedy & Vanlandewijck, 2011) and horse and rider performance determinants for dressage (Hobbs et al., 2020). Each researcher had equestrian experience and brought this knowledge to discussions and critical assessments of each question. A final iteration of the interview schedule is available in Supplement 2.

Pilot interviews

The interview schedule was piloted by conducting telephone interviews with a dressage judge, a classifier and a coach. Participants were asked to provide feedback on the wording of questions and their potential to fulfil the aims of the study, whilst promoting free flowing dialogue. Pilot study feedback did not necessitate any changes to the interview schedule. Thus, the final iteration of the interview schedule and pilot study data were brought forward for use in the main study.

Interview protocol

Interviews were conducted between May and October 2019. Four interviews were conducted in person at the FEI's Para Equestrian Forum in May 2019 at the participants' request. All other interviews were conducted via telephone. Interviews were digitally recorded using an encrypted digital voice recorder and transcribed verbatim following written or verbal consent from each participant. Prior to recording the interview, participants were introduced to the researcher, briefed on the purposes of the research, the expected interview duration, the anonymity of their data and their rights to withdraw from the

study. Interviews concluded with the opportunity for the participant to share anything they felt was important that had not been covered by the interview questions.

Data analysis

Data analysis was conducted in accordance with the Framework method, described by Ritchie and Spencer (1994). Following familiarisation with the transcripts, a thematic framework/coding strategy was developed, where the first few transcripts were initially coded. During this initial coding, *a priori* study objectives and interview topics were employed as “overarching categories” (Gale et al., 2013), with the narratives of participants being used to develop codes within each category. The process was repeated until no new codes were generated and the final thematic framework/coding strategy was agreed between three researchers (LSG, CT, SJH). In the indexing stage, the finalised thematic framework/coding strategy was systematically applied to all remaining transcripts by one researcher (LSG) using qualitative data analysis software (NVivo Version 12, QSR International). In the charting stage, a matrix was created for each overarching category and transcript/participant by collating and summarising the underlying codes. Finally, the matrices were used to guide interpretation of the data set, where connections between codes and participant responses were examined in relation to the original objectives and inductively derived concepts and issues. From here, codes were grouped to develop themes within each overarching category.

Results

Key determinants of performance in para dressage: the equine athlete

When asked about the impact of the horse on overall performance in dressage, participants described the horse as having an important influence on dressage scores, with one participant describing the horse as the highest predictor of performance.

Val, athlete The way the horse moved and was ridden in became the highest predictor of the results. Of course, the athlete had to ride the horse and be accurate or relatively accurate, but the gaits of the horse was the highest predictor.

Participants discussed how a judge will focus mainly on the horse’s performance during a test, with an emphasis on the quality of the horse’s gaits and the accuracy of movements. Many participants provided examples of how a skilled athlete, partnered with a horse with “average” movement will generally achieve lower scores than an equivalent, or less-skilled athlete partnered with a horse with naturally higher quality movement and accuracy.

Emily, classifier: The judges are scoring the horse’s movement, the horse’s cadence, the horse’s elasticity, the horse’s way, if the horse doesn’t have that to start with then you are not going to score as well as someone who is riding one that day, even before you add in your skill and your ability.

All participants described the horse as having some influence on overall dressage performance. However, many also highlighted the importance of the horse-rider partnership and rider ability as being of similar, or equal importance, for overall performance in para dressage.

Molly, athlete: The most talented rider could be on the least talented horse and they are probably not going to win. But the most talented horse could be sat on by not the best rider. I would say it is a pretty much 50:50 partnership, between getting the right rider with the right horse that could do well. In Rio I certainly wasn’t on the most talented horse, but our partnership made us really strong and therefore that was why we did so well. So yes, it is a tough one. I would say probably 60% rider 40% horse or 50:50.

Thus, participants described the important contributions that both equine and human athlete, as well as the horse-rider partnership, make to overall performance in para dressage. This is an important finding to consider from the outset, as it provides stakeholder justification for the relative importance of both the equine and human athlete for para dressage performance. With this established, participants described perceived abilities or characteristics of equine athletes, which were essential for achieving higher dressage scores. Equine gait and movement quality and character and temperament represented the main themes within the overarching category of equine performance determinants and are described in detail below.

Equine gait and movement quality

The quality of a horse’s gait was described by participants, and subsequently coded according to an internationally recognised training scale (FEI (Fédération Equestre Internationale), 2007) that includes the qualities of rhythm, relaxation/suppleness, connection, impulsion/forwardness, straightness/symmetry, and collection. These codes, as well as “inherent gait and movement quality” were grouped to form the theme of equine gait and movement quality. As in able-bodied dressage, horses are scored according to their ability to show they have achieved each component of the training scale (FEI (Fédération Equestre Internationale), 2007). This was deemed a key performance determinant for the equine athlete.

Cathy, classifier: What you are looking for in dressage is that impulsion, they have to have the movement with the submission. I think especially for the para horses, you need horses that are a little bit more rideable but still have the gaits and the submission, the impulsion component, so you know so you are still looking at same as able-bodied in terms of the gait quality.

Hayley, judge: We follow in para dressage the training scale, and that is most important in dressage. The first thing is the regularity in the rhythm, that should be 100% clear in the 3 gaits of the horse. So, if a horse does miss one of those clear gaits that will influence the performance.

Interestingly, many participants focussed on the horse's quality of movement in relation to the importance of its suitability for the para athlete's impairment, activity limitation, and grade to ensure safety and the development of the horse-rider partnership.

Janet, classifier: If the horse moves smoothly then the rider has a chance for their sensory system to work well and for the coordination system to work well. If the horse has a very high movement, so it is a lot of up and down or side to side, then the rider is going to require much better balance, much better coordination and strength to stay onboard, and to actually give the correct aids, so the horse's movement does affect the rider a lot.

Athletes often described their specific preferences for equine movement to fulfil quality movement criteria described above, whilst being suitable for their impairment and activity limitation. For example, certain equine movement traits are described as aiding the athlete to develop connection, forwardness/impulsion, and straightness:

Addie, athlete: I like a horse that is really uphill and kind of has that neck, because I have weakness in my hand and core instability, so I can't spend a lot of time and energy trying to muscle a horse on the bit. Personally, because of the one-sidedness, I prefer a horse that is a little more forward because the further behind the leg they get, the more crooked the horse gets, and deeper and deeper into the hole we go.

Cheryl, classifier: A person that hasn't got that ability to drive the horse because of their impairments, then you want a horse that is quite naturally going forward, but at the same time you don't want a horse that is running away with them. And, our riders in the lower grades, the way the system is setup, they need a horse with a really good walk, they need a horse that doesn't take a lot of effort to keep moving.

Quality of movement was also often discussed within the context of modern para dressage, with the increased calibre of horses and subsequent movement quality becoming more apparent as the sport matures. Thus, the selection of horses for the sport has changed, with participants describing a focus on horses with gait qualities like those in able-bodied dressage. However, participants stated that this increase in gait quality, which is often associated with more exaggerated or dramatic movement, should not come at the expense of safety or suitability for a para athlete's impairment and grade.

Pam, athlete: Para dressage is one of the quickest evolving sports in the world. You know, if I look back, I started my first para competition was in 2002 and they were just coming out of borrowed horse competitions. If I look 17 years later, the amount of change is exponential. You have got horses now competing in the paras that the able-bodied riders would want.

Emily, classifier: There is a very close balance between getting an amazing horse, that will get good scores and not being too much for the rider to manage, and there is a real delicate balance there nowadays.

Equine character and temperament

Nearly all participants described the importance of horses having a suitable character and temperament for para dressage, which was often described as being equally, if not more, important than movement for optimal performance.

Ian, athlete: I would say that for lower grades, the temperament is one of the most important skills the horse needs, apart from the gait. In some lower grades the horse only has to walk. In others only walk and trot. The gait may be important, but I think temperament is most important.

Desirable characteristics were intelligence, a good work ethic, self-confidence, bravery, and a calm disposition. The most commonly described trait was the horse's ability to adapt and cope with the athlete's impairment/activity limitation and subsequent riding style/technique. For example: the horse must have the desired character traits to be trained to respond to differing aids, which are tailored to the athlete's impairment:

Jodie, athlete: You can't give the aids as a normal rider, so you have to find a way to say to the horse what you want to do, and it is to understand. That's often a problem, so we need intelligent horses. That's the biggest point, I think. A horse that wants to work with you and is intelligent enough to know what you mean, and to not be afraid.

Horses need to tolerate involuntary movements and to distinguish these from a true riding aid:

Cheryl, classifier: This is where you really do have to pick the right horse because if you have a rider with a significant spasm in their leg and their legs sort of way behind the girth, and spasming against the horse's side, you have got to have a pretty good horse that can tolerate and not react to that inappropriately.

Thus, the ability of a horse to perform in para dressage is largely related to its character, specifically its ability to adapt to an impaired athlete, especially in the lower grades. Both equine performance themes highlight how the impacts of impairment, activity limitation and grade are considered by stakeholders when describing determinants of equine performance for para dressage.

Key determinants of, and the impact of impairment on, human athlete performance in para dressage

When asked about the most relevant functional abilities or skills required to produce better dressage performance in the horse, participant responses were coded using balance, core stability, horse-rider coordination/harmony, rider coordination, muscle power, symmetry, joint mobility, and talent and personality. Balance and core stability were often discussed interchangeably and in relation to symmetry and rider coordination. Each of these codes were generally described in relation to developing dynamic postural control for maintaining horse-rider coordination and were thus combined to form a theme. Muscle power, joint mobility for riding and inherent talent or rider personality were more commonly described in isolation and thus formed their own themes. In accordance with equine performance determinants, the impacts of impairment, activity limitation and grade were generally discussed within the context of each theme for the human athlete and are therefore presented accordingly below.

Dynamic postural control for maintaining harmony between horse-rider movement

Horse-rider coordination, namely the ability for the rider to move the pelvis in synchrony with the horse's back while the trunk and limbs move independently of the pelvis, was believed to be closely linked to balance, core stability, rider coordination and symmetry. These codes were generally described as most important for producing better dressage performance in the horse. Stakeholders believed that the horse's ability to move freely and with impulsion was strongly influenced by the athlete's ability to independently coordinate different body segments, to balance and absorb the horse's movement. Thus, the athlete's dynamic postural control was strongly related to the development of a partnership between the horse and athlete.

Molly, athlete: The ability to move with the movement of the horse, I think that's a big bonus, something I wish I had. I think especially in the trot, because that is quite a difficult movement to sit to, and so the ability to be able to move the pelvis and the trunk with the movement of the horse definitely would aid bigger stride and a better quality of movement.

In the equestrian world, these abilities are often referred to as the elusive "feel" or "harmony between horse and rider", where the rider is able to continuously respond to the sensory input from the horse in a coordinated manner that positively influences the horse's movements. Many para dressage athletes have impairments that affect their extremities, but maintain a functioning pelvis and/or trunk, which enables them to follow the horse's movement through their pelvis, whilst maintaining a balanced and independent trunk. Thus, athletes with activity limitations that affect the trunk and pelvis generally compete in lower grades (FEI (Fédération Equestre Internationale), 2020d). This theme was often discussed within the context of the athlete's impairment and activity limitation and the subsequent influence on the horse's performance and overall dressage scores.

Anna, athlete: It [the impairment] definitely affects the movement of my horse in the sense that because I don't have much pelvic control, I tend to give her wrong signals that inhibit her forward momentum. So that affects the score.

Symmetry and athlete coordination were generally discussed as being related to balance and core stability. Core stability was described as aiding the athlete's symmetry, as described by Paul in the quote below. An athlete's ability to absorb the dynamic movement of the horse, whilst remaining balanced, symmetrical, and centred, was also often associated with the ability to coordinate effective hand and leg aids. Thus, the ability to move the limbs independently from the base of support, was associated with their ability to coordinate the effective timing and amplitude of aids provided to the horse, which was linked to better accuracy and performance during a dressage test. Athletes with this ability were also described as being more competent riding a variety of horses, as they tend to remain more balanced, which can influence not only the horse's performance, but it's confidence in the rider.

Paul, coach: You only need 3 things to ride a horse. A head, a symmetrical trunk, and something to sit on. The symmetry of the trunk is the core stability, and symmetry of the trunk is very important and if you have neurological asymmetry due to a head injury or whatever or cerebral palsy, anything that makes somebody neurologically asymmetric really affects movement, balance and the way I teach everything must be rhythmical, straight and in balance. If you have got those three things, you can ride without legs.

Melinda, classifier: The core control stuff, which is a mixture of muscle and proprioception, knowing where you are in space, and then to be able to do movements outside the midline. So, because the horse is doing a hundred beats a minute at a walk, your body has to be able to take that movement up, because otherwise you are going to struggle with your leg and your hand aids.

Dynamic postural control, achieved largely through core stability, balance and ability to coordinate isolated movements on a dynamic surface, was deemed the most important determinant of performance for maintaining harmony between the horse and rider. Overall, this theme was described as the most important determinant of athlete performance for the sport of para dressage, as it influenced the quality and accuracy of the horse's movement, which were established as having the greatest impact on scores.

Muscle power

The perceptions surrounding muscle power as a key determinant of athlete performance varied, but the consensus was that the generation of maximal force, or muscle strength, was less important when compared to other determinants like balance or coordination. Instead, the importance of muscle power (the rate at which muscular force is generated/applied), as a determinant of rider performance, was related to coordinating the timing, sequencing and duration of muscular contraction, as well as grading the amount and rate of muscular force developed to provide an aid and/or maintain dynamic postural control.

Cathy, classifier: As a rider, we think about strength, we think about range, we think about those kind of things but I don't think that those are quite as important as being able to do more of that fine-tuned coordination in terms of grading your muscle strength. So, controlling the timing and sequencing of the strength you are applying if that makes sense. I think it is more of that isometric strength, rather than that concentric and eccentric kind of control. I think it is more about stabilising strength and being able to keep that kind of static muscle contraction for a prolonged period, especially for dressage.

As with all performance determinant themes, the importance of muscle power was related to the athlete's specific impairment, activity limitation and the type of horse/horse-rider partnership. Irrespective of the impairment, underlying overall physical strength and the ability to generate muscle power in the trunk and pelvis was deemed important, with hip abductor, shoulder rotator cuff, lumbar and abdominal muscles specifically highlighted by some participants. The importance of leg power was strongly related to the type of impairment and whether the horse-rider partnership included

a horse with a forward-going nature or sensitivity to leg aids, while arm power was generally deemed to be less important across impairments.

Ken, athlete: Less important will be your hands and your arms. So, you don't really need to have strength there if you have a good seat and you have good back and legs that are reacting well, and you can of course have less in your hands and the horse will be reacting better. So of course, when you talk about the para riders, like for me now I have not so much strength on the under leg, but the horse still can understand when for example, I put my leg back, and for flying change for example. I don't need to press there so hard, but he can understand. But also, it is about the relation that I have with my seat and my back and how I hold the horse there with my seat and my back.

Joint mobility for riding

Joint mobility represented the theme that was the least frequently discussed in relation to rider performance. Interestingly, it was discussed only by classifiers. The importance of joint mobility for riding was generally related to the athlete's ability to adopt a proper riding position in the saddle. Thus, joint mobility was considered fundamental for riding, but not necessarily in relation to its impact on performance. Joint mobility in the arms and legs were deemed to be of equal importance, with hip, knee, and shoulder mobility specifically cited. Shoulder girdle, pelvis, and thoracic spine mobility were highlighted as areas requiring further attention in classification due to their roles in providing subtle rein aids and absorbing the movement of the horse.

Janet, classifier: If you have got increased muscle tone in the legs you would tend to have reduced range of movement at the hips, knees and ankles, so it might be very difficult for the person to sit comfortably on the horse, until they have relaxed into the position. So, they might be sitting in a slightly backward, the seat might be slightly backward because they can't abduct their hips as much.

Inherent talent and personality

As with the equine athlete, personality and talent were deemed important traits for performance in human athletes. Participants described athletes as being confident, calm, positive, determined, brave, passionate, and focussed, with an ability to concentrate on their performance. Interestingly, in contrast to the horse, these personality traits were not linked to an athlete's impairment or activity limitation in the sport, rather they were not considered different to the traits of an able-bodied athlete.

Caroline, judge Whether it's the able-bodied or para rider, I think the basis is exactly the same. You need passion, you need discipline, you need a feel and a symbiosis with the horse that you are riding.

An athlete's talent was generally described as an elusive "feel", often used by equestrians and described above. This is described well by Cathy, a classifier:

Cathy, classifier Some never seem to be able to figure out the timing, they never had a sense of when to push the horse forward, when to slow down, when to adjust, when they just kind of, they learnt to post and they learnt to post at one rhythm and that was it. Whatever, independent of what the horse could or couldn't do and so, I guess it is what you kind of describe is that elusive feel, you know, and it is that, that natural feel.

Discussion

Themes derived from interviews are discussed in relation to existing knowledge on para classification and performance determinants for dressage, namely Hobbs et al. (2020), to fulfil the first objective of this study. The perceived impact of impairment on these performance determinants/themes are also discussed to fulfil the second objective of the study. The potential for findings to inform the development of an evidence-based para dressage classification system is also discussed.

Key determinants of, and the impact of impairment on performance for para dressage

In dressage, most marks are related to the horse's performance, with few related to the rider's performance alone. Thus, Hobbs et al. (2020) suggest that performance from the rider relates mainly to their ability to positively influence the horse, which must therefore be considered when establishing key performance determinants for para dressage. Findings from this study confirm this statement, as participants highlighted the importance of the equine athlete's performance on overall para dressage scores, as summarised within the equine character and temperament and gait and movement quality themes.

Many of the codes within the equine gait and movement quality theme have been measured objectively in research to describe superior gait quality or to predict dressage performance, as summarised by Hobbs et al. (2020). For example, stakeholder perceptions for the importance of equine suppleness and rhythm, have been corroborated in research, with greater forelimb fetlock extension correlated with superior trot quality and subjective scores for suppleness (Back et al., 1994) and increased stride regularity, representing rhythm, predicting better dressage scores (Biau & Barrey, 2004). Similarly, a light, consistent connection with the horse's mouth was described as desirable in this study and measures of rein tension have shown that this is correlated to higher "rideability" scores for horses (König Von Borstel et al., 2014). Collection, which refers to the horse's ability to lower and engage its hindquarters and is developed through impulsion for a light and mobile forehand, was also described by stakeholders (FEI (Fédération Equestre Internationale), 2007). Objective variables that represent the horse's ability to generate impulsion and collection have been significantly associated with higher gait quality and dressage scores. These include but are not limited to: hind first diagonal dissociation and greater hindlimb protraction, greater dorsoventral displacement/activity, and propulsive forces, as well as shorter stance durations, and increased flexion of the hindlimb joints (Biau & Barrey,

2004; Deuel & Park, 1990a, 1990b; Holmström & Drevemo, 1997; Holmström et al., 1994). Thus, the perceived determinants of equine gait quality were largely represented by objective measures that are significantly associated with superior equine gait quality or dressage performance.

An athlete's dynamic postural control was considered by stakeholders to have the greatest influence on the horse and overall dressage performance. It refers to the ability to maintain the position of the centre of mass within the base of support during expected and unexpected perturbations (Sirois-Leclerc et al., 2017; Winter et al., 1990). A horse's centre of mass is displaced three-dimensionally during movement, inferring expected and unexpected postural perturbations on the rider. Thus, maintenance of postural stability when seated on a moving base of support has been described as critical for horse riding (Olivier et al., 2017, 2019). Stakeholders described dynamic postural control as achieved through balance and core stability and as having a significant influence on the athlete's ability to absorb the horse's movement, coordinate the application of accurate aids, and maintain straightness/symmetry in both horse and rider. Athletes with impairments affecting dynamic postural control were sometimes thought of as being the most disadvantaged for para dressage, as highlighted by the fact that they generally compete in lower grades (FEI (Fédération Equestre Internationale), 2020d). These stakeholder perceptions agree with research that has quantified horse-rider harmony, or the coupling of horse and rider movement, using optical motion capture and inertial measurement unit (IMU) technology (Lagarde et al., 2010; Münz et al., 2014; Peham et al., 2001). In comparison to their less skilled counterparts, highly skilled equestrians display greater temporal regularity and a more stable synchronisation with the horse's movement (Lagarde et al., 2010; Münz et al., 2014; Peham et al., 2001), which coincides with higher dressage scores (Lagarde et al., 2010; Peham et al., 2001). A skilled rider's ability to anticipate the horse's movement and synchronise accordingly has been linked to decreased motion variability (Peham et al., 2004) and nose-up trunk tilt in equine gait (Münz et al., 2014), supporting the suggestion that dynamic postural control can influence the horse's rhythm and collection. These studies led Hobbs et al. (2020) to describe the importance of an "independent seat", or pelvic movements that follow the horse's trunk movements, allowing independent coordination of the limbs to give aids and develop quality movement in the horse. Thus, stakeholder perceptions, along with the quantitative evidence provided by Hobbs et al. (2020), suggest that dynamic postural control represents a key determinant of performance for para dressage.

Muscular strength, or the generation of maximal force, was generally considered as less important for para dressage performance. This is supported by studies reporting non-significant differences in the strength of various trunk, pelvis arm and leg muscles between able-bodied equestrians and non-rider control groups (Meyers, 2006; Westerling, 1983) and in back strength between amateur and elite riders (Sung et al., 2015). Instead, stakeholders described the importance of muscle power: fine-tuned coordination of muscular contractions for controlling the timing, duration, rate, and amount of force required to provide leg, hand, or seat aids

to the horse. Stakeholders also described the relative importance of overall trunk and pelvis muscle power across impairments to maintain dynamic postural control, driving aids through the rider's seat, and subsequent coordination with the horse's movement. Various impairments, namely neurological conditions, were described as limiting the athlete's ability to conduct these key activities. The relative importance of muscular coordination is supported by research reporting the coordinated activity of trunk muscles in advanced riders at sitting trot for maintaining postural control, which differed from the energetically inefficient coactivation pattern of trunk muscles and seemingly compensatory thigh adductor muscles observed in novice riders (Terada, 2000; Terada et al. 2004; Pantall et al., 2009). The consensus amongst referenced studies is that horse riding elicits some adaptations and requirements for muscular strength (Meyers, 2006; Westerling, 1983), but that the coordination of muscle activation is more important than the generation of maximal force (strength) (Terada et al. 2004), which supports stakeholder perceptions.

Hypertonia and impaired muscle power were amongst the eligible impairments described as impacting the joint mobility for riding theme, which influenced athlete performance by limiting their ability to adopt an appropriate riding position and maintain dynamic postural control for effective communication with the horse. This finding aligns with Hobbs et al. (2020), who included significant differences in joint range of motion between advanced and novice athletes in their theoretical model for linking horse and rider performance. In accordance with the dynamic postural control theme, the significantly greater pelvic tilt of advanced riders at trot, facilitates a significantly more vertical trunk position, which has been shown to result in greater coupling of the rider's pelvic and horse's trunk movements (Münz et al., 2014). Advanced athletes also show a following hand/arm and stiller legs, as evidenced by significantly greater elbow flexion/extension and reduced knee flexion/extension ROM, respectively (Eckardt & Witte, 2016). This led Hobbs et al. (2020) to theorise that significant differences in joint range of motion allow the advanced rider to influence the horse's impulsion, trunk motion (collection), connection and stride length by providing more consistent and accurate aids and maintaining horse-rider coordination, which is largely in accordance with findings from this study.

Stakeholders placed equal, if not greater, importance on equine personality-related traits in comparison with physical ability for sport performance, which converges with studies surveying the wider equestrian population (Graf et al., 2013; König Von Borstel et al., 2013; Suwała et al., 2016). Equestrians across a range of disciplines, have described an ideal sports horse personality profile to include sensitivity, adaptability, submissiveness, willingness to work, and self-reliance, with low fearfulness (König Von Borstel et al., 2013; Suwała et al., 2016), which is highly reflective of the preferences described by participants in this study. Elite able-bodied equestrian athletes have been reported to exhibit significantly higher anxiety management and concentration and higher, but non-significant, confidence and motivation than their sub-elite counterparts (Meyers et al., 1999). This supports the personality traits

described in this study for elite performance in para dressage, which were not considered to be different to the traits of able-bodied athletes. This study highlights the unique consideration of the horse's ability to adapt to an athlete's impairment for para dressage, however, findings reveal that horse and rider personality traits for elite performance are largely in accordance with the wider equestrian community. These themes further solidify the contribution of the horse and horse-rider partnership for developing theoretical models of sports performance for para dressage.

Informing the development of an evidence-based classification system for para dressage

The themes outlined in this study will inform the development of standardised sport-specific measures of performance for use in the next stage of this research project, which will assess the relationship between impairment and the extent of activity limitation caused for para dressage. This relationship should form the basis of all evidence-based classification systems (Tweedy et al., 2016; Tweedy & Vanlandewijck, 2011) and will thus be used to develop recommendations for para dressage classification. As suggested by Tweedy et al. (2016), interviews were conducted in this study to refine the performance determinants outlined by Hobbs et al. (2020), particularly in relation to the impact of impairment and subsequent activity limitation, so that sport-specific measures of performance can be developed. Key performance determinants for the athlete were summarised by the dynamic postural control, joint mobility and muscle power themes. Each theme was perceived as being highly predictive of overall performance in para dressage and sensitive to differences in measures of impairment, which fulfil requirements set by Tweedy et al. (2016) for the selection of performance measures.

Findings from this study reveal that stakeholders consider maintenance of dynamic postural control and the ability to absorb the horse's movement as the most important determinant of performance for para dressage. This finding corroborates the scientific evidence from Hobbs et al. (2020), suggesting that sport-specific measures of performance for para dressage should include measures of dynamic postural control. This measure could be performed and therefore standardised across all eligible impairments and informed by the objective, quantifiable measures described in the scientific literature presented by Hobbs et al. (2020). Stakeholders also highlighted the perceived importance of specific muscle groups and body segments for dressage performance that could inform the development of both measures of impairment and sport-specific performance, using normative values from able-bodied athletes (Hobbs et al., 2020).

Although this study employed a relatively small sample of stakeholders, with varying roles and experience within para dressage, general agreement amongst the participants was observed in relation to key performance determinants and the impact of impairment on these for para dressage. Further, these findings also agreed with the scientific literature outlined by Hobbs et al. (2020), which quantified the impact of these determinants on dressage performance. Thus, these findings justify the development of sport-specific

measures of dynamic postural control, as well as muscle power and joint mobility, in the next stages of the wider research project. A challenging consideration for these next stages of the research are mediating factors that influence the relationship between the proposed performance determinants and measures of impairment, particularly the influence of training (Tweedy et al., 2016). Evidence-based classification must ensure that athletes who improve their performance through effective training are not competitively disadvantaged by being placed in a class with athletes who have less severe impairments/activity limitation (Beckman & Tweedy, 2009; Tweedy et al., 2016; Tweedy & Vanlandewijck, 2011). Future research investigating performance measures for para dressage should consider how sports training influences the association between impairment and the extent of activity limitation caused.

Limitations

The aims and objectives of this study were developed so that findings could be used to inform the next stages of the larger research project. Thus, only interview data that were relevant to our understanding of perceived performance determinants, and the impact of impairment on these, were included and analysed to fulfil the aim of this study. Indeed, the interview schedule that was employed in this study (Supplement 2) did include questions and/or elicit discussions about controversial issues related to classification within para dressage. These topics included, but were not limited to, the impact of perceived classification errors, athlete re-classification, and intentional misrepresentation on athlete morale and equity within competition, as well as suggested improvements for the current classification system, and the impact of training on performance and classification. These are imperative considerations for the ongoing debate across para/disability sports for whether it is possible to develop classification systems that are wholly objective, reliable, valid, transparent, resistant to training and misrepresentation, and ultimately fair and equitable. The social-cultural literature surrounding classification in para/disability sport has reported on athlete and stakeholder perspectives on the above issues for swimming (Dornick & Spencer, 2020; Howe & Jones, 2006), athletics (Howe, 2008; Howe & Jones, 2006), and visually impaired football and cricket (Powis & Macbeth, 2020), to name just a few. Each of these topics have formed the focus of stand-alone pieces of research, but no known studies have reported on these topics for para dressage. It was felt that these topics were beyond the scope of the current study and should thus be reported in future, stand-alone research articles where in-depth analysis and reporting would be possible.

Conclusion

Key performance determinants for para dressage were summarised by stakeholders as the athlete's ability to maintain dynamic postural control for absorbing the horse's movement and coordinating leg, hand, and seat aids, which all have a direct influence on the horse's quality and accuracy of movements during a dressage test. These main findings agree with the scoping review by Hobbs et al. (2020), which concluded

that horse-rider harmony for maintenance of gait/movement and the ability of the rider to apply the correct aid(s) were linked to better overall dressage performance. The impact of impairment and the importance of the horse-rider partnership, which is based on both physical and psychological traits, were discussed across all themes. Stakeholder involvement in this research not only ensures compliance with the IPC Classification Code's mandate that relevant opinions and experiences are considered and used to inform the development of the classification system, but that research is relevant, sensitive, and will have maximum positive impact for the people that are affected most by para dressage classification.

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