EVIDENCE-BASED CLASSIFICATION IN PARALYMPIC SPORT: APPLICATION TO FOOTBALL-7-A-SIDE

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ABSTRACT

CPISRA Classification Rules for football-7-a-side should improve compliance of the International Paralympic Committee Classification Code, where the language of the International Classification of Functioning Disability and Health is used. Eligibility for is described in terms of impairment, and the aim of the system is to place athletes into classes according to the extent of activity limitation caused by their physical impairments. CPISRA Football permits the participation of athletes with with hypertonia, ataxia, and atetosis, and the should meet a minimum disability criteria to play football. Minimum disability criteria can be met if an athlete's impairment causes sufficient activity limitation in the activity of interest (passing, running, change of direction, among others). Currently, class profiles provide guidance for classifiers during the appointment of players to appropriate classes. However, classes are differentiated from each other based on qualitative descriptions and there is still opportunity for individual interpretation which decreases consistency among classifiers. This paper review recent and current research in Paralympic athletes with hypertonia, athetosis and ataxia, and link research in two Paralympic sports, IPC athletics and football-7-a-side, for the development of evidence-based classification systems.

Key Words: cerebral palsy, football, functional classification, paralympic games

RESUMEN

Las reglas de clasificación de CPISRA para el fútbol-7 paralímpico deben mejorar el cumplimiento del Código de Clasificación del Comité Paralímpico Internacional, mediante la aplicación de la Clasificación Internacional de Funcionalidad, Salud y Discapacidad. La elegibilidad para el deporte paralímpico se describe en términos de impedimentos, y el objetivo de este proceso es asignar a los deportistas una clase deportiva que refleje el impacto en la actividad deportiva. El fútbol CPISRA permite la participación de deportistas con diagnósticos relacionados con prevalencia de hipertonía, ataxia o atetosis, y para competir en este deporte deben manifestar un criterio mínimo de elegibilidad. Una vez que se confirma que el deportista presenta uno de esos impedimentos, se debe contrastar que éste tiene un impacto sobre la actividad deportiva concreta (pase, carrera, cambios de dirección, entre otros). Actualmente, los perfiles funcionales permiten a los clasificadores diferenciar uno del otro basándose en descripciones cualitativas que hagan que exista variación en los criterios de evaluación y toma de decisiones entre clasificadores. Este ensayo revisa la investigación actual y reciente en deportistas con hipertonía, ataxia y atetosis, y enlaza la investigación en dos deportes paralímpicos, atletismo y fútbol-7, para el desarrollo de sistemas de clasificación basados en evidencias.

Palabras clave: parálisis cerebral, fútbol, clasificación funcional, juegos paralímpicos

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INTRODUCTION

The International Paralympic Committee (IPC) is the global governing body of the Paralympic Movement, as well as the organiser of the Summer and Winter Paralympic Games (PG). The PG are the pinnacle of the career of Paralympic athletes and motivate others to participate or engage in Paralympic events. The Paralympics take place every two years alternating between summer and winter Games. Last London Summer PG (29 August to 9 September 2012) were the largest Paralympics ever, with participation of 4302 athletes from 164 National Paralympic Committees (NPC), and with fourteen countries appearing in the Paralympics for the first time ever. A total of 503 events in 20 sports were held during these games and, also, for the first time since their suspension after the 2000 Paralympics in Sidney, events for athletes with intellectual disability were also held in selected sports (e.g. athletics or swimming). Recent Winter PG, held in Sochi from 7 to 16 March 2014, received the participation of 45 NPCs, and these Games featured 72 medal events in five sports, and saw the debut of snowboarding at the Winter Paralympics. Next Rio PG in 2016 will include sport events for Para-Triathlon and Para-Canoeing.

There are actually 22 Summer and 5 Winter Paralympic sports. IPC acts as international federation for nine sports: four summer paralympic sports (Athletics, Powerlifting, Shooting, and Swimming), four winter paralympic sports (Alpine Skiing -including Snowboard-, Biathlon, Ice Sledge Hockey, and Nordic Skiing), and Wheelchair Dance Sport, which is not contested at the PG but which is governed by the IPC. The remaining 19 Paralympic sports are governed by international federations that are structurally independent but have been admitted to the membership of the IPC. These international federations comprise the International Organizations of Sport for the Disabled (IOSDs), which provide sports opportunities for people with specific disabilities. IBSA (International Blind Sports Federation) is the governing body for Football-5-a-side, Goalball, and Judo; IWAS (Wheelchair and Amputee Sports Federation) for Wheelchair Fencing; and CPISRA (Cerebral Palsy International Sports and Recreation Association) for Football-7-a-side, although this sport will become independent next January 1st in 2015 by governance of a new CP-Football International Federation. We will focus our review on this sport later.

As international (specific) sport federations, there are a group (n=5) of paralympic sports under their governance: Boccia (BISFed: Boccia International Sports Federation), Sailing (IFDS: International Association for Disabled Sailing, which works closely with the International Sailing Federation -ISF-, Sitting Volleyball (WOVD: World ParaVolley), Wheelchair Basketball (IWBF: International Wheelchair Basketball Federation), and Wheelchair Rugby (IWRF: International Wheelchair Rugby Federation). Finally, the

remaining sports (n=9) are integrated in the governance structure of international sport-specific federations: Para-Archery (World Archery), Para-Canoe (ICF: International Canoe Federation), Para-Cycling (UCI: International Cycling Union), Para-Equestrian (FEI: International Equestrian Federation), Para-Rowing (FISA: International Rowing Federation), Para-Triathlon (ITU: International Triathlon Union), Table Tennis (ITTF: Table Tennis Federation, through the ITTF Para-Table Tennis Committee), Wheelchair Curling (WCF: World Curling Federation), and Wheelchair Tennis (ITF: International Tennis Federation).

Howe (2008) usefully divides the development of the Paralympic movement into three phases: first, its beginnings in Stoke Mandeville as a form of rehabilitation for people with spinal cord injuries (Sir Ludwing Guttman legacy); second, as a movement providing opportunities for people with all types of physical disabilities to participate in sport against physical equals; and third, its current form as an elite, commercial sporting spectacle (Tweedy & Howe, 2011). This last phase is characterised by increased formal collaboration between the International Olympic Committee (IOC) and the IPC (Doll-Tepper 1999). The many 'benefits' to the Paralympics of these closer ties with the Olympics include corporate sponsorship, long-term financial support, access to high-quality facilities during the Games, and countless other commercial bonuses (Howe, 2008: p. 84). Indeed, the Paralympic tradition of top-down management that began with Guttmann continues today with the IPC, comprised primarily of able-bodied administrators with a sport-specific, rather than disability-specific, orientation (Wedwood, 2014). Then, PG receive some criticism, because a wider population of disabled people is misrepresented, and can be counterproductive to disability rights beyond sport (Braye, Dixon, & Gibbons, 2013). Thus, classification is one area of the PG where the inherent tensions in the cultural model-sports dichotomy become very clear (Brittain, 2010). As IPC has moved the PG further towards the sporting model the pressure to provide an event that is saleable to sponsors and the media has increased (Howe & Jones, 2006).

What is Classification in Paralympic Sport?

According with Tweedy and Howe (2011), classification is a critical aspect of Paralympic sport, for two key reasons. Firstly, classification determines who is not eligible to compete in Paralympic sport. As the stature sport increases (increased public awareness or media attention) there is a proportional importance of decisions which determine eligibility for Paralympic sport. Traditionally athletes within each sport/event were classified by type and degree of disability to ensure equitable competition. However, this resulted in a

very large number of events, medals and world records – peaking in Seoul in 1988 with 1257 events, 971 world records and 2208 medals for around 3000 athletes (Darcy, 2012; Strohkendl, 2001). Originally, probably because Paralympic sport originated as extension of the rehabilitation process, early systems of classification were medically based. The organizational structure of classification with a medical approach separate the classes by impairments as spinal cord injury, amputations, brain damage, among others, and each sport receive a class according athlete´s impairment and compete with the same class in all the sports. This conception of classification it not feasible today due to the specialization and athletes´ performance of every Paralympic sport.

Secondly, classification is the sole means by which success in Paralympic sport is legitimized. If stakeholders in Paralympic sport (athletes, media, administrators, the media, or the public) suspect that the athletes who succeed in Paralympic sport are simply those who have disabilities that are less severe than their competitors, then the value of success in Paralympic sport become questionable. Moreover, because the classification systems are so complex, most people find it confusing, presenting an obstacle to the Paralympics in gaining more widespread public acceptance (Darcy & Cashman, 2008).

Glancing at the recent past, one of the most important contributions in Adapted Physical Activity last decade was the *International Classification of Functioning, Disability and Health*, known more commonly as ICF (World Health Organization, 2001), that provides a standard language and framework for the description of health-related states. ICF is a multipurpose classification intended for a wide range of uses in different sectors, from sanitary and healthcare services to paralympic sport (Tweedy & Vanlandewijck, 2011). This classification poses what a person with a health condition can do in a standard environment (their level of capacity), as well as what they actually do in their usual environment (their level of performance). These domains are classified from body, individual and societal perspectives by means of two lists: a list of body functions and structures, and a list of domains of activity and participation. In ICF, the term functioning refers to all body functions, activities and participation, while disability is similarly an umbrella term for impairments, activity limitations and participation restrictions. This was a radical shift about the understanding of the disability from emphasizing people's disabilities to their level of health. In other words, ICF put the notions of 'health' and 'disability' in a new light (Reina, 2014), and this approach is also applied to Paralympic sport.

Due to the maturation of the Paralympic movement, sport ceased to be a mere extension of rehabilitation and become important in its own right (Tweedy & Howe, 2011). The focus on sport, rather than rehabilitation, drove

the development of functional classification systems, where the main factors that determine class are not the diagnosis and medical evaluation, but how much the impairment of a person impacts upon sport performance. Following a first stage of classification called examination, which is an assessment of impairment, novel tasks and movements that are closely related to the movements required in the sport, an athlete might be assigned a sport class; if not second stage a sport specific assessment, which includes the observation and assessment of the athlete performing specific skills for the sport. As a last step, in the third stage, the athlete is observed in competition (Tweedy & Bourke, 2009). Then, a key purpose of the classification process is to minimize the impact of the impairment on the outcome of competition. Then, impairment is the unit of classification, and the basis of the ICF and the IPC position regarding classification is to classify impairments according to how much they affect the core activities of the sport or activity limitation (Tweedy, 2002).

In contrast to the medical classification approach, in which athletes compete in the same class for all sports, functional systems of classification are necessarily sports-specific. This is because any given impairment may have a significant impact in one sport and a relatively minor impact in another. For example, criteria to participate in a running event in Paralympic Athletics vary for athletes with unilateral upper limb deficiency. One athlete with below elbow limb deficiency (amputation or dysmelia) can only compete in sprint event (100 to 400 m) and those with above elbow limb deficiency could compete in all distances. The reason for including the types of upper limb deficiency is not because they alter the biomechanics of the running action, but because they have been judged to alter the biomechanical execution of the crouch start or jumping actions in a way that is demonstrable and which will adversely affect performance (IPC Athletics, 2014).

Currently, most Paralympics sports use systems of classification that are described as functional, with some exceptions. IBSA sports for athletes with visual impairments remain medically based classification systems, based on the evaluation of visual field and visual acuity. Also, wheelchair tennis has two wide classes organized by ranking points, and Powerlifting and Judo are organized by weight and sex classification criteria, similar than non Paralympic sports. Special attention will be paid in Football-7-a-side, sport on which we will apply this current classification approach in Paralympic sport.

IPC´s Position regarding classification. Towards evidence based classification systems.

The recently published IPC Position Stand on classification in Paralympic sport states that the purpose of Paralympic classification systems is to promote

participation in sport by people with disabilities by minimizing the impact of impairment on the outcome of competition (Tweedy & Vanlandewijck, 2011), where impairment (World Health Organization, 2001) is any problem with body structure or body function (e.g., hypertonia, athetosis, ataxia, impaired range of movement, impaired muscle power, short stature, limb deficiencies, or legs length difference). Thus, classification systems aim to ensure that athletes who succeed in Paralympic sport do so because they have the most favourable anthropometric, physiological and psychological attributes and have enhanced them to best effect through training and diet; athletes should not succeed simply because their impairment is less severe than that of their competitors.

This Position Stand (Tweedy & Vanlandewijck, 2011) goes on to state that, in order to minimize the impact of impairment on the outcome of competition, each classification system should: i) describe eligibility criteria in terms of type and severity of the impairment; ii) describe methods for classifying eligible impairments according to the extent of activity limitation they cause, where an activity limitation (World Health Organization, 2001) is difficulty executing an activity (e.g. running, jumping, kick or pass a ball, change of direction). Classification systems that achieve this purpose will help to ensure that competitive success within a class is determined by factors such as skill, determination and training and will reduce the chances that an athlete will be precluded from success because they have an impairment that causes more activity limitation than their competitors (Tweedy, 2002).

In many current classification systems, a multiprofessional team estimates the extent of activity limitation resulting from impairment through assessment of four principal areas: a) impairments of structure and function (e.g., muscle strength, reflexes, hypertonicity, range of movement); b) activity limitation experienced in motor tasks that are novel, yet biomechanically related/similar (i.e., motor tasks unlikely to have been practiced by an athlete in the sport concerned); c) assessment of activity limitation in sport specific motor tasks (i.e., drills and movements fundamental to the sport of the athlete); d) assessment of factors other than impairment that will affect activity limitation (e.g., the equipment used by the athlete, their level of training, age and anthropometry) (Tweedy, 2002). Results from all four areas of assessment are taken into account and a class is assigned when the panel reaches consensus. To minimize potential sources of intra- and inter-panel variability in assigning classifications, standardization of assessment methods is vital (Tweedy, Williams, & Bourke, 2010).

In November 2007, the General Assembly of the IPC approved the IPC Classification Code, which review was approved in January 2013. New version of this code is expected to be approved next november-december 2015, after

receive amendments from government body and heads of classification from all Paralympics sports. This code provides comprehensive guidelines, policies and procedures for the conduct of classification in sports governed by the IPC or its member federations. From a sports science perspective, the code is significant because it explicitly mandates the development of evidence-based classification systems (Code Section 15.2). This position stand has a twofold purpose: a) to provide a theoretically grounded description of the scientific principles underpinning classification in Paralympic sport; and b) to define the term evidence-based classification and provide guidelines for how it may be achieved.

Although evidence-based methods for classifying impairments must primarily use valid and reliable measures of impairment, such measures cannot be the sole basis of classification. This is because, although eligible impairments are permanent, many types of impairment are, to varying degrees, responsive to training (Beckman & Tweedy, 2009). For example, while people with incomplete spinal cord injury and spastic hypertonia may have permanently impaired muscle strength, changes in the strength of affected muscle groups can be induced by chronic disuse or resistance training (Glinsky, Harvey, & Van Es, 2007). It is vital that athletes who have positively influenced their impairment scores through effective training are not competitively disadvantaged by being placed into a class for athletes with less severe impairments (Tweedy & Vanlandewijck, 2011).

To ensure that highly trained athletes are not competitively disadvantaged requires methods that will permit classifiers to differentiate highly trained athletes from novices (Beckman & Tweedy, 2009). A battery of reliable activity limitation tests will provide classifiers a way to differentiate athletes who are highly trained from those who are not because, for a given impairment score, an athlete who is well trained will perform commensurately better on the test battery than one who is untrained.

However, this approach receives also some criticism from disabled activist (Braye, Dixon, & Gibbons, 2013). Thus, with increasingly closer ties to the International Olympic Committee (IOC), the IPC streamlined what it saw as a complex, cumbersome system that presented logistical problems and which created a potential threat to the marketability of the Games to the mainstream media and potential sponsors (Howe, 2008). This streamlining resulted in the amalgamation of some classes – for instance, two different disability types – leading ultimately to inequitable competition and also to the elimination of other classes, many of which were for women and the more severely disabled (Howe, 2008). Not only do Paralympians have little power to challenge the IOC and/or the IPC regarding classifications or other disability rights issues, but for

many Paralympians such issues are not a high priority because they are sport focused rather than disability focused (Hardin & Hardin, 2008).

Current classification system for Paralympic Football-7-a-side: The cutpoint problem.

Football 7-a-side has been a part of the Paralympic Games since 1984. The sport, which is for those with cerebral palsy or related brain damage conditions, is similar to football for able-bodied players with a few modifications. There are seven players on the field at a time rather than 11, the measurements of the playing field are smaller, there is no offside rule and throw-ins may be made with just one hand. Matches consist of two halves of 30 minutes each. The governing body of this sport is CPISRA, and a new international federation will rise next January 2015 for this sport.

CPISRA provides sport opportunities for individuals with neurological impairment with a motor control impairment of a cerebral nature causing a permanent and verifiable Activity Limitation (CPISRA, 2013). According IPC position regarding classification, only athletes with ataxia (control of voluntary movement), athetosis (involuntary contractions of muscles), and hypertonia (high muscle tone) could be eligible for this sport. Current CPISRA classification rules include different displays of hyperthonia: spasticity, rigidity, and dystonia. According the consensus from Sanger, Delgado, Gaebler-Spira, Hallett, and Mink (2003), Spasticity is defined as hypertonia in which 1 or both of the following signs are present: 1) resistance to externally imposed movement increases with increasing speed of stretch and varies with the direction of joint movement, and/or 2) resistance to externally imposed movement rises rapidly above a threshold speed or joint angle. Dystonia is defined as a movement disorder in which involuntary sustained or intermittent muscle contractions cause twisting and repetitive movements, abnormal postures, or both. Rigidity is defined as hypertonia in which all of the following are true: 1) the resistance to externally imposed joint movement is present at very low speeds of movement, does not depend on imposed speed, and does not exhibit a speed or angle threshold; 2) simultaneous co-contraction of agonists and antagonists may occur, and this is reflected in an immediate resistance to a reversal of the direction of movement about a joint; 3) the limb does not tend to return toward a particular fixed posture or extreme joint angle; and 4) voluntary activity in distant muscle groups does not lead to involuntary movements about the rigid joints, although rigidity may worsen.

Based in these eligible impairments, football-7-a-side has actually 4 classes, based on the traditional CPISRA classification system, where four classes (C1-

C4) were for wheelchair athletes and other four (C5-C8), were for ambulant athletes (Figure 1). Applied to football, last four classes appear in the rules as:

- *Class FT 5*. Diplegia, Asymmetric Diplegia, Double hemiplegic, or Dystonic. It include moderate involvement with spasticity grade 2-3; involvement of both legs which may require orthotics/splints for walking; an asymmetric diplegia or double hemiplegic athlete with involvement on both sides with lower limbs more affected than upper extremities; or athletes with dystonia where the lower limbs are more affected than upper extremities.
- *Class FT6*. Athetosis, Dystonic, Ataxic or Mixed Cerebral Palsy or related neurological conditions. It include moderate involvement in all four limbs; athlete ambulates without assistive devices but might require orthotics/splints; athetosis, dystonia or ataxia is typically the most prevalent factor but some athletes can have problems with athetosis or ataxia mixed with spasticity; athletes with dystonic athetosis in all four limbs belong in this classification unless the impairment is minimal.
- *Class FT7*. Hemiplegic, including spasticity Grade 2-3 in one half of the body (on the frontal plane); walk/run with a limp/clearly noticeable due to spasticity in the lower limb; hemi gait pattern 2, 3 or 4 as per grouping described in gait patterns in spastic hemiplegia in children and young adults by Winters, Gage and Hicks (1987). They usually have a good functional ability in the other side of the body.
- *Class FT8*. Diplegia, Asymmetric Diplegia, Double hemiplegia, and/or Dystonia. It include hemiplegia with spasticity grade 1 to 2; monoplegia with spasticity grade 1 or 2 in major joint in lower limb; athetosis, dystonia, ataxia or mixed cerebral palsy or other neurological conditions.

Although this system also include some description of sport activity limitation of each class (based on impairments and its severity), it is also true that the basis of this classification is based on the "disabled body" paradigm (Brittain, 2010; Howe, 2008). Also, eligible impairments appear throughout class description, and some subjective terms are used (severe, moderate, mild, or minimal).

Even though class profiles and methods used to determine cut-points provide guidance for classifiers during their decision making, there is still a lot of room for individual interpretation which decreases consistency between classifiers (Bicici, Vanlandewijck, & Tweedy, 2012). For example, players for class FT8 must demonstrate a limitation in function to classifiers based on evidence of spasticity (increased tone), ataxia, athetosis or dystonic movements while performing on the field of play or in training, and he/she must have an evident impairment of function observed during classification and on the field

of play. In other words, the level of neurological impairment associated with these conditions must disadvantage players as far as competing in high performance/elite able bodied football is concerned. The key question that arises here is how classifiers could make good decisions when some points in class profiles are vague and open to interpretation.

Here an example about balance description in football profiles. FT5 is described as "usually has normal static balance but exhibits problems in dynamic balance e.g. attempting to pivot or stop and start. Reduced range of movement of hip could alter rapid movements in all directions" (CPISRA, 2013: 22), and FT6 are "athletes who have athetosis or dystonia may have good dynamic balance compared with static balance. Both Athletes with dystonia, athetosis and ataxia, in particular, will have problems with balance and with starting, stopping, and turning when running. They will also have varying degrees of difficulty with balance while hopping and jumping; with many postural body adjustments for static/dynamic balance. The Athlete has delayed saving/protective reactions when falling or losing balance". Although FT8 could include players with athetosis, ataxia and dystonia impairments, balance is not described in this profile. Also, balance was addressed neither for FT7 nor FT8, and balance has a strong relationship with many football skills as shooting, passing, head kicking, or change of direction (CODA). Further, there is no information about what good static/dynamic balance is or about what the problems can be exhibited in dynamic balance. In the literature a wide variety of balance assessment methods are available for examining subjects of different ages, gender and with various deficits. Normative data is provided, giving assessors a frame of reference to interpret outcomes when assessing their subjects (Springer, Marin, Cyhan, Roberts, & Gill, 2007; Isles, Choy, Steer, & Nitz, 2004). However, as mentioned above, terms such as normal, good or better do not provide sufficient guidance to classifiers in their decision making (Bicici et al., 2012), because these terms are based on the assumption that everybody has the same perception.

Unfortunately, there is very little guidance on how to make decisions in such cases stated above or how to interpret some descriptions in class profiles, resulting in subjective measurement, which threatens the reliability of decision making. Then, experience of the classifiers appears as a factor that could influence in classification process. Because classes are differentiated from each other based on qualitative descriptions, when allocating an athlete to a class, decision-making can be complex and frequently have classifiers required to address three main cut-points: moderate activity limitation of the classes FT5 (spastic diplegia), FT6 (player with ataxia, athetosis or dystonia) and FT7 (spastic hemiplegia) versus FT8 (minimal activity limitation), adding FT8

versus Not Eligible (NE) in case the activity limitation is not observed during the game.

This decision making is crucial in football-7-a-side. According current rules (CPISRA, 2014: 2), "each team must field at least one class FT5 or FT6 player at all times, or the team will play with one less player...and each team may have one class FT8 player on the field of play during a game". Then, general performance of a team could be influenced actually by the classification of their players. In other words, a player with "moderate" or "mild" spastic diplegia could be classified in FT5 or FT8 classes, with a major impact on team play or team squad.
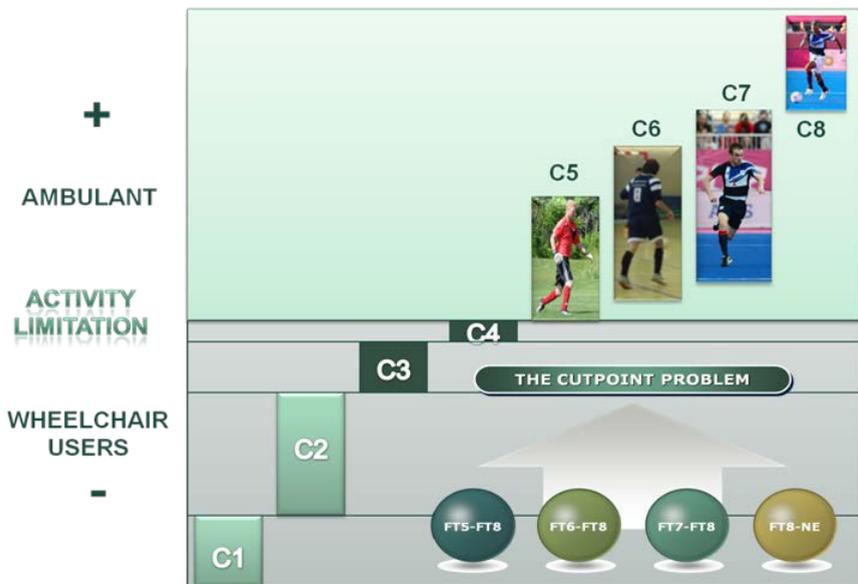
FIGURE 1: Theorical proposal about the potential performance in CPISRA classification profiles applied to football (Reina, Nogeira, Sharp, & Steele-Mils, 2013).

Towards evidence-based classification in Paralympic Football-7-a-side

From a sports science perspective, the International Paralympic Committee Code (IPC, 2007) explicitly mandates the development of evidence-based classification systems (Code Section 15.2). Evidence-based practice (EBP) is a growing movement in the health and educational disciplines that recommends emphasis on research outcomes during decision making in practice. EBP is made possible through evidence based research (EBR), which attempts to synthesize the volume and scientific rigor of intervention effectiveness (Hutzler, 2011). For that proposal, Tweedy (2002) described the taxonomic relationship between the ICF and Paralympic classification, which maps the domains relevant to Paralympic sport against the comprehensive ICF structure.

Recent research has been published in the literature about evidence-based classification, in sports as athletics-jumps (Nolan, Patritti, Stana, & Tweedy, 2011), athletics-throws (Frossard, 2012; Tweedy, Connick, Burkett, Sayers, Meyer, & Vanlandewijck, 2012), athletics-wheelchair propulsion (Vanlandewijck, Verellen, & Tweedy, 2010, 2011; Vanlandewijck, Verellen, Beckman, Connick, & Tweedy, 2011), swimming (Evershed, Frazer, Melliont, & Burkett, 2012; Oh, Burkett, Osborough, Formosa, & Payton, 2013), or winter sports (Burkett, 2012; Pernot, Lannem, Geers, Ruijters, Bioemendal, & Seelen, 2011).

As we introduced, IPC recognizes actually 10 impairments that are eligible for Paralympics Sports: hypertonia, ataxia, athetosis, impaired muscle power, impaired range of movement, limb deficiency, leg length difference, short stature, visual impairment and intellectual disability (Tweedy & Vanlandewijck, 2011). Since 2013, IPC supports evidence-based classification granting three leading research centers for physical impairment (University of Queensland, Australia), intellectual impairment (Katholieke Universiteit Leuven, Belgium) and visual impairment (Vrije Universitiet Amsterdam, Netherlands). These centers acts as coordinators of evidence based classification in these impairments. In the case of football, there are actually a close cooperation between the group lead by Professor Sean Tweedy (School of Human Movement Studies, University of Queensland) and the author of this paper, Head of Classification for Paralympic football-7-a-side since October 2013.

Various criteria described that measurement tools should have are; reliability, validity, responsiveness, clinical utility or standardization. According with Bicici et al. (2012), besides these practical aspects of these properties, test battery for evidence based classification needs to be: easy to administer, record and score; require minimal equipment; as well as be safe to apply, appropriate for athletes (FT5-FT8 football players), concise and comprehensive.

The study from Beckman and Tweedy (2009) evaluated five tests to determine which combination explained the maximum variance in running performance in a non-disabled population, to permit psychometric evaluation of the tests without the confounding influence of impairment, and to provide an indication of normative performance. The test battery was reliable and valid and it is applied to evidence based classification in athletes with hyperthonia, athetosis and ataxia, which shows impairments of coordination, strength and range of movement (Beckman, Vanlandewijck, Connick, & Tweedy, 2013; Connick, Beckman, Deuble, & Tweedy, 2013).

Bicici and Tweedy (2013) identify and describe a group of motor tests which have objective, quantifiable outcomes, clear protocols and established reliability and were judged by experts to be of potential use in differentiating

classes. This study approach six cut-points in IPC athletics for athletes with the three described impairments, which description is similar to the profiles used in football, because both come from the 8 classes CPISRA classification system. To address classification-related decision making, a Delphi process was used. The Delphi process is a technique which is used to gain consensus among a panel of experts by using a structured series of questionnaires that are completed anonymously. Twelve experts participated in two rounds of the Delphi process which sought to obtain consensus on tests that might be useful for differentiating between classes. The consensus level was set at 70% or greater and the number of consensus-based tests for each cut-point was as follows: 39 tests for cut-point one (T35 vs T38), 42 tests for cut-point two (T36 vs T38), 35 tests for cut-point three (T37 vs T38), 5 tests for cut-point four (T35 vs T36), 20 tests for cut-point five (T35 vs T37), and 10 tests for cut-point six (F35 vs F36, class for throws). These tests are standardized, practical and have quantifiable outcomes which are expected to reflect the difference between existing classes.

Figure 2 show the results of 100 m sprint for runners with athetosis, ataxia and hyperthonia at the London 2012 Paralympic Games. It is interesting to evidence similar results for the last four athletes in class T37 and T38, or the last two athletes in class T36 showed lower performance than the winner in T35 class. If we have this kind of "overlaps" in a sport that "only" requires the running action (including starting from the blocks), classification in football become a bit more complex, because more skills are involved.
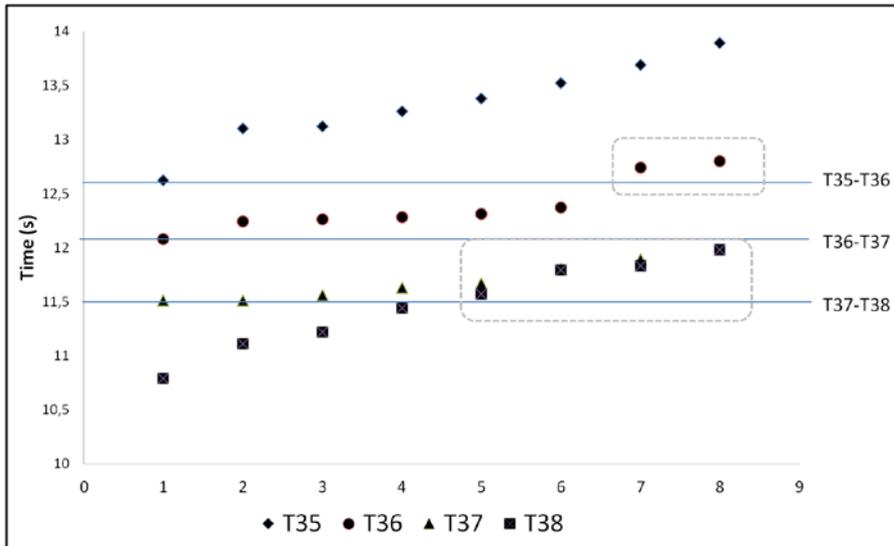
FIGURE 2: Results at the Finals of the London 2012 Paralympic Games
(Classes T35 to T38).

Football is a sport that requires speed abilities and football-specific technical skills like sprint, agility, dribbling, ball control, shooting and juggling (Höner, Votteler, Schmid, Schultz, & Roth, 2014). From the starting point of these studies applied to athletes with hyperthonia, ataxia and athetosis (Beckman & Tweedy, 2009; Bicici, Vanlandewijck, & Tweedy, 2012) a long-term research project is actually conducted for evidence-classification in this Paralympic sport (Reina, Nogeira, Sharp, & Steele-Mils, 2012). Players (n=140) from 10 national teams (Argentina, Brazil, Canada, Netherlands, Northern Ireland, Portugal, Scotland, Spain, USA, and Venezuela) took part in a data collection during last CPISRA Intercontinental Cup, held in Barcelona in June-August 2013. Regarding to the class, the distribution of this sample is FT5 = 13, FT6 = 22, FT7 = 86, and FT8 = 19, plus 38 non-disabled football players. Table 1 shows the test battery used in this project, grouped by evaluated skills: range of movement, coordination, balance, power/jumping, running, CODA (change of direction), dribbling and ball control, and shooting.

TABLE 1
Test battery for evidence-based classification in Paralympic football-7-a-side.

Test	Description and Reference	Equipment	Measure
Range of movement			
ROM	Ankle Dorsiflexion, Supine Composite Flexion and Backward Stepping Lunge Connick, Beckman, Deuble, & Tweedy (2013)	Goniometer Tape-measure	Degrees Distance (cm)
Side-Step	Maximum sidestep length, by dividing the total distance moved by the number of steps (4). Maximum sidestep length is standardized by dividing by the leg length. Fujisawa & Takeda (2006)	Tape-measure	Distance (cm)
Coordination			
Rapid Heel-Toe Placement	Athlete sits barefoot on a chair and tries to touch corners of 20 x 30 cm rectangle on floor. Athlete alternates heel and toe in each corner as close as possible, first left to right then around right to left. Anonymus expert in Bicici, Vanlandewijck, & Tweedy (2012)	Stopwatch Marker	Time (s)
Split Jumps	Athlete is requested to stand with legs slightly apart and one in front of the other. Then jump over a line changing legs (Left in front, jump changing to Right in front). The arms are simultaneously moved contra-lateral to the legs. Beckman & Tweedy (2009)	Stopwatch Marker	Time (s) perform 25 correct cycles
Side Stepping	Athlete is requested to stand with legs slightly apart between two lines separated at 40 cm. Then jump over the line performing symmetrically legs abduction-abduction (open-close). The arms can move in a free way. Beckman & Tweedy (2009)	Stopwatch Marker	Time (s) perform 25 correct cycles
Running on Place	Participant runs on the same spot as fast as possible. A cycle is right foot contact to next right foot contact. Beckman & Tweedy (2009)	Stopwatch Marker	Time (s) perform 25 correct cycles

<div align="center">TABLE 1(Cont.)</div>

Hexagon Hop Test	A hexagon with 60 cm sides and 120-degree angles is marked on a hard-surface floor. The test begins with the subject standing on a tape strip placed in the middle of the hexagon (starting location) and performs double-leg hopping from the center of the hexagon over each side and back to the center in a clockwise direction until the participant goes around the hexagon 3 times and returns to the center (18 jumps). Beekhuizen, Davis, Kolber, & Cheng (2009)	Stopwatch Marker	Time (s)
Balance			
Tandem Walk	Participant walks heel to toe along a line for 5 m. Later, they perform 10 correct steps on the line and time used is recorded. Arms still cross in front chest. Anonymus expert in Bicici, Vanlandewijck, & Tweedy (2012)	Stopwatch Tape Measure Marker	Time (s) complete 5m and perform 10 steps
One Leg Stance	The player stands one leg barefooted with their arms across the chest. Test is performed during 30 s. Springer, Marin, Cyhan, Roberts, & Gill (2007)	Forces platform (Kistler 9287BA)	Centre of pressure (COP)
Power / Jumping			
Triple Hop for Distance	Subjects are instructed to stand on one leg and perform 3 consecutive hops as far as possible, landing on the same leg. Both limbs are tested, and no restrictions are given to subjects regarding the use of arm movement. Munro & Herrington (2011)	Tape Measure Marker	Distance (m)
4 Bounds for Distance	Participant starts on a marked line and are instructed to cover the maximum possible distance in four consecutive, single-leg bounds from a standing start. The first bound is from their non-preferred leg, landing on their outstretched preferred leg. Using forward momentum to continue the movement, they then leap from their preferred leg to their non-preferred leg, and this pattern is repeated. Beckman & Tweedy (2009)	Tape Measure Marker	Distance (m)
Standing Broad Jump	Participant stands on a line and, in their own time, jumped as far forward as they could, landing on both feet. Familiarization included standardized instructions, and participants can use the stretch–shorten cycle and their arms to increase jump distance. Beckman & Tweedy (2009)	Tape Measure Marker	Distance (cm)

<div align="center">TABLE 1(Cont.)</div>

CMJ	Participants stand on a marked area (force platform) and, in their own time, perform a countermovement jump as high as they could, landing on both feet. Familiarization included standardized instructions, and participants must place their hands on the hips. Cámara, Grande, Mejuto, Los Arcos, & Yanci (2013)	Forces platform (Kistler 9287BA)	Flight time (ms) X, Y, Z ground forces (N)
Leg Strength	Player will placed back to a dynamometer, seated on a chair, and he must push as a he is performing a ball´s kick. Player must push in a slow and increasing way until his maximum pushing during 5-6 seconds. No trunk and arm involvement is permitted, and arm must be placed cross on the chest and the trunk will be supported at the chair backrest. Reina, Moya, Sarabia, & Sabido (2013)	Lafayette Digital Manual Muscle Tester, model 01165	Peak force (N) Time to peak (ms) Rate force develop. (N/ms).
Running			
40 m Sprint	The objective of this test is to provide a measure of top speed in running. Markers are place at 0, 10, 25 and 40 m, with two pairs of infrared timing light gates. Participants start at 0 m and use the first 20 m to accelerate so that they are at top speed when they reach the third gate, and then aim to maintain top speed through to the fourth gate. Modified from Beckman & Tweedy (2009)	Time gates	Time (s) at 10, 25 and 40 m
10 m Speed Skip	Markers are placed at 0, 10 and 20 m with pairs of infrared timing light gates positioned at the 10 and 20 m markers. Participants perform the skip—a hop–step– hop pattern—and are given an opportunity to practice until they can successfully complete the pattern over 10 m. Participants accelerate over the first 10 m so that they are at top speed when they reach the first light gate (10 m), and maintain top-speed as they move through to the second gate (20 m). Beckman & Tweedy (2009)	Time gates Cones	Time (s)

TABLE 1(Cont.)

Change of Direction (CODA)

MAT	Participant must run as much as possible MAT as follows: 1) sprint forward (5 m) to a cone and touch the top of it with the hand; 2) move laterally (2.5 m) without crossing the feet and touch cone top with the left hand; 3) run laterally (5 m) and touch the cone top with the right hand; 4) move back laterally (2.5 m) and touch cone top with the left hand; and 5) run backwards (5 m) to starting line. Yanci, Los Arcos, Reina, Gil, & Grande (2014)	Time gates Cones	Time (s)
Illinois Agility Test	The length of the course is 10 meters and the width (distance between the start and finish points) is 5 meters. Four cones are used to mark the start, finish and the two turning points. Another four cones are placed down the center an equal distance apart. Each cone in the center is spaced 3.3 meters apart. On the 'Go' command the stopwatch is started, and the player runs around the course in the direction indicated, without knocking the cones over, to the finish line, at which the timing is stopped. This test is also performed later dribbling the ball. Modified from Váczi, Tóllar, Meszler, Juhász, & Karsai (2012)	Time gates Cones Ball	Time (s)

Dribbling and Ball Control

Stop and Go	The athlete stands in a standing position without support behind a starting line, to start the run at the signal and run to a mat (10 m) and stop completely on the mat with both feet. After the first contact, the player must remain on the mat during 2 seconds and a beat will sound. Immediately they must run again to the next mat (10 m) and stop again, and to continue to the final mark at 10 m from the second mat. Reina (2012)	Time gates Pressure mat and counter Ball Cones	Time (s) at 10, 20, and 30 m.

<div align="center">TABLE 1(Cont.)</div>

Turning and Dribbling	The athlete stands in a standing position without support behind the starting line, to start the run at the signal and he must run to a line placed at 10 meters and turn to change direction of the displacement towards the starting line. After to reach the starting line, the player must turn again and dribble the ball towards the goal as fast as possible.	Time gates Ball Cones	Time (s) to complete 30 m
	Reina (2012)		
Shooting	Players have 5 attempts with left leg and 5 with right leg to pass the ball into a 1x1 square place at the center of the goal.	Radar Sportgun SR3600	Km/h Score
	Reina (2012)	Ball	

<div align="center">CONCLUSIONS</div>

The aim of current research is to identify and describe quantitative and qualitative (video) outcomes from a group of motor and football performance tests which have objective, quantifiable outcomes, clear protocols and established reliability and which are judged by experts to be of potential use in differentiating classes. Then, these tests are standardized, practical and have quantifiable outcomes which are expected to reflect the difference between existing classes. This can help to improve the reliability of decision-making in the classification of eligible players with hypertonia, ataxia and athetosis in CPISRA Football.

Figure 3 shows the relationships between recent classification research in athletics (runners) and its application to paralympic football-a-side. Footages from the performance in all the tests (table 1) will be analyzed by a group of international classifiers. Those classifiers can provide an on-line classification of each athlete, and we will be able to match classifiers decisions with the results of the objective tests. This will allow us to re-structure the class profiles of using objective standardized criteria, thereby enhancing the reliability and validity of these classes, improving the description of the classification profiles. Then, an outcome of this research will be the development of a reliable check list that lead observation process (i.e. observation in competition), improving classifiers decision-making for cut points FT5 vs FT8, FT6 vs FT8 and FT7 vs FT8.

Long term benefits of this research will be the contribution for evidence-based classification system. Pending approval from the governing organisations (CPISRA / new CP-Football International Federation), outcomes from this project will be used to directly inform a revision of the Class profiles. Research will not change awareness of the Paralympic movement but it will improve the

good standing of the movement. A more reliable and valid classification system benefits all Paralympic stakeholders: athletes and coaches have confidence they are not disadvantaged by the system; media and spectators feel they can understand the competition when they watch it; and the administrators and organizations responsible for the sport are less exposed to legal challenges and classification controversies. Enhanced reliability and validity of classification could make Football-7-a-side more attractive to watch, sponsor and support.
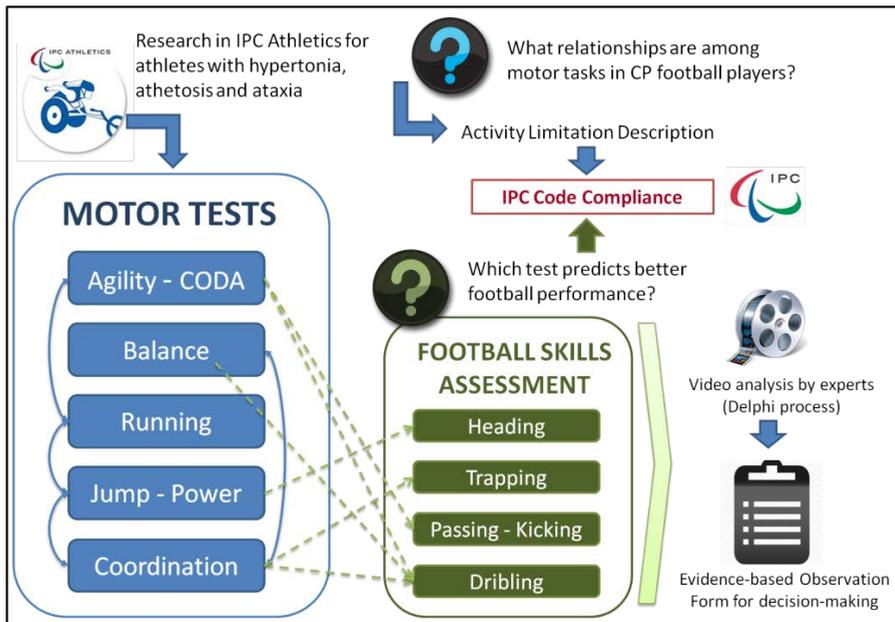

FIGURE 3: Relationship between IPC Athletics classification research
and football-7-a-side.

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