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**Original Investigation**

# Experts' consensus statement to guide the evidence-based classification of sitting volleyball athletes with a physical impairment: A Delphi study

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***Purpose:*** The main aim of this study was to identify future steps and research priorities for developing evidence-based classifications by experts' consensus in sitting volleyball.

***Methods:*** Forty-nine experts were invited to take part in a three-round Delphi study in eleven topic areas specific for development of classification in sitting volleyball. Two researchers independently analyzed the opinions of experts from each phase. To ensure external validation of the study, the third researcher reviewed the result of the analysis of the other two researchers and proposed corrections.

***Results:*** Fundamental sitting volleyball skills as sport performance determinants specific for the discipline were established. Experts identified that upper limb function is crucial for all volleyball activities and agreed with nearly all current minimum impairment and sport class VS1/VS2 criteria; however, they addressed that players with upper limb impairment are in the same class with lower limb impairment players, and suggested consideration for a separate class for those players.

***Conclusions:*** In the end, with conclusions pertaining to several eligible impairment groups of lower and/or upper limbs, the separation for upper limb impairment athletes or new impairments criteria for class VS1 needs to be discussed and developed. Importantly, respondents' opinion should not be the only evidence for developing and changing the current classification system. Any change in the system should come based on research results considering sport specific and participants needs.

***Keywords:*** Paralympic, sport, performance, class, disability.

## Introduction

Paralympic sport classification aims to group athletes with a similar impairment into sport classes to promote fair competition by minimizing the impact of the eligible impairment on the result of competition.[1-3] That is, classifications are used to ensure that successful para-athletes are those who have the most advantageous blend of skill as well as anthropometric, physiological, and psychological qualities, and the successful outcome does not depend on para-athletes' impairment.[4] Therefore, evidence-based classification systems must be based on valid and reliable methods for assigning sport classes to athletes. [5] For this purpose, the International Paralympic Committee (IPC) created the IPC Athlete Classification Code [6-10] that International Sports Federations (IFs) use for their specific disciplines. The IPC Code supports a harmonized and holistic approach to sport classification. According to the IPC Code, IFs must develop sport-specific classification systems for each parasport by means of multifaceted scientific research. Indeed, such research must be evidence-based and target the association between impairment and key motor performance indicators in the given parasport.[9]

Sitting Volleyball (SV) is one of two para-sport disciplines governed by World ParaVolley (WPV). SV playing rules are based on the international rules for able-bodied volleyball (Fédération Internationale de Volleyball - FIVB) with some exceptions. Notably, SV requires smaller court dimensions (10x6 m), as well as a lower net height at 1.15 m (men) and 1.05 m (women). Perhaps most importantly, while playing the ball a portion of the athlete's torso must be in contact with the ground.[1] Finally, unlike able-bodied volleyball, service blocks are allowed.

To fulfill the requirements of the IPC Code for the SV classification system[9], WPV prepared classification rules that defined who is eligible to participate in WPV and Paralympics competitions, including 7 out of 10 possible impairment types allowed under

the IPC International Standard for Eligible Impairments (limb deficiency [LD], impaired passive range of motion [IPROM], impaired muscle power [IMP], limb length difference [LLD], hypertonia, ataxia and athetosis). WPV established minimum impairment criteria (MIC) for each physical impairment type. Currently, volleyball sitting 1 (VS1) and volleyball sitting 2 (VS2) are the two sport classes in SV. WPV classification complies with the regulations regarding class descriptions (VS1, VS2), classification manual preparation, and assessment procedures for each eligible impairment. Athletes classified in VS1 have physical impairments that more significantly affect the fundamental skills related to SV while athletes classified in VS2 have physical impairments that minimally affect the fundamental skills related SV. A SV team can have a maximum of oneVS2 player on the court at a time for a fair competition.[11] Developing an evidence-based classification system for SV offers an exceptional prospect to identify how to achieve the aims of classification in SV and divide athletes into sport classes with a sport-specific system. There is a dearth of knowledge regarding whether the current MIC criteria and sport classes defined for SV reflect the limitations of biomechanical execution of fundamental SV skills. Core SV skills are categorized as scoring skills (attack hit, serve, block, and block of serve) and non-scoring skills (defense/digging, diving/stretching, setting, reception and moving on court in the sitting position).[1,11] Limited research has explored whether the current system in SV is sport specific.[1,12-14] Developing an evidence-based classification in SV in compliance with the IPC Code is a priority of the WPV classification commission. The development of an evidence-informed classification system can be approached, at least partially, by consulting SV experts' opinions using methods such as a Delphi study. This method has been successfully used to achieve progress in the classification system in other Paralympic sports, including sports for people with vision impairments such as judo, goalball, 5-a-side football, truck athletes, and swimming[15-20], and sports for people with physical impairments such as wheelchair basketball, and wheelchair fencing.[21-23] This method is commonly used to gather the collective opinion of the group of experts on a particular topic. It is based on the premise that "pooled intelligence enhances individual judgment and captures the collective opinion of the group of experts".[24,25]

The WPV strives to deliver a proper classification system compliant with the IPC Code to all stakeholders. Justification for conducting this study and developing the associated research question was to examine if using the Delphi method is possible to collect advantages and disadvantages of the current classification system in SV from SV experts as well as to explore new ideas for future studies and solutions for the current problems. The main aim of this study was to identify future steps and research priorities for developing evidence-based classifications based on experts' consensus in SV. The specific aims were: (1) to establish how many and which groups of eligible impairments and classes should be in SV, (2) to evaluate which fundamental SV skills are most likely to impact SV performance, (3) to evaluate

**Table 1.** The characteristics of participants in each phase of the Delphi study.

| **Participants** | | **WPV invited experts (n, %)** | | **WPV study experts (n, %)** | | **Phase 1 (n, %)** | | **Phase 2 (n, %)** | | **Phase 3 (n, %)** | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Gender** | Male | 72 | 71 | 42 | 72 | 33 | 67 | 24 | 63 | 17 | 68 |
| | Female | 29 | 29 | 16 | 28 | 16 | 33 | 14 | 37 | 8 | 32 |
| | Total | 101 | 100 | 58 | 100 | 49 | 100 | 38 | 100 | 25 | 100 |
| **Zone** | Asia Oceania | 19 | 19 | 10 | 17 | 9 | 18 | 5 | 13 | 2 | 8 |
| | Africa | 12 | 12 | 7 | 12 | 7 | 14 | 5 | 13 | 4 | 16 |
| | Europe | 33 | 33 | 19 | 33 | 15 | 31 | 13 | 34 | 10 | 40 |
| | Pan American | 37 | 37 | 22 | 38 | 18 | 37 | 15 | 39 | 9 | 36 |
| | Total | 101 | 100 | 58 | 100 | 49 | 100 | 38 | 100 | 25 | 100 |
| **Role in WPV** | Athletes | 21 | 21 | 11 | 19 | 10 | 20 | 8 | 21 | 7 | 28 |
| | Classifiers | 15 | 15 | 12 | 21 | 10 | 20 | 10 | 26 | 8 | 32 |
| | Coaches | 18 | 18 | 11 | 19 | 9 | 18 | 3 | 8 | 0 | 0 |
| | Referees | 25 | 25 | 12 | 21 | 10 | 20 | 9 | 24 | 6 | 24 |
| | ITOs | 16 | 16 | 7 | 12 | 6 | 12 | 4 | 11 | 2 | 8 |
| | Other | 6 | 6 | 5 | 9 | 4 | 8 | 4 | 11 | 2 | 8 |
| | Total | 101 | 100 | 58 | 100 | 49 | 100 | 38 | 100 | 25 | 100 |

Note: n - number of participants; - percentage of participants; WPV - World ParaVolley; ITOs – International Technical Officers; Others – researchers in classification in parasports

which measurements of impairment would be proper to allocate players to a particular sports class, (4) to evaluate what would be the specific MIC for each type of impairment in SV, and (5) to evaluate what the specific criteria would be between classes in SV based on experts' opinion.

## Methods

***Participants***

To obtain a wide range of opinions on the topic under study, a decision was made to invite six groups of participants (athletes, classifiers, coaches, referees, international technical officers, and others in SV; Table1) to complete the three-phased Delphi study survey as all the above-mentioned groups have observed athletes being evaluated within the WPV classification system.[25] Given that this was the first study of this kind in SV, the opinions of every party involved in the process of development of the sports discipline were considered crucial for helping develop knowledge in this area. To identify experts, we asked WPV Commissions chairs (Classification Commission, Coaches Commission, Athletes Health & Medical Commission, Technical Commission) to delegate experts from their commission considering inclusion criteria for participating in the study. The study was approved by The Local Ethics Commission (Code of Ethics of the World Medical Association - Declaration of Helsinki). All participants included in this study agreed to participate.

Inclusion criteria for participation was dependent on the role each individual played within SV. For SV classifiers, the decision was made to include level 2 and 3 international certified SV classifiers who have been actively classifying for at least two years within the WPV classification system. The inclusion criteria for coaches were at least 2 years' experience as a head coach of the national team or just retired from coaching a national team (later than 2018). The recruited athletes had to have at least two years' experience as a zonal or international player. We were seeking SV athletes who were currently competing or retired (later than 2019). Those requirements were necessary to ensure that athletes forming the experts' panel were classified at least once. The inclusion criteria for referees and technical officers were at least 5 years in the profession and for referees a level 3 International Certification or two years of refereeing with level 2 Zonal Certification. All chosen participants declared sufficient English proficiency and filled the questionnaire independently. The study had a large sample size compared to other Delphi studies concerning parasport classification due to the heterogeneous nature of their roles with relation to SV (Table 1).

***Experimental Design***

It was qualitative observational study. Two researchers independently analyzed the opinions of experts from each phase. To ensure external validation of the study, the third researcher reviewed the result of the analysis of the other two researchers and proposed corrections. Two of three researchers engaged in the analysis are experts in SV classification. The result of this validation analysis was subsequently discussed and agreed upon in A-K sections (suppl. Table 1).

***Instruments***

We used the Delphi study method in 2021, utilizing online questionnaires prepared in Microsoft Forms®. All questions in each phase were organized into 11 sections (A-K).[3,4,26,27] At least one general question was included in each section in phase 1. The first questionnaire contained socio-demographic questions (Table 1) for each group of experts and 38 open and closed questions, in which we asked the experts to elaborate on their answers. The questions were preceded with a rationale and explanation for why we asked about specific issues. After each question, there was a space where participants had to explain why they opted for a given answer.

In phase 2, there were 49 open and closed questions. If consensus was not reached in phase 1, the questions were re-worded based on answers provided in phase 1 and asked once again. Other questions were more detailed and pertained to themes which emerged in phase 1.

In phase 3, there were 40 open and closed questions based on answers from phase 2. In phases 2 and 3 experts were provided with a comprehensive overview of answers from the previous phase, evaluation of answers and potential consensus established. If consensus was not achieved, experts were being asked to give reasons for that situation.

The experts had 20-30 days to complete each of the questionnaires during each phase (suppl. Figure 1). The time allocated to fill in the questionnaire was extended in phases 2 and 3 due to lower-than-expected initial response rate. This situation may have resulted from preparation and participation in the Tokyo 2021 Paralympics, and from the Covid-19 pandemic.

The threshold for consensus was set at 70%, whereas consensus was considered near at 65-69%, and considered to be not reached at 64% and less. Hasson et al. stated that establishing consensus thresholds should be related to research findings. In other research utilizing Delphi surveys the values were established for 51% and 80%.[28] If the answers for a general question (phase 1) received less than 70% agreement, it meant that experts did not achieve agreement for the specific topic, and it was necessary to prepare questions for the next phases. The calculations were made separately for each question asked. The participants could have declared that they did not feel qualified to give an answer to any given question. Those answers were excluded from establishing consensus for each question.

***Statistical analysis***

All findings are presented as a descriptive analysis and are immediately discussed in sections A-K (Supplementary Table 1). Microsoft® Excel 2023 (version 16.77.1 Microsoft Corporation, One Microsoft Way, Redmond, WA 98052-7329, USA) was used for the descriptive analysis. For analyzing participants' statements, qualitative content analysis was employed, enabling the categorization of the most frequently occurring patterns in their responses.

## Results

***A: Aim of classification***

In phase 1, the panelists were asked if they believed that *in SV the way that physical impairments are currently classified fulfills the aim to "minimize the impact of eligible impairments on the outcome of the competition"*? Since consensus was not reached (yes 46%, partially 40%, no 8%, not sure 6%), which supports the necessity of conducting this study, we rephrased the question in phase 2. The panelists were asked to decide *what is necessary for the current classification system to fulfill its aim to minimize the impact of differing degrees of impairments on the outcome of the competition (multiple choice question)*. After excluding two panelists who did not feel qualified to answer the question (5%), 45% of the panelists suggested that *no actions are necessary*, 11% thought *more players in VS2 class should play on the court* and 28% thought *new classes for people with upper limb impairment should be created.* Multiple answers were given by 16% of respondents. Lack of consensus in previous phases resulted in a phase 3 question where we asked

experts to confirm their opinion or *elaborate two specific points/ ideas/activities/actions which will cause physical impairments currently classified in SV to fulfill its aim*. Consequently, 84% of panelists agreed that while the aim is fulfilled (consensus was reached), they see controversial issues.

***B: Eligible impairments***

In this section the seven groups of eligible impairments in SV were taken into consideration. In phase 1 panelists agreed that seven groups of eligible impairments should continue to play SV (81%; consensus was reached in phase 1). Surprisingly, when asked for elaboration of their opinion (phase 1), experts indicated a possibility of excluding people with hypertonia, ataxia, and athetosis from the Paralympic level of SV because of many disadvantages for SV (the impairment is fluctuating, problems with coordination and control of movement). On the other hand, 68% of panelists agree that *athletes with hypertonia, athletes with ataxia, athletes with athetosis should be included to play SV* (consensus was nearly reached in phase 2).

***C: Permanency of the impairment***

This section pertains to types of eligible impairments that are fluctuating or irregular or might be under medical treatment or intervention. In phase 1 panelists agreed that *athletes with a fluctuating impairment should be eligible to play SV* (72%; consensus was reached). In addition, *review status should be given to the player throughout his/her sports career* (86%; consensus was reached in phase 2).

***D: Minimum impairment criteria (MIC)***

SV MIC represents the minimal level of physical disability of seven eligible impairments. The existing classification system considers an athlete to be eligible to compete in SV when their eligible impairment meets this criteria. In phase 1, panelists did not achieve consensus that the current MIC for each impairment in SV accurately reflects the level at which it has an impact on sport performance (serving, overhead setting, blocking, blocking of serve, spiking, digging, receiving, moving the body on the court). We were interested in whether, and if so, which lower and upper limb MIC should be: "more restrictive", "more liberal" or "no changes recommended" (Table 2; suppl. Table 1).

We found consensus for *relative to the game of SV* (75% after exclusion of 6 people who did not feel qualified to answer) in phase 2 for the question about establishing MIC for SV for lower limb impairments that should be: (1) *relative to the standing able-bodied game* - 8 (25%), (2) *relative to the game of SV* - 24 (75%), and (3) *I do not feel qualified to answer* - 6 (16%). The same question was asked for MIC for SV for upper limb impairments. Consensus was reached for MIC *relative to the game of SV* (85% after exclusion of 5 people who did not feel qualified to answer).

The next question in phase 2 was about choosing an approach to eligibility and MIC in SV: (1) *MIC based on how the impairment impacts the biomechanical execution of performance of key activities in the game of standing volleyball* - 8 (26%); (2) *MIC based on how the impairment impacts performance of key activities in the game of SV* - 23 (74%); (3) *I do not feel qualified to answer* - 7 (18%). Consensus was reached for (2) *MIC based on how the impairment impacts performance of key activities in the game of SV* (74% after excluding 7 people who did not feel qualified to answer).

***E: Sport class allocation***

In panelists' opinion, the upper limb is crucial in performing all above-mentioned skills. Further, in phase 2 we were interested in whether, and if so, which lower and upper limb description of VS1/VS2 classes should be: "more restrictive", "more liberal" or "no changes recommended". We reached a "no changes recommended" consensus for each current criteria for VS1 and VS2 classes, but they suggested "more liberal criteria" for wrist and fingers IPROM.

***F: Congenital and acquired physical impairments***

In phase 1, we asked whether the panelists thought that the reason for an athlete's eligible impairment (congenital and/or acquired physical impairments) had different influences on an athlete's

**Table 2.** Panelists' responses to lower and upper limb MIC in phase 2 and 3.

| | | phase 2 (n = 38; n, %) | | | | phase 3 (n = 25, n, %) |
|---|---|---|---|---|---|---|
| | **Minimum Impairment Criteria (MIC)** | more restrictive | **no changes recommended** | more liberal | NQ | **agree to keep MIC** |
| **LOWER LIMB** | Lower limb deficiency: Chopart or Lisfranc amputation one or both sides | 8<br>27% | | 6<br>21% | 9<br>24% | |
| | Leg length discrepancy: Shortened lower limb length by 7% or greater | 5<br>16% | 18<br>**NC: 60%** | 7<br>24% | 8<br>21% | **C: yes - 21 (91%)**<br>no - 2 (9%), NQ - 2 (8%) |
| | Loss of muscle points ONE or BOTH lower limbs: 7 or > | 7<br>24% | 16<br>**NC: 55%** | 6<br>21% | 9<br>24% | **C: yes - 19 (100%)**<br>no – 0, NQ - 6 (24%) |
| | Impaired PROM Hip: Not more than $90^0$ of hip flexion (bend) | 4<br>14% | 22<br>**C: 76%** | 3<br>10% | 9<br>24% | no phase 3 |
| | Impaired PROM knee one side: Knee flexion (bend) reaches $45^0$ but not more than $90^0$ | 9<br>30% | 20<br>**CN: 67%** | 1<br>3% | 8<br>21% | **C: yes - 20 (100%)**<br>no – 0, NQ - 5 (20%) |
| | Impaired PROM ankle: Ankle is ankylosed (fixed) in any position | 10<br>33% | 16<br>**NC: 54%** | 4<br>13% | 8<br>21% | **C: yes - 14 (78%)**<br>no - 4 (22%), NQ - 7 (28%) |

| | | | | | | |
|---|---|---|---|---|---|---|
| UPPER LIMB | Upper limb deficiency: Any 4 digits on one hand at MCP joints (junction of fingers to hand); OR | 5<br>17% | 20<br>**CN: 69%** | 4<br>14% | 9<br>24% | no phase 3 |
| | Upper limb deficiency: Thumb and 2 adjacent fingers on one hand; OR | 5<br>17% | 17<br>**NC: 59%** | 7<br>24% | 9<br>24% | **C: yes - 17 (77%)**<br>no - 5 (23%), NQ - 3 (12%) |
| | Upper limb deficiency: Thumbs both hands | 5<br>17% | 20<br>**CN:69%** | 4<br>14% | 9<br>24% | no phase 3 |
| | Upper limb deficiency: Index and long fingers both hands | 6<br>21% | 18<br>**NC: 62%** | 5<br>17% | 9<br>24% | **C: yes - 19 (90%)**<br>no - 2 (10%), NQ - 4 (16%) |
| | Upper limb deficiency: Dysmelia reducing length of upper limb by 25% or > | 4<br>14% | 18<br>**NC: 62%** | 7<br>24% | 9<br>24% | **C: yes - 17 (85%)**<br>no - 3 (15%), NQ - 5 (20%) |
| | Loss of muscle points – one limb: Total 15 or > | 3<br>11% | 23<br>**C: 78%** | 3<br>11% | 10<br>26% | no phase 3 |
| | Loss of muscle points – one limb: loss of 3 muscle points in shoulder flexion (no lift arm against gravity) | 2<br>7% | 24<br>**C: 86%** | 2<br>7% | 10<br>26% | no phase 3 |
| UPPER LIMB | Loss of muscle points – one limb: loss of 3 muscle points in elbow extension (no straighten elbow against gravity) | 2<br>7% | 24<br>**C: 86%** | 2<br>7% | 10<br>26% | no phase 3 |
| | Impaired shoulder PROM: Abduction or flexion (lifting arm to side or front) not more than 90 degrees one side | 4<br>14% | 21<br>**C: 75%** | 3<br>11% | 10<br>26% | no phase 3 |
| | Impaired Elbow PROM: Unable to straighten arm past the 45 degrees bent position | 3<br>11% | 23<br>**C: 78%** | 3<br>11% | 10<br>26% | no phase 3 |
| | Impaired Wrist PROM: Wrist stiff between neutral (hand in line with forearm) to full extension (wrist bent back) | 9<br>32% | 17<br>**NC: 61%** | 2<br>7% | 9<br>24% | **C: yes - 20 (91%)**<br>no - 2 (9%), NQ - 3 (12%) |
| | Impaired Fingers PROM: Afunctional one hand | 8<br>29% | 17<br>**NC: 61%** | 3<br>10% | 9<br>24% | **C: yes - 20 (91%)**<br>no - 2 (9%), NQ - 3 (12%) |
| | Hypertonia, Ataxia, Athetosis* | 5<br>19% | 20<br>**C: 74%** | 2<br>7% | 11<br>29% | no phase 3 |

Note: n - number of participants; NQ - Not qualified to answer; NC - Consensus was not reached; C - Consensus was reached; CN - Consensus was nearly reached; PROM – passive range of movement; MIC - Minimum Impairment Criteria; * Class 8 CPISRA clear evidence of spasticity (Ashworth grade 1-2 in affected limbs), ataxia, athetosis or dystonia with an evident impairment of function observed during classification and on the Field of Play)

sport performance. Neither congenital nor acquired impairments were thought to give the athletes an advantage in terms of sports performance (>80%). Based on justifications presented by the panelists, in the next phase we asked if they believed that sports experience (in volleyball or other sport) gained prior to the acquired impairment impacted positively (was an advantage) in SV sport performance. This time we reached the consensus (92% after excluding one person who did not feel qualified to answer). Also, after rephrasing the question from phase 1 we asked whether the respondents thought that congenital impairments gave the athletes an advantage over athletes with acquired impairments in terms of sports performance or vice versa. This time the panel shared their opinions that neither congenial nor acquired impairments gave the athletes an advantage (72% of panelists agreed after exclusion of five people who did not feel qualified to answer, 92% in second question after exclusion of one person).

***G: Methods used for the measurement and assessment physical impairment***

There are specific methods in SV classification to measure each eligible impairment. At first, we were interested in whether the panel believed that these specific methods were enough for SV

athletes to assess the impact of their impairment on each of the fundamental activities/sport performance (serving, blocking, blocking of serve, spiking, digging, receiving, moving the body on the court). We did not reach a consensus since only 63% of respondents stated that these specific methods, were enough to assess the impact of an athlete's impairment on each of the fundamental activities/sport performance. Some claimed that these measurements only partially fulfill their function and 9% of panelists declared that currently used measures are not enough. This may be why experts stated that athletes' observation on the court must be considered (9%) especially for the borderline cases (not eligible/VS2, VS2/VS1), IPROM and IMP. Therefore, in phase 2 the panelists were asked to identify whether the specific impairment measure listed was enough to establish severity of each impairment. The panelists agreed with the measurement method for (1) IPROM goniometry testing (85% after exclusion of 12 people who did not feel qualified to answer); (2) LD limb length measurement and length comparison: consensus was reached (93% after exclusion of 8 people); and (3) LLD leg length measurement and length comparison (93% after exclusion of 8 people). There was disagreement on (1) testing IMP - manual muscle testing (58% panelist agreed and 42% disagreed); (2) specific functional tests and spasticity grades by the Ashworth scale for hypertonia testing (63% vs 37%); (3) specific tests for ataxia (63% vs 37%); and (4) specific tests for athetosis (58% vs 42%). In this question, up to 19 respondents excluded themselves from answering which indicates the complexity and specificity of the matter in question for our panel. To explore this issue further, we asked the panel which groups of eligible impairments must always be (without exceptions) under observation assessment (OA). After phase 3, we reached an agreement for every eligible impairment. Again, from 7 to 15 of the panelists excluded themselves from answering.

Also, in phase 1 we questioned the panel whether OA of sport performance, which is now an optional supportive method to assess each eligible impairment and athlete's functional abilities in SV games, should be obligatory (excluding obvious impairment impact on functional abilities - amputation). The panelist reached an agreement (84%).

Since phase 2 consensus was not reached in all areas, we requested the panelists to suggest a specific method/measurement/tool that should be used in addition to functional sport specific testing and observation. A few panelists proposed some unspecified methods (functional tests) as well as numerous valid and reliable tools to measure IMP.

***H: Classification rules and regulations***

Currently, at each competition in SV where international classification takes place, the classification is performed by a panel of classifiers. There are two classifiers, with at least one L3 and one L2, in an international panel. We asked the experts how many classifiers should be in one panel to perform classification assessment. There was not an agreement regarding the number of classifiers in a classification panel however 84% respondents believed that there should be two or three classifiers in each panel. The suggestion from experts about three people in one panel was understandable - it is easier to resolve disputes between three classifiers. In phase 2 we have rephrased the question asking what the minimum number of classifiers is necessary to have in a classification panel. Again, there was a disagreement between panelists since 45% decided that two classifiers are enough and 55% that three classifiers are the minimum number.

In phase 1, nearly 30% of respondents decided that wearing of an upper limb prosthesis on court in SV should change an athlete's sport class. The same question was asked concerning wearing of a lower limb orthosis. This time consensus was reached since 84% of experts believed that wearing of lower limb orthosis should not change the athlete's class. In phase 2 we asked whether using upper limb prosthesis can help gain better functionality on the court. Our panelists agreed (79%).

Additionally, in phase 2 we asked whether the use of an upper limb orthosis or prosthesis in SV should change the athlete class only if it affected the performance of key activities enough that they would be allocated a different class (a prosthesis/orthosis of upper limb used by an athlete with upper limb amputation below elbow). Once again, regarding the upper limbs we did not reach a consensus. The same question was asked regarding lower limbs, and 48% agreed with this statement, 52% disagreed and five people were excluded because they did not feel qualified to answer. Consensus was not reached.

We asked experts to address those three conditions (Table 3, suppl. Table 1). Currently, during classification evaluation: (a) both lower limbs are considered when assessing muscle power; or (b) one joint in one lower limb is considered when assessing IPROM, LD, LLD, amputation; or (c) one upper limb is considered when assessing IMP, IPROM, amputation, or upper limb length difference.

***I: Practical implications of current SV classification***

In phase 1, an open-ended question was prepared which asked for recommendations on practical implications of the current SV classification. Consistent and clear suggestions were helpful to create one question for phase 2. Specifically, we checked if they agree that if there should be discussion on sport rules regarding a special place in the court *for a player with upper limbs impairments (regardless of the impairments and no matter which class, Upper Limb_VS1 or Upper Limb_VS2). Around 85% of the panelists disagreed* (Table 3, suppl. Table 1).

***J: Intentional misrepresentation (IM)***

In phase 1 we asked if panelists were aware of an athlete who misrepresents their abilities: 53% confirmed, 30% contradicted and 17% were not sure. The panelists agreed that athletes who misrepresent should be sanctioned. The comments received in phase 2, 23% stated that *only the athlete should be sanctioned for athlete's IM* (Table 3, suppl. Table 1).

***K: Research priorities***

Participants did not suggest future research priorities directly. The most common answers were those related to the boundaries between VS1 and VS2, difficulty in assessing IMP, player's review status, and practical issues connected to classification (OA, number of classifiers, translation).

## Discussion

***A: Aim of classification***

Since consensus was not achieved in the first two phases we asked experts to confirm their opinion or *elaborate two specific points/ideas/activities/actions which will cause physical impairments currently classified in SV to fulfill its aim*. Consequently, 84% of panelists agreed that while the aim is fulfilled (consensus was reached), they see controversial issues. The rest number of panelist (16%) did not agree with the presented ideas because they considered players with upper limb impairment and lower limb impairment should not be in the same class, IPROM of hip joint should be considered in the assessment, or specification of upper limb prosthesis use should be further evaluated. This result was expected.

***B: Eligible impairments***

Panelists agreed that athletes *eligible to play SV should have*

**Table 3.** Panelists' responses to propositions and suggestion of three questions.

| | Agree* (n, %) | Not Agree* (n, %) | NQ (n, %) |
|---|---|---|---|
| **Proposition of three different conditions considered in SV classification assessment** | | | |
| both lower limbs are under consideration assessing muscle power | 22 **C: 85%** | 4 15% | 12 31% |
| one joint in one lower limb is under consideration assessing passive range of motion, leg length difference, amputation (lower limb deficiency) | 21 **C: 78%** | 6 22% | 11 29% |
| one upper limb is under consideration assessing muscle power, passive range of motion of upper limb | 18 **C: 69%** | 8 31% | 12 31% |
| **Proposition of UPPER LIMBS impairment changes in sport rules in SV** | | | |
| possibly: the current situation in sport rules | 29 **C: 85%** | 5 15% | 4 15% |
| mandatory: six on court players must include one upper limb impairment | 6 18% | 28 **C: 82%** | 4 10% |
| with VS2 lower limb impaired player: maximum two VS2 players on the court: one is with lower limb impairment; one is with upper limb impairment | 9 27% | 24 **C: 73%** | 5 13% |
| **Suggestions of ideas how to manage intentional misrepresentation (IM) in SV** | | | |
| introduce more detailed objective classification criteria and more transparent classification procedures | 30 **C: 86%** | 5 14% | 3 8% |
| complete observation assessment during the tournament for all the players | 22 **CN:65%** | 12 35% | 4 11% |
| educate all parties involved about IM and its consequences | 36 **C: 95%** | 2 5% | 0 |
| continue to implement an effective and fair process of inquiry and management of cases of IM with application of appropriate sanctions to athletes, and to anyone complicit to such IM, e.g.: coaches, teams, or the national organization as appropriate | 36 **C: 95%** | 2 5% | 0 |

Note: *Calculations made after exclusion of panelists who did not feel qualified to address statements; ** calculations made for all 38 panelists which took part in second round of the Delphi study; n – number of participants; NQ – not qualified to answer; SV – sitting volleyball; C - Consensus was reached; CN - Consensus nearly reached; IM - intentional misrepresentation; VS – volleyball sitting class

*impairments affecting either one or both lower OR upper limb(s). This is the current situation with SV classification rules* (89%; consensus reached in phase 2). This classification rule makes SV open for people with impairments in different body regions. In contrast to SV, an athlete eligible to play wheelchair basketball (WB) must have impairment affecting at least one lower limb.[29,30] To play wheelchair rugby, an athlete must have impairment in at least three limbs.[31]

***C: Permanency of the impairment***

Panelists agreed that *athletes with a fluctuating impairment should be eligible to play SV* (72%; consensus was reached). This is compliant with the IPC code.[6-10] However, panelists had varying opinions on if *athletes under medical treatment should be eligible to play SV* in phase 1 and finally agreed that *an athlete cannot play SV/cannot be classified until the athlete has completed all medical treatments to promote recovery and has residual impairment* (80%; consensus in phase 2).

***D: Minimum impairment criteria (MIC)***

The absence of consensus on foot amputation in MIC highlights the need for further discussion and investigation in the future. This highlights the importance of establishing MIC relative to the SV game instead of the standing game, as fewer players might be found eligible to play.

***E: Sport class allocation***

Sport classes are determined based on the impact of the impairment on performance in the adapted form of the sport. In SV there are two sports classes: VS1 and VS2 which was confirmed through experts' consensus in phase 1. Moreover, participants could not agree on the most important specific skills for classification in SV (overhead passing (setting), blocking serve receive, forearm passing, digging, movement on the court, attacking, extended reach, serving).

***F: Congenital and acquired physical impairments***

The participant's answers clearly indicate that only sports experience prior to acquiring impairments positively impacts sports performance. Similar conclusions were drawn from other Delphi study research (except from Krabben's et al.,[16]) where the panel decided that the age at which impairment is acquired influences the impact of the impairment on performance.[18-20] Importantly, in Runswick's et al. [20] study, there was a disagreement whether acquired or congenital impairment would have an advantage.

***G: Methods used for the measurement and assessment physical impairment***

To sum up this part, the issue of OA and the methods used for the measurement and assessment of physical impairment in SV was raised in the research priorities section as well. Together with a significant group of panelists who did not feel qualified to answer the questions it clearly indicates that the matter is complex and not understood properly by all parties involved in the study. In previous Delphi studies researching the classification process the issue of appropriate methods to measure the eligible

impairments has raised doubts and consensus was difficult to achieve.[18,32] Lack of understanding of the issue may lead to perceiving the classification process as not sufficiently fair. This, in turn, may undermine the trust in the whole classification process. We recommend WPV to provide an online video about the classification process in SV and outline clear procedures of classification to enable broader knowledge, awareness and understanding among SV players and coaches.

***H: Classification rules and regulations***

One of the widely debatable issues in SV is whether wearing any kind of orthosis or upper limb prosthesis could/should change an athlete's class. At present the classification rule says that "*Wearing any kind of orthosis or upper limb prosthesis on court cannot change the athlete's class*". We asked experts' whether the wearing of an upper limb prosthesis on court in SV should change an athlete's sport class. In phase 1, nearly 30% of respondents decided that wearing of an upper limb prosthesis on court in SV should change an athlete's sport class. The most common justifications for their opinion were that the use of an upper limb prosthesis (equivalent in dimensions) and the function (i.e., ability to block, movement on the court, extended their reach, or overhead pass) are better, even though the impairment is still present (below elbow amputation).

In the opinion of the respondents, rules as currently described in the manual[11] should stay, because classification and sport results should not be related to tools and assistive equipment.

***I: Practical implications of current SV classification***

Most panelists saw some problems with the classification process of athletes with upper limb impairments or neurodegenerative diseases because their impairment could be severe, and coaches will not choose them to compete with others. The question was about special classes and rules for athletes with upper limb impairments. Around 85% of the panelists disagreed with a new sports rule regarding a special place in the court for a player with upper limb impairments (Table 3, suppl. Table 1).

***J: Intentional misrepresentation (IM)***

According to IPC[9], IM is a situation when an athlete intentionally misrepresents his or her skills and/or abilities and/or the degree or nature of their eligible impairment to a classification panel" (paragraph 6.2). In addition, "any athlete or athlete support personnel, who knowingly assists, covers up or disrupts the evaluation process with the intention of deceiving or misleading the classification panel is guilty of IM" (paragraph 6.3). IM is a serious offense since it can undermine the legitimacy of para sport.[16,20] In phase 1 we asked if panelists were aware of an athlete who misrepresents their abilities: 53% confirmed, 30% contradicted and 17% were not sure. We also asked an open-ended question requesting opinions about athletes who misrepresent their abilities during classification The comments received helped create one question for phase 2 (the last one for this section). We also ask an open-ended question requesting opinions about athletes who misrepresent their abilities during the tournament.

Panelists indicated education of all parties involved, and the fair process of inquiry as the most effective tools to manage IM cases. Those statements are consistent with decisions made by panelists in Krabben's et al.'s [16] study. However, athletes being stressed during classification could be perceived as they misrepresent their abilities before the tournament. Mindfulness training for these players could be a solution in their competitive and classification anxiety.[33]

***K: Research priorities***

Due to a scarcity of research in the SV classification process the panelists were asked their opinions about the research priorities in the discipline. This open-ended question only appeared in phase 1 and offered many recommendations.

Research issues were raised in various sections and phases of the questionnaire which may point to the importance of asking questions to further develop this discipline. Also, the feedback from this study indicates that panelists vary in the level of knowledge about the classification process. Some of the panelists proposed research priorities that are already explained in detail in the SV classification manual. Moreover, some panelists declared that the classification process is too complicated while others emphasized the need to elaborate on some issues. This may indicate the need to educate all involved parties about classification to give broader awareness of the procedure.

On the other hand, the aim to evaluate the specific criteria for classes differentiation in SV based on experts' opinion was articulated in our presentation of the results.

However, our findings did not identify clear determinants that distinguish groups of SV athletes into classes, considering the sport's specificity. A similar approach to evidence-based classification in paraswimming was presented by Payton et al. [34] In their study, authors identified active drag as a specific determinant differentiating athletes with central motor and neuromuscular impairments during freestyle swimming suggesting it should be considered in reclassification. We hoped to identify a specific determinant for SV based on experts' responses. Unfortunately, no such insights emerged from the final section of our study or elsewhere. Based on our expertise, a key determinant influencing SV athletes with impairments appears to be trunk stabilization in sitting position and the ability to return to a basic sitting position following a sporting action. Assessing trunk function in the seated position as adopted by athletes in SV, could serve as a potential determinant for class differentiation. Nevertheless, further studies in this field are necessary.

*Limitation of the study and recommendation for future research*

The decreasing number of experts participating in subsequent phases could be considered a limitation of the study. The global COVID-19 pandemic and preparations for the Tokyo Paralympics in 2021 could have affected the response rate. Additionally, the long and detailed questionnaire could have led to the resignation of panelists completing subsequent forms. There was an uneven distribution of characteristics of the expert panel, with 71% identifying as men, 70% from Europe and the Pan American Zone. The dominance of experts from The Global North may contribute to unheard voices in WPV. However, SV is a paralympic sport discipline, and similar to Fliess Douer's et al. [35] study, the social-demographic characteristic of the sample reflects the SV community. In the future, it would be worth supplementing the results of this study with individual in-depth interviews (IDI) to collect data allowing a detailed understanding of the respondents' opinions and distinguish the basic discourses behind their beliefs.

## Practical Applications

This paper results are important in development classification before implementing changes in the rules of classification systems, which will have to take place due to the publication of the new International Paralympic Committee Classification Code after Paralympics in Paris 2024 (December 2024/January 2025). There are only few papers about this topic. All parasports will be conducting similar studies in their sport to keep the high level of classification development.

## Conclusions

This study, using the Delphi method aimed to indicate the future steps and research priorities toward evidence-based classification using SV experts' consensus, was the first of its kind in SV. Apart from providing the opportunity to systematically collect large portions of data, it allowed all parties involved in the classification process to share their opinions on the most urgent and critical issues and treated respondents as autonomous and essential participants in the SV community. Moreover, the considerably larger sample size than in other classification process studies was an advantage of this research. The size of the research sample and its differentiation in terms of the roles played by the respondents allowed for an in-depth perspective on the classification process. In conclusions:

(1) The current number of eligible impairment groups of lower and/or upper limb should stay like it is. More than two classes in SV (VS1, VS2) could be considered in the future because many respondents indicated that players with upper limb impairments have very specific functional limitations, different from others. Ultimately, the respondents would not decide to increase the number of classes under the current circumstances.

(2) All skills, such as overhead passing (setting), blocking serve receive, forearm passing, digging, movement on the court, attacking, extended reach, serving, are key skills for SV game and it was not possible to choose the most important ones. Upper limb function is important in the game because all skills rely on the upper limb.

(3) Nearly all criteria to allocate SV players to a particular sports class remain intact. More liberal criteria for wrist and fingers IPROM should be developed.

(4) The lack of consensus indicates the need to discuss MIC foot amputation.

(5) One of the most important points for future discussion by WPV is the separation of classes for upper limb impairment athletes or new impairment criteria/description for class VS1.

The researchers observed from this Delphi study process that there were areas of inquiry where significant number of experts did not feel qualified to answer the question. This demonstrates the need to increase knowledge and awareness about various issues related to classification in SV as well as to pay attention to the communication system between WPV and stakeholders. Insufficient knowledge of any key entities involved with the classification process may result in lack of trust and hinder the development process of SV.


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## Ethical Committee approval

The Senate Commission of Science Research Ethics at Jozef Pilsudski University of Physical Education in Warsaw: SKE-01-02/2020 in accordance with the ethical standards as described in the Declaration of Helsinki.

## Informed Consent Statement

Informed consent statement was obtained from all participants.

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## Topic

Sport science

## Conflicts of interest

The authors have no conflict of interest to declare. It could be important to underline that JM, LEA are classifiers in SV, and they obviously were excluded from the experts' group in this study. JM, NO, FE, LEA are members of WPV Scientific Research Commission, BM is an expert in classification as well he is a classifier in wheelchair basketball.


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## Author-s contribution

JM, NO: Substantial contributions to the conception AND design of the work; AND the acquisition, analysis, and interpretation of data for the work; AND drafting the work AND revising it critically for important intellectual content; AND final approval of the version to be published; AND agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved; AND conceptualization; AND the author of correspondence.

LEA, FE, BM: Design of the work; AND the acquisition, analysis, and interpretation of data for the work; AND revising it critically for important intellectual content; AND final approval of the version to be published; AND agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. JM, LEA are classifiers in SV, and they were excluded from the experts' group. JM, NO, FE, LEA are members of WPV Scientific Research Commission. BM is an expert in classification as well he is a classifier in wheelchair basketball. All authors read and agreed to the published version of the manuscript on Acta Kinesiologica.

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## Supplement Materials Capture

suppl. Figure 1. Timeline of all the Delphi study phases
suppl. Table 1. The process of reaching consensus on the central questions posed in each of the 11 sections (A-K)

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