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Wheelchair handball classification system: purpose and validation evidence-based

Abstract

The aim of the present work is to propose and validate an evidence-based Wheelchair Handball Classification System, that allows its widespread use and the standardization of the classification system in different Wheelchair Handball competitions. The study involved 98 Wheelchair Handball athletes of both sex (87 males, 11 females), aged between 14 and 76 years old (*M*=40.32; *SD*= 11.73) with physical impairments. All wheelchair handball players that had participated in the last 3 national championships were invited to participate. We applied the assessment protocol to the participants and athletes' classification process had three phases: Medical and Physiological functional assessment; Technical assessment (evaluation of specific movements with wheelchair manipulation and Handball skills) and observation in a game situation (with videorecorder). We used a Classification Points Form to permit the assessment of muscle strength and range of movement of upper limbs, trunk, lower limbs, wheelchair manipulation and Handball skills. The manipulation of wheelchair was measured considering the symmetrical movement, acceleration, braking and change direction, using the Sprint 20m – speed test and a Slalom test. The handball skills were assessed, using dribbling, reception, catching the ball from the floor, shoulder and shopped pass and 9m to the goal shot.

Data Analysis was done using descriptive statistics and an Ordinal Linear Regression. The dependent variable was the classification class and we considered five independent variables (mean of upper limbs, trunk, lower limbs, wheelchair manipulation and Handball skills). Data Analysis was done using IBM SPSS Statistics. The results showed that the proposed model presents a high degree of adjustment and permitted identify determinant variables of performance in that sport and indicates key tasks to optimize classification process. There was consistency in the specific parameters to assign a class to the athlete, according to their functional capacity, associated with the specific neuromotor alterations of each clinical condition.

Keywords: adapted sport, wheelchair handball, classification, specific classification systems, evidence-based Classification System, physiological functional assessment, wheelchair manipulation, Handball skills

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Abbreviations: MIC, minimal impairment criteria; IPC, international paralympic committee

Introduction

The main objective of the present work is to propose and validate an evidence-based Wheelchair Handball Classification System, that allows its widespread use and the standardization of the classification system in different Wheelchair Handball competitions. Sports and physical activity have a key role in the integration process of people with disabilities into society[1] and have an important contribution to the promotion of equal opportunities between people with and without disabilities in the sporting, educational and social context, is also recognized.[2]

The contribution of sports practice by people with disabilities is increasingly evident, recognizing its fundamental role in prevention, rehabilitation, socialization, integration,[3,4] among many other benefits acquired through the practice of sports, allowing raise levels of motor function, improve psychological aspects (self-image, self-esteem, etc.) and increase the effective participation of people with disabilities in society.[1]

There are several conceptions about purposes of sports practice for people with disabilities, namely the sport for all, driven by participation, and, on the other side, an elite sport perspective.[5] At present work, we will develop an approach related with the last one (Hight Performance). Considering this perspective, Eligibility and Classification are essential processes for the practice of any Parasport. Finding the Minimal Impairment Criteria (MIC) for each Parasport is the key to starting this process. The functional classification is one of the most important elements for the practice of Paralympic Sport, because it is through it that the differences between athletes who have different disabilities are minimized, its main functions are to determine the eligibility to compete and to separate them by groups, assigning them a score.[6] Paralympic classification systems aim to promote the participation of athletes with disabilities by trying to control the impact of disability on performance.[7] In Parasport, athletes have a disability that disadvantages their performance. The classification serves to minimize this impact, to make the competition fairer, seeking to safeguard the sporting truth, which determines who can compete in a sport and, according to their limitations, create similar groups (sports classes), to create a fair environment and uniform playing field.[8]

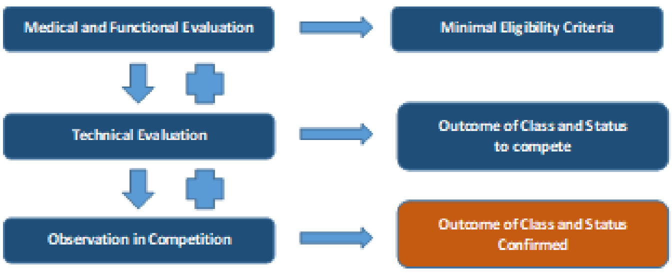
Sherril[9] defines classification in Sport for people with disabilities as essential and refers that it is the area where research is most needed and can be conceptualized as an evaluation system that aims to make competition fairer and more egalitarian. Historically, considering the evolution of the Classification process, we found that initially the "medical model" or "General Classification System" was in force.[10] Recognition of the limitations of these classification methods and techniques led to the "Combined Classification System" being tested during the 1986 World Games (Gothenburg). From the Barcelona

Paralympic Games in 1992 onwards, the "Functional Assessment and Classification System"[11] came into force, and with this system, the focus became the athletes' level of functionality, considering more the impact of disability, in carrying out motor tasks specific to each modality, thus presenting greater ecological validity. The biggest problems with classification systems are related to the higher degree of variation, subjectivity and the fact that athletes exaggerate their impairment by deliberately underperforming during classification process. [12] Classification system should expect that the performance on the field reflects the functional class of the athlete, and so, athletes with higher ratings should demonstrate a stronger field performance because they have greater functional potential.[13]

According to Tweedy et al.,[7] classification system has a clearly stated purpose to promote participation in sport by people with disabilities by minimizing the impact of impairment on the outcome of competition and empirical evidence indicates that the methods used for assigning class will achieve the stated purpose (objective, reliable methods for measuring both core constructs – impairment and activity limitation). Result of this evolution, in terms of methods and techniques used in the athlete's classification process, consistent with the IPC Athlete Classification Code[8] and accompanying international standards, currently the third version of the 2023 IPC classification code is being developed. Based on international experience of the Handball Portuguese Federation, a classification team was created, with six classifiers: one doctor (international classifier), one physiotherapist (international classifier), two teachers and researchers in the field of sport (University of Lisbon) and two handball coaches (one is also an international referee). In a period of ten years (2009-2019) this team toured the country carrying out the sports classification of national players, was responsible for the classification of international players who participated in a European Tournament in Leiria, Portugal (2019), which culminated in the production of Wheelchair Handball Classification Rules and Regulations Manual.[13]

That Classification process was based on an empirical approach, according to the level of functionality of the athletes, considering the following steps:

Evaluation criteria for the assignment of a Sports Class and Sports Class Status.



The Classification process based on that empirical approach, according to the level of functionality of the athletes, presented four sports classes, with the following characteristics:

Class 1: Due to extensive proximal shoulder weakness and lack or weakness of triceps function, a forward head movement is present when pushing the toilet but has a longer push on the wheel (combination of pushing and pulling the rear of the wheel); Due to the lack of triceps strength, the athlete holds the back of the wheelchair to propel themselves, using the biceps by bending the elbow while pushing (called the "unopposed biceps push"). Some players may increase strength in the upper chest and shoulders, the player is able to start, stop, and rotate in various directions (is able to rotate in all directions without stopping easier and faster spin; Due to the weakness of the wrist extenders and the lack of other wrist and hand functions, players can use the forearm on the steering wheel to start, turn, and stop. Poor control of the trunk and instability in the chair. Due to proximal weakness of the shoulder, arm, and wrist, direct passes get stuck in the lap or are made only over short distances; Players make the 'volleyball serve' move for longer distance passes and use both hands for passing the ball for shorter distance Can hold the ball with his wrists firmly, but he doesn't have good hand function.

Class 2: Increased shoulder strength and stability allows for more effective and efficient ball handling skills; good strength and stability in the shoulders allow for good thrust speed on the court. The functional grip is used to take advantage of the boost rim when challenged; Players can have some control of the torso guaranteeing them better stability in the chair. The increased strength and stability of the shoulders allows for some distance and consistency of pass; players have reasonably balanced finger flexion and extension without truly grasping and releasing; An asymmetry is noted in the arms. In this case, players use the strongest arm predominantly for chair and ball skills; Effective shoulder passes with control at moderate distance are possible; the player dribbles the ball safely, but cannot hold the dribble for long; Due to the flexion of the fingers, the player can perform an overhead pass with one hand, but only with limited accuracy and distance due to an imbalance in finger strength; It is possible to safely catch the ball with both hands. The player can also catch one-handed passes; can be observed due to the better ability to isolate wrist/finger function; The player may have an asymmetrical function in the arm or hand, noticeable in chair and ball handling skills.

Class 3: Due to the balanced function of the fingers, the player can hold the rim of the wheelchair increasing the speed of pushing; Can have reasonable to good trunk control, providing better stability in the chair. Due to a function in the fingers, the player can control the ball in various planes of motion to pass, dribble, receive and protect the ball during these activities; the player can dribble and pass the ball well with one hand; the player can dribble multiplied with one hand fully controlling the ball; The player stabilizes with the opposite arm to allow for greater reach, due to a reasonable to good torso function.

Class 4: The player has good trunk function, is very stable in the wheelchair, and can use the trunk functions for ball and chair skills. Due to the combination of hand and torso function, the player usually has excellent ball control with one-handed controlled passes for distance and excellent ball safety during passing and receiving. Good stability and control of the chair with the movements of the trunk and hips. Good stability of the hips. This class includes all players with the minimum eligibility criteria, as well as players with disabilities. Great ball handler and very fast playmaker.

Considering the IPC indications, regarding the evolution, in terms of methods and techniques used in the athlete classification process, several sports tried to develop specifics and Evidence-based classification systems.[14,15,16,17] To test the athletes' performance, field tests were used, done at the same space that the athletes usually practice the sport. Recently, Gagnon et al.,[14] refers that wheelchair propulsion can evaluate upper limb strength and trunk stability and that tests appear to be suitable for assessing basic motor skills. Speed and agility are components that significantly influence a sports performance, making it effective and precise in respect to the situation.[15]

Altavilla et al.,[16] refers to the fact that a good resistance increases the physical performing capacity. In this system, the technical gesture is not evaluated, but only the volume of action, given by the range

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of movements in various directions.[8] The conceptualization of the classification process was done according to Tweedy et al.,[17] being applied the five-step process for the research required to develop an evidence-based system of classification. Recognizing the importance of conducting further research in that specific area, based on an empirical approach, according to the level of functionality of the athletes, we intended to develop specifics and Evidence-based classification system for Wheelchair Handball.

The aim of the present work is: (1) determine the suitability of the methodology used in the previously classification process, (2) propose changes and (3) create a classification system, following IPC guidelines, specifics, and Evidence-based classification systems, that allows its widespread use and the standardization of the classification system in different Wheelchair Handball competitions, to make competition fairer and more equalitarian.

Material and methods

Participants

The study involved 98 Wheelchair Handball athletes of both sex (87 males, 11 females), aged between 14 and 76 years old (*M*=40.32; *SD*= 11.73) The different health conditions among the athletes involved in the study were: 5 with Spina Bifida (5.1%); 33 with Amputees (33.6%); 43 with Neurofibroma, Systemic Lupus Erythematosus, Diplegic, Paraplegic, Spinal Cord Injury (43.8%); 7 with Multiple Scleroses, Muscular dystrophy, Familiar Paramyloidosis (7.14%); 3 with Traumatic Brain Injury, Stroke, Hemiplegic (3.06%); 4 with Polio (4.08%) and 3 with Tetraplegic (3.06%). Considering their latest functional classification score, the distribution was: 7 (7.1%) of class 1; 34 (37.1%) of class 2; 21 (21.4%) of class 3; 36 (36.7%) of class 4.

Procedures

All wheelchair handball players that had participated in the last 3 national championships were invited to participate in the study. After explaining the study aims and the study protocol, we received the athletes' or parents' informed consent and participation agreement. The protocol complies with the requirements of the Helsinki Declaration and the Ethics Committee of the Faculty of Human Kinetics. The assessment of the content validity involved seven adapted sports Experts, namely two wheelchair handball head coaches, three wheelchair handball qualificators and two sport researchers from two different universities. Each expert received an e-mail containing the purpose of this study, an explanation of the procedures and a detailed description of the protocol. A focus group between experts was done and a unanimous agreement between experts in this validation procedure was found. All procedures for the study were pilot experienced for practicability of implementation and effectiveness.

Before each test session, all participants were given ten minutes to warm up at their own pace. Participants were instructed to perform all tests at maximum level and were allowed to rest adequately between tests. We applied the assessment protocol to the participants; its application lasted an average of 90 minutes. The athlete classification process had three phases: Physiological functional assessment; Observation and evaluation of specific movements (Wheelchair Manipulation and Handball Skills); Observation in a game situation (with videorecorder).

Measures

In the present study we used the classification class, measured by latest classification class (considering four classes), and as exogenous variables we considered variables related with: (1) Physiological functional assessment; (2) Wheelchair manipulation; (3) Handball skills.

Physiological functional assessment

We used a *Classification Points Form* to permit the assessment of muscle strength and range of movement of following:

UPPER LIMBS: Shoulder (flexion, extension, abduction, adduction, internal rotation, external rotation); Elbow (flexion, extension); Wrist (flexion, extension); Hand (grasp/release); Fingers.

TRUNK; Trunk (flexion, extension, rotation, side flexion, upper abdominals, lower abdominals).

LOWER LIMBS; Hips (flexion, extension, abduction, adduction); Knees (flexion, extension); Ankles (flexion, extension).

Each of items was evaluated on a scale from 0 to 2 (0-Can't done - the athlete can't perform the movement; 1-Medium done- the athlete can't perform the movement against gravity or less than 50% of full range of movement; 2-Well done - the athlete can overcome resistance and full range of movement) considering muscle strength (Daniels & Worthingan Scale)[18] and range of movement of all limbs (left/right; upper/lower). According to this procedure the variables mean of upper limbs, trunk, and lower limbs, were created.

Wheelchair manipulation

The manipulation of wheelchair was measured according with the procedure defined by Aliberti et al.,[19] and considering the Symmetrical movement, Acceleration, Braking and Change direction, using the following tests:

I. Sprint 20m – speed: The participant started from a firm position behind the starting line and, following a signal, made a straight sprint of 20 m, as fast as possible. The sprint was performed twice, 2 minutes break and the best result was recorded.
II. Slalom test - Participants were instructed to push the wheelchair at a self-selected maximum speed along a slalom trajectory defined by cones aligned in a straight line, at 3m, 2m and 1m (the sequence was 3m, 3m, 3m, 2m, 2m ,1m, 1m, 3m)

Considering both tests, each of the variables (symmetrical movement, acceleration, braking and change direction), was evaluated on a scale from 0 to 2 (0-Can't done; 1-Medium done; 2-Well done). About braking evaluation, the parameters used were the distance of braking and braking reaction time.

Handball skills

Ball skills tested the capacity of dribbling, reception, catch from floor; pass shoulder and chopped (all in a static and dynamic way) and shot at 9m to the goal (using the kinesthetic chain Trunk, Arm and Hand). Those skills were considered determinants of performance in that sport in that sport.[12, 20] A scale from 0 to 2 (0-Can't done; 1-Medium done; 2-Well done) was used. according to the procedure defined.

Final score

The Final Score was obtained through a summary of all evaluation tests (Medical and Physiological functional assessment, Technical Assessment (Wheelchair manipulation and Handball skills). The statistical distribution of these results allowed the identification of three cut points, suggesting the existence of 4 classes: Class 1- up to 22 points; Class 2- between 23 and 35 points; Class 3- between 36 and 58 points; Class 4- equal to or greater than 59 points. After the classification process is completed, we used observation in a game situation to confirm the assigned class, working as a double check. The reliability of the codification was assessed by the inter-coder and the intra-coders' agreement. Three members of the research team were trained to codify the results and during the training phase there was a discussion of the statements relating to each category. The inter-coder and the intra-coders' were assessed with a three-week interval, using the Bellack´s percentage of agreement formula.[21] Twenty percent of total codification was analyzed, being referenced that a minimum of 10% is necessary to evaluate reliability.[22] The lower values that we found were 93% for the inter-coder agreement and 98% for the intra-coders, indicate that an adequate reliability.[23]

Data analysis

A descriptive analysis was done to obtain *frequencies, means, standard-deviations, minimal* and *maximal values*. An *Ordinal Linear Regression* was also conducted, considering, as a dependent variable *the classification class* and five independent variables (*mean of upper limbs*, *mean of trunk, mean of lower limbs*, *mean of wheelchair manipulation* and *Handball skills*). The requirements to use the *Ordinal Regression* were verified through the *Multicollinearity test* and *Proportional odds*. The *Model Fitting Information*, *Goodness-of-Fit* and *Pseudo R-Square* were calculated. Data was analyzed using IBM SPSS Statistics v.29.0. The level of significance was $p \leq 0.05$.

Results

The next Table 1 provides a descriptive analysis of Physiological functional assessment and show that globally the athletes had a high level of functionality at upper limbs, (M=1.65; SD=0.51) followed by trunk functionality (M=1.40; SD=0.67) and the level of functionality of lower limbs is smaller. A more detailed description of all assessments carried out can be found in the following tables. The next Table 2 provides a descriptive analysis of Physiological functional assessment of lower limbs and shows that globally the athletes had a low level of functionality. Considering the lower limbs, the high mean values were found at Right Hips, with a mean value of 0.76 and the lowest mean value was obtained at Right Ankle-Foot (M=0.40).

Table 1 Descriptive analysis of physiological functional assessment

Variable	Average	SD	Max.	Min.
Lower limbs	0.57	0.6	1.67	0
Trunk	1.4	0.67	2	0
Upper limbs	1.65	0.51	2	0.38

Note: Each of items was evaluated on a scale from 0 to 2 (0-Can't done; 1-Medium done; 2-Well done)

Table 2 Descriptive analysis of physiological functional assessment of lower limbs

Variable	Average	SD	Max.	Min.
Right hip	0.76	0.85	2	0
Right knee	0.61	0.82	2	0
Right ankle-foot	0.4	0.7	2	0
Left hip	0.7	0.85	2	0
Left knee	0.52	0.79	2	0
Left ankle-foot	0.41	0.72	2	0

Note: Each of items was evaluated on a scale from 0 to 2 (0-Can't done; 1-Medium done; 2-Well done)

Table 3 shows a descriptive analysis of Physiological functional assessment of Trunk and shows that globally the athletes had a medium level of functionality at Trunk. Regarding the trunk functions, the high mean values were found at trunk flexion (M=1.53) and the lowest at trunk extension (M=1.27). The next Table 4 provides a descriptive analysis of Physiological functional assessment of Upper Limbs and shows that globally the athletes had a good level of functionality.

Table 3 Descriptive analysis of physiological functional assessment of trunk

Variable	Average	SD	Max.	Min.
Trunk flexion	1.53	0.63	2	0
Trunk extension	1.27	0.84	2	0
Trunk rotation	1.43	0.7	2	0
Trunk lateral flexion	1.39	0.73	2	0

Note: Each of items was evaluated on a scale from 0 to 2 (0-Can't done; 1-Medium done; 2-Well done)

Table 4 Descriptive analysis of physiological functional assessment of upper limbs

Variable	Average	SD	Max.	Min.
Right shoulder	1.76	0.46	2	0
Right elbow	1.74	0.46	2	0
Right hand	1.63	0.6	2	0
Right hand fingers	1.62	0.62	2	0
Left shoulder	1.77	0.45	2	0
Left elbow	1.78	0.41	2	1
Left hand	1.67	0.6	2	0
Left hand fingers	1.66	0.62	2	0

Note: Each of items was evaluated on a scale from 0 to 2 (0-Can't done; 1-Medium done; 2-Well done)

Table 5 provides a descriptive analysis of the manipulation of wheelchairs considering four aspects, namely, the Symmetrical Movement, Acceleration, Braking and Change Direction. Globally the athletes had a good level in terms of wheelchair manipulation. A descriptive analysis of wheelchair manipulation shows that a high mean value was at braking (M=1.52) and the lowest was found at symmetrical movement (M=1.38).

Table 5 Descriptive analysis of physiological functional assessment of wheelchair manipulation

Variable	Average	SD	Max.	Min.
Symmetrical movement	1.38	0.55	2	0
Acceleration,	1.5	0.54	2	0
Braking	1.52	0.52	2	0
Change direction	1.47	0.58	2	0

Note: Each of items was evaluated on a scale from 0 to 2 (0-Can't done; 1-Medium done; 2-Well done)

The next Table 6 provides a descriptive analysis of ball skills and shows that globally the athletes had a medium level of performance. The high mean values were found at Shoulder Pass (M=1.65) and Dynamic Reception (M=1.61), and, on the other side, the lowest mean value was found at dynamic catching the ball from floor (M=1.03). Considering the shot, the high mean values were found at using Arm (M=1.59) and the lowest mean value was found at using Trunk (M=1.25).

The Model Fitting

The model fitting information Table 7 shows a significant improvement in fit of the final model over the null model [$x^2(5) = 253.$, $p<.001$]. The model Goodness-of-Fit Table 8 contains the variance and the chi-square tests, which are useful for determining whether a model exhibits a good fit to the date. Non-significant tests results are indicators that the model fits the data well.

Table 6 Descriptive analysis of ball skills

Variable	Average	SD	Max.	Min.
Static dribbling	1.55	0.58	2	0
Dynamic dribbling	1.1	0.87	2	0
Shoulder pass	1.65	0.5	2	0
Chopped pass	1.5	0.61	2	0
Static reception	1.12	0.89	2	0
Dynamic reception	1.61	0.49	2	1
Static catching ball from floor	1.5	0.63	2	0
Dynamic catching ball from floor	1.03	0.94	2	0
Shot using trunk	1.25	0.87	2	0
Shot using arm	1.59	0.57	2	0
Shot using wrist	1.48	0.68	2	0

Note: Each of items was evaluated on a scale from 0 to 2 (0-Can't done; 1-Medium done; 2-Well done)

Table 7 Model fitting information

Model	-2 log likelihood	Chi-square	df	Sig.
Intercept only	253.832			
Final	0	253.832	5	<.001

Table 8 Goodness-of-Fit

	Chi-square	df	Sig.
Pearson	97.206	190	1
Deviance	28.739	190	1

In this analysis, we saw that both the Pearson chi-square test [$x^2(190) = 97.206$, p=1.000] and the deviance test [$x^2(190) = 28.739$, p=1.000] present a non-significant value, which means that the model fit is good. The results of pseudo-R-square present a high value Table 9 for all the tests (Cox and Snell, Nagelkerke and McFadden), that represents the proportion of variance in the criterion that is explained by the predictors. The next Table 10 shows the regression coefficients and significant tests for each of the independent variables in the model. The results show that four variables, with a statistically significant value, were found: Lower Limbs, Trunk, Upper Limbs, and Ball Skills. On the contrary, the only variable that did not prove to be a predictor of the athlete's final class was the handling of the wheelchair.

Table 9 Goodness-of-Fit

Pseudo R-Square	
Cox and Snell	0.915
Nagelkerke	0.997
McFadden	0.985

Table 10 Parameter Estimates

Variables	Estimate	Std. Error	Wald	df	Sig.
Lower limbs	4.202	1.442	8.495	1	0.004
Trunk	3.794	1.639	5.359	1	0.021
Upper limbs	10.386	4.287	5.871	1	0.015
Wheelchair	2.72	1.435	3.593	1	0.058
Ball skills	9.595	3.147	9.298	1	0.002

The predictor variables related with physiological functional assessment, namely Lower Limbs, Trunk and Upper Limbs and Ball Skills in the ordinal regression analysis were found to contribute to the model. The Estimate odds ratio suggests a positive relationship with the class classification, it means that as scores increase in these variables, there is an increased probability of falling at a higher level on class classification. The test for proportional odds Table 11 tests whether our one-equation model is valid. For our model, the proportional odds assumption appears to have been held because the significance of our Chi-Square statistic is 1.000 >.05.

Table 11 Test of parallel lines

	-2 log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	0	97.206	190	1
General	0	28.739	190	1

Finally, a complementary classification analysis was done, to permit to compare the classification observed with the classification predicted by the Model Table 12. The results of that comparison show that all the classes had a percent correct higher than 90% and the global overall percentage was 98%. These results corroborate the idea that the model proposed had a very good fit.

Table 12 Relation between the classification observed and the classification predicted by the model

Observed	Predicted				Percent correct
	1	2	3	4	
1	10	1	0	0	90.90%
2	0	33	0	0	100.00%
3	0	0	23	0	100.00%
4	0	0	1	30	96.80%
Overall Percentage	10.20%	34.70%	24.50%	30.60%	98.00%

Discussion

Globally, the results obtained showed that the proposed model presents a high degree of adjustment, with almost all exogenous variables included in the model proving to be predictors of the class assigned in the classification process. This study aimed to develop a specific classification system for wheelchair Handball and that is fundamental for the involvement of all the processes associated to the practice of parasport and naturally to the practice of that specific discipline.[24] The only variable that did not prove to be a predictor of the athlete's final class was the handling of the wheelchair. Our results demonstrated that the handball players have less functionalities in lower limbs, that's according to the impairment, because they are athletes who use wheelchairs for their daily lives, including their sports practice. Also, according to the results, it is at the distal level in the lower limbs that they present greater limitations. This result can be justified by the fact that a lower level of manipulation of the wheelchair may be due to a lower level of functionality of the upper limbs or trunk. On the other hand, chair handling is a highly trainable variable that can be improved with training. As the IPC recommend, during the evaluation we must avoid including the skills that they are likely to improve with training, as this does not represent situations of loss of functionality, but more the adaptive process.

The complexity and variability of the disabilities have shown that this situation is extremely important, hence the need for studies that show this relationship, since there are few studies on the classification, particularly in Wheelchair Handball. Handball is a sport that requires speed abilities and specific handball technical skills and coordination performance.[25] All the other variables included in the model (Trunk, Upper Limbs, Lower Limbs, and Ball Skills) prove to be predictors of the class assigned. That fact indicates that variables are determinants of performance in that sport, and complementary indicates that identify the key tasks to optimize the performance, as referred to a previous works.[12,20, 25] Considering the conceptualization required for evidence-based classification process[18], the five-step process has been completed, that is: (1) the eligible impairment types are identified - physical impairments; (2) a theoretical model was developed to identify the determinants and limitations of performance in this sport; (3) the development of tools to measure both the impairment and the determinants of performance, based at field test, that can be used in practice; (4) the use of those tests permit to assess the relationship between impairment and specific performance in this sport; (5) Identify the MIC (at least a loss of 4 points in functional assessment tests) and establish class for the sport, according with two criteria defined by Connick et al.[26]

Conclusion

The results obtained showed that the proposed model presents a high degree of adjustment and permitted identify determinant variables of performance in that sport and indicates key tasks to optimize classification process.

In this classification system, there was consistency in the specific parameters to assign a class to the athlete, according to their functional capacity, associated with the specific neuromotor alterations of each clinical condition. Long term benefits of this research will be the contribution for evidence-based classification system.

The careful evaluation of these athletes can be a key element to implementing this parasport for people with disabilities. Promoting the monitoring of these athletes and parasport is crucial as early as possible, to promote this parasport internationally and to be able to improve motorization and become a Paralympic sport.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

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