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Towards Beijing 2022: Discussion on the growth in size of Paralympic Winter Games in terms of participating data from Örnköldvik 1976 to PyeongChang 2018

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ABSTRACT

Paralympic Winter Games (PWG) born in 1976. Across Games, media personnel has increased suggesting an increase in PWG size. However, the growth of PWG from Örnköldvik 1976 to PyeongChang 2018 in terms of participating data has not been discussed. This work aims to find if the growth in media coverage comes together with an increase in PWG size in terms of National Paralympic Committee, sports, medal events, and athletes. The presence of trend over PWG editions is evaluated with Mann-Kendall Trend Test and differences among sports and continents with Kruskal Wallis test. Showing a significant monotonic trend, the number of countries ($p < .001$, $\beta = 0.81$) and the number of participating athletes ($p < .001$, $\beta = 7.40$) seem to be good indicators of PWG. These two indicators are good descriptors of PWG size because related to sociocultural and political aspects. In contrast, number of medal events being related to many factors did not show statistically significant trend ($p = .95$); therefore, this indicator seems to be less appropriate to describe PWG size. If the whole history is considered, slow but significant changes in number of sports ($p < .001$, $\beta = 0.08$) suggest this indicator could be considered in describing Games size.

Keywords: Games size; Winter sports; Adaptive sports; International sports events; Olympism.

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INTRODUCTION

Paralympic Winter Games (PWG) as we know them today are a very young event, which was born forty years ago, in 1976. Before then, people with physical disabilities practiced sport only for rehabilitation purposes. After the Second World War, Sir Ludwig Guttmann became the director of the National Spinal Injuries Unit in Stoke Mandeville, a centre in which soldier and civil were assisted for injuries due to the War. In this centre, sport was promoted as a natural exercise for rehabilitating physical fitness, speed and coordination, strength and endurance (Guttmann, 1976). In 1948, Sir Ludwig Guttmann organized the first Stoke Mandeville Games for wheelchair athletes and since this year the Games event has increased in importance. The 1960 was a pivotal year because the Stoke Mandeville Games became the Paralympic Games. For the first time, Summer Olympic Games and Paralympic Games were held in the same city (Rome, Italy), venue, and year (1960). This event was labelled as the first Summer Paralympic Games (Vanlandewijck & Thompson, 2011). Four years later, in 1964, a similar scenario was seen in Tokyo (Japan). For Winter Olympic and Paralympic Games, it took few more years (1992) to get a unique event due to the difficulties in environment and infrastructure.

The first PWG were held in 1976 in Örnsköldvik (Sweden). In this event, only amputee and athletes with visual impairment participated (Vanlandewijck & Thompson, 2011). Athletes competed in two events: Alpine Skiing and Cross-Country Skiing. Another important date in Paralympic Games scenario was the 22 September 1989, year in which the International Paralympic Committee was founded as international non-profit organization to act as the global governing body of the Paralympic Movement (International Paralympic Committee, 2012a). Paralympic Movement stimulates the growth of disability sport worldwide promoting Paralympic Games and other para-sport events as well (Misener & Darcy, 2014). In 1992, Winter Olympic and Paralympic Games were held for the first time in the same city (Albertville, France) using the same venue and facilities (Legg & Steadward, 2011). After that event, the sixth PWG were held only two years later (in 1994) in order to alternate Summer and Winter Games every two years (International Olympic Committee, 1986). All PWG editions are represented in the timeline in Figure 1.

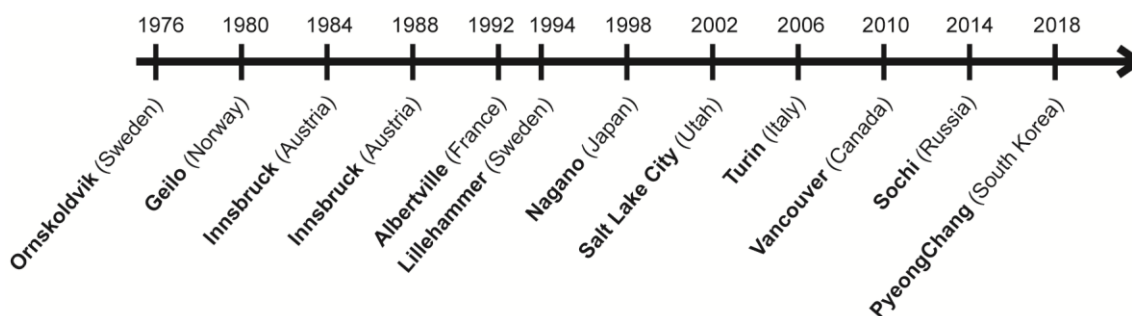


Figure 1. Paralympic Winter Games timeline.

The last PWG, PyeongChang 2018, was the greatest in terms of size. Since the first event, there has been an enhancement in the number of athletes, participating nations, and included sport disciplines (International Paralympic Committee, 2018b). The participation data in terms of a total number of athletes and countries is the most used method to define the Games size (Lauff, 2011). In the literature, studies exist that give an overview on athletes participation and medals (Gold & Gold, 2007; Mauerberg-DeCastro, Campbell, & Tavares, 2016) and on participation of the developing countries (Lauff, 2011) in Summer and Winter Paralympic Games. Concerning PWG, participation in terms of nations and athletes between 1992 and 2014

has been investigated (Brittain, 2017a). In addition, an overview of medal success and historical participation of two representative countries per continent has been presented (Brittain, 2017b). However, an exhaustive and comprehensive description of PWG size in terms of athletes and countries participating data since the first event in 1976 up to date is still missing.

Other than participation data, also organization (hosting cities, sports programs, and events) and revenues (television rights and audience) have been used as indicators to assess the Olympic Games size (Chappelet, 2002). In addition, the number of tickets sold, broadcasting rights, total costs, and capital revenues have been identified as criteria to distinguish between events and mega-events (Müller, 2015). The great interest in Paralympic Games has been documented by the increasing trend of published article researches in sport communication field, passing from 3-4 published articles between 1980 and 1999 to 40 published articles between 2010 and 2015 (Hambrick, 2017). Finally, a well-documented increase in PWG media coverage has been shown in years: media personnel in Sochi 2014 was five times higher compared to media personnel in Albertville 1992 (Brittain, 2017c). Greater media interest in such event suggests that PWG has increased in size. The aim of this work was to discuss if this growth in media coverage comes together with an increase in size in terms of athletes and countries participating data from Örnsköldvik 1976 to PyeongChang 2018 and towards Beijing 2022.

METHODS

In this section, it is described dataset collection and statistical analysis used for trend analysis and for the evaluation of statistical differences.

Data

In order to evaluate the growth of the PWG, data about total number of National Paralympic Committee (NPCs), number of sports, number of medal events, and number of participating athletes were collected referring to the International Paralympic Committee web site (International Paralympic Committee, 2016b). In addition to the total number of NPCs, the number of NPCs per each continent was assessed. Concerning the total number of medal events, also the number of medal events per sport was evaluated. Finally, concerning the total number of participating athletes, the number of participating athletes per gender, continent, and sport were considered as well.

Analysis

The trend of all these variables was assessed over PWG editions (in which they were present) using the Mann-Kendall Trend Test and, if significant, the Theil-Sens estimator was calculated in order to define the direction and the magnitude of the monotonic trend (β). The Theil-Sens estimator is a non-parametric regression technique that calculate the median of pairwise slopes between all observations (Sen, 1968). Kruskal Wallis test was used to evaluate significant differences in the number of medal events assigned to different sports, in the number of NPCs coming from different continents, in the number of participating athletes competing in different sports, in the number of participating athletes coming from different continents, and in the number of participating male and female athletes.

RESULTS

In this section are presented the results about the number of national Paralympic committee, number of sports, number of medal events, and number of participating athletes.

Number of National Paralympic Committee

Figure 2 reports the total number of participating NPCs in the PWG over the years and shows a significant monotonic increasing trend since the first edition of the Games ($p < .001$, $\beta = 0.81$). Despite the monotonic increase, a plateau of 31 participating countries is visible for two following editions of PWG, in Lillehammer 1994 and Nagano 1998 (International Paralympic Committee, 2016b). With 49 NPCs, PyeongChang 2018 reaches the highest number of participating NPCs in the history of PWG. To date, there is no speculation on the NPCs for Beijing 2022.

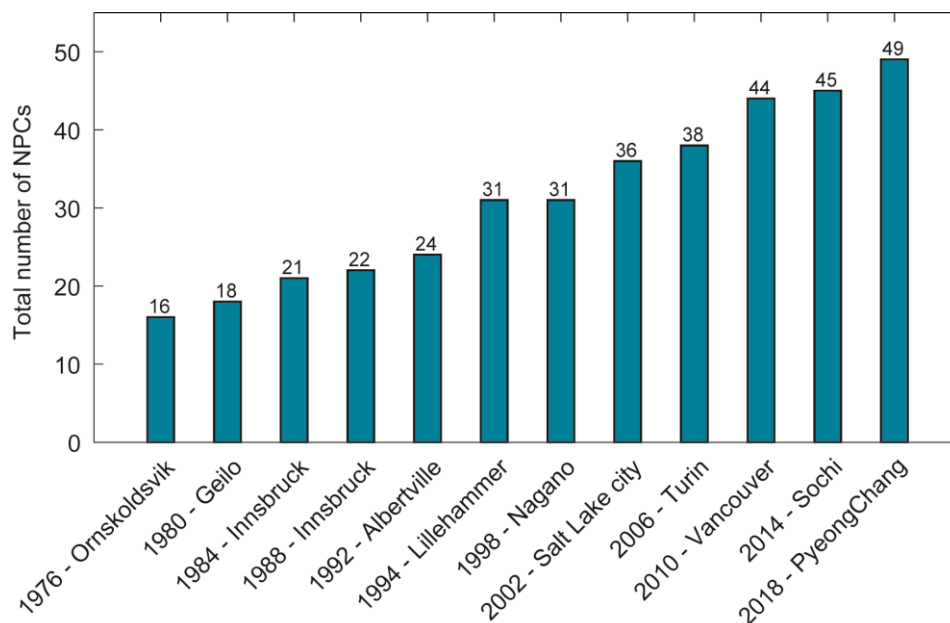


Figure 2. Total number of participating National Paralympic Committees (NPCs) at the Paralympic Winter Games over the years.

Figure 3 shows in detail the number of participating NPCs per each continent. Since the beginning of the Games, the greatest contribution is given from European nations, as it also happens in the Winter Olympic Games (Chappelet, 2002). Indeed, among the 16 NPCs participating in Örnsköldsvik 1976, 12 are from Europe (Austria, Belgium, Czechoslovakia, Finland, France, Great Britain, Norway, Poland, Sweden, Switzerland, Yugoslavia, and West-Germany), while the other four are from Americas (Canada and United States), Asia (Japan), and Africa (Uganda). In 1976, Oceania does not take part in the Games. Europe has greatest increasing trend of NPCs ($p < .001$, $\beta = 0.5$), almost doubling the number of nations in the last Games (PyeongChang, 33 nations) compared to the first (Örnsköldsvik, 12 nations). In PyeongChang 2018, one European country (Georgia) and two Asian countries (Tajikistan and North Korea) joint the PWG for the first time. In contrast, European nations, such as Albania, Azerbaijan, Cyprus, Ireland, Luxembourg, Malta, and Portugal have never taken part in PWG. In PyeongChang 2018, due to the Russia suspension from the Games, some athletes participated as Neutral Paralympic Athletes. In addition, considering only the PWG editions in which continents are present, Europe shows higher number of participating countries compared to Asia ($p < .01$), Oceania ($p < .001$), Americas ($p < .01$), and Africa ($p < .001$). No other statistical differences are found in the number of participating countries between the countries.

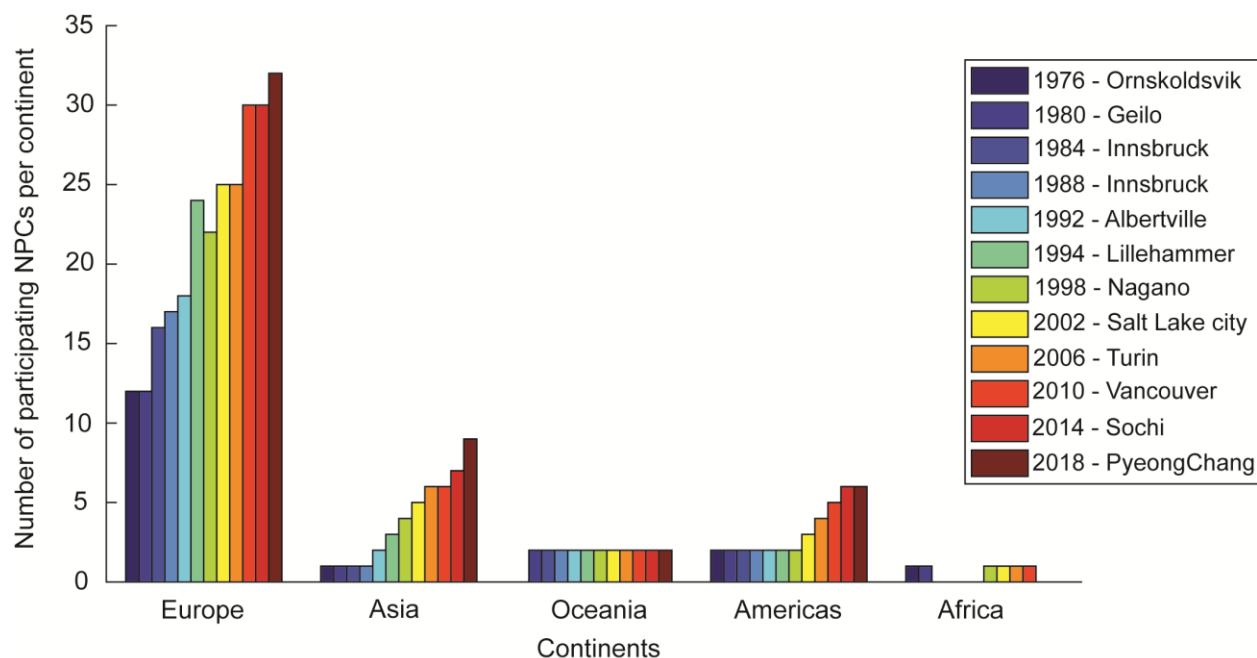


Figure 3. Number of participating National Paralympic Committees (NPCs) per each continent over the years.

Asia and Americas show a significant increasing trend (Asia $p < .001$, $\beta = 0.21$; Americas $p < .001$, $\beta = .10$), but both continents have a constant number of participant nations until the edition of the 1988 and the 1998 respectively. Japan is the only Asian nation that participates between 1976 and 1988; then South Korea competes for the first time in 1992, Kazakhstan in 1994, China in 2002, Mongolia in 2006, and Uzbekistan in 2014. Canada and United States are the only Americas' participating nations until 1998; then Chile is present in 2002 PWG edition, Mexico in 2006, Argentina in 2010, and Brazil in 2014. In contrast, Oceania and Africa have a low, but constant number of participating nations along time without significant trend in NPCs participating number. Oceania debuts in PWG in Geilo 1980 with two countries (Australia and New Zealand), which are still present in PyeongChang 2018. Africa, being represented by Uganda in Örnköldsvik 1976 and Geilo 1980, and by South Africa in Nagano 1998, Salt Lake City 2002, Turin 2006, and Vancouver 2010, does not show a trend along history. The reasons why Oceania has a low number of NPCs can be related to the low numbers of nations in the continent, while for Africa the reason of a low participation can be explained considering the climate conditions, which are not favourable to winter sports.

Number of sport and medal events

Figure 4 illustrates the total number of sports included in the PWG. Overall, the number of sports shows a significant increasing trend over the Winter Paralympic history ($p < .001$, $\beta = .08$), passing from 2 in Örnköldsvik 1976 to 6 in PyeongChang 2018.

The first two sports included in the PWG are Alpine Skiing and Cross-country Skiing. Then additional sports are added along the editions: Ice Sledge Speed Skating (Geilo 1980), Biathlon (Innsbruck 1988); Para Ice Hockey (Lillehammer 1994), and Wheelchair Curling (Turin, 2006). Para Snowboard debuts in Sochi 2014 with two medal events as a discipline of Alpine Skiing and it becomes an independent sport in PyeongChang 2018. The presence of Ice Sledge Speed Skating is discontinued; it is only present in Geilo 1980, Innsbruck 1984 and 1988, Lillehammer 1994, and Nagano 1998. In the next edition in Beijing 2022, six sports will be

included: Alpine Skiing, Cross-Country Skiing, Biathlon, Para Ice Hockey, Wheelchair Curling, and Snowboarding (International Paralympic Committee, 2019).

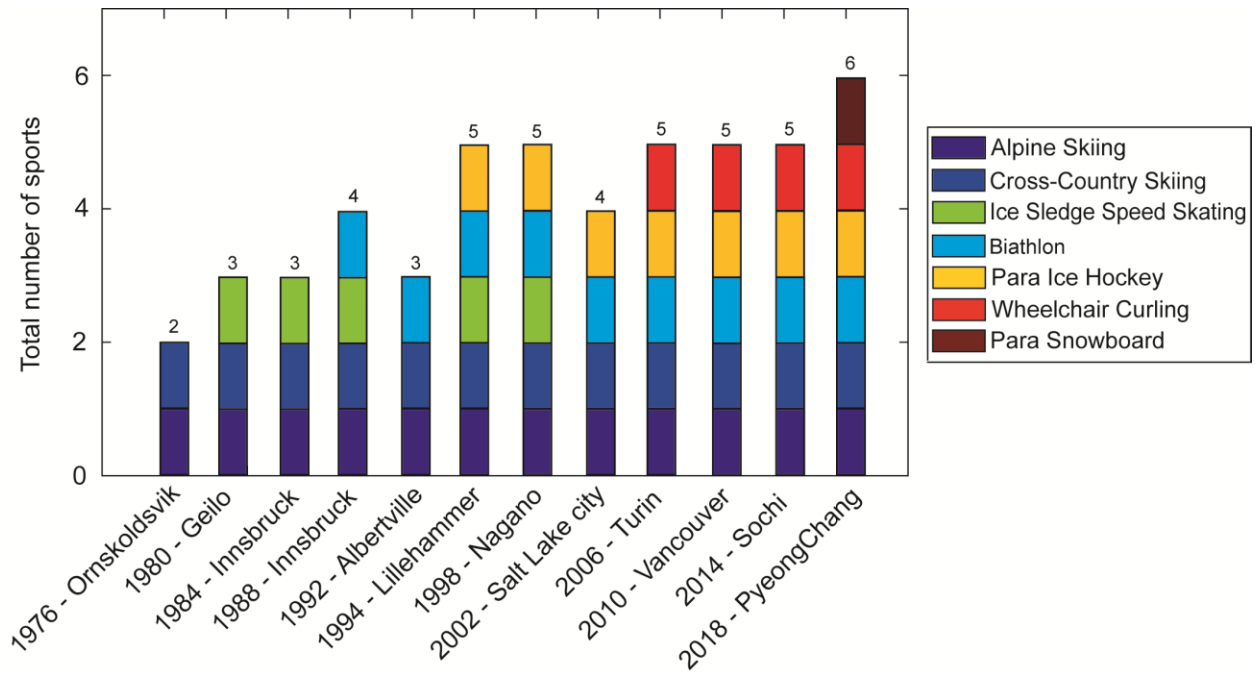


Figure 4. Development in the total number of sports at the Paralympic Winter Games.

Figure 5 shows the total number of medal events and Figure 6 shows how these events are distributed among the sports over years.

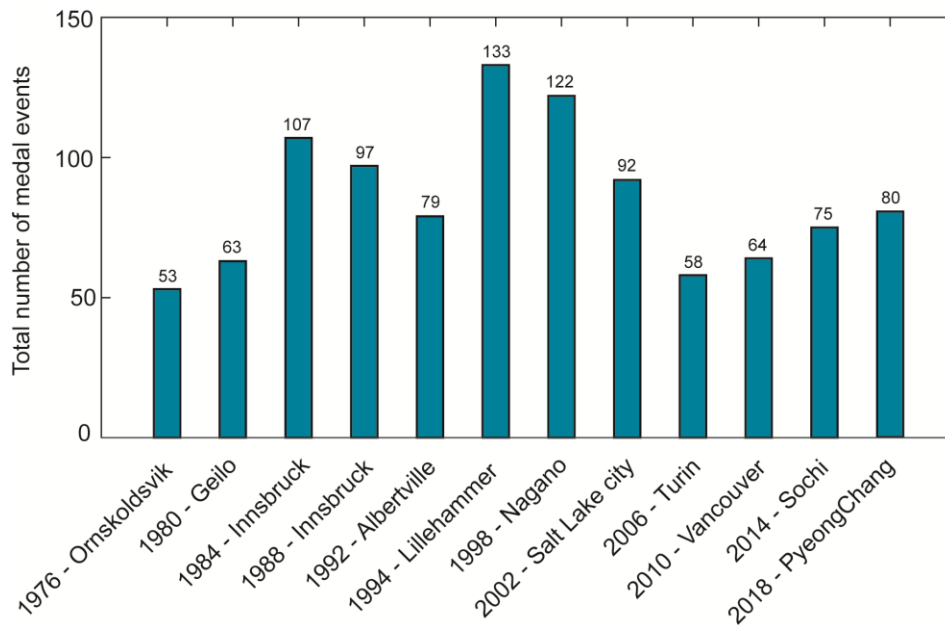


Figure 5. Development in the total number of medal events the Paralympic Winter Games.

The total number of medal events does not show a significant trend in history ($p = .95$). The absence of trend may depend on the combination of four factors: the number of competition events, number of categories in which athletes are divided, medals criteria assignment, and genders. Figure 5 shows that the total number of medal events fluctuates over years, peaking in Lillehammer 1994 with 133 medal events. After the peak, total number of medal events decreases showing a minimum (58 events) in Turin 2006. This minimum is very close to the number of medal events in the first edition of the Games (1976 Örnköldvik, 53 events) even though in Turin 2006 the number of sports (5 in 2006 vs 2 in 1976, Figure 4) and participants (474 in 2006 vs 196 in 1976, Figure 7) are higher. To better understand this aspect, a comparison in the number of competition events, categories, and genders in the most popular sport (Alpine Skiing) is done considering Örnköldvik 1976, Lillehammer 1994, and Turin 2006 (Table 1).

Table 1. Alpine Skiing total number of medal events in Örnköldvik 1976, Lillehammer 1994, and Turin 2006 divided per genders, competition events, categories, and classes. There are three different categories (standing, sitting, and visual impaired), which are divided in classes. Classes for standing are: I, II, III, IVA, IVB, LW1-LW9, classes for sitting: LWX-LWXII, visual impaired: B1-B3.

Paralympic Winter Games edition	Gender					
	Male			Female		
	Competition	Medals	Number of medals	Competition	Medals	Number of medals
Örnköldvik 1976	Giant slalom	I, II, III, IVA, IVB	5	Giant slalom	I, II, III, IVA, IVB	5
	Slalom	I, II, III, IVA, IVB	5	Slalom	I, II, III, IVB	4
	Alpine combination	I, II, III, IVA, IVB	5	Alpine combination	I, II, III, IVB	4
Lillehammer 1994	Downhill	B1-2, B3, LW1/3, LW2, LW4, LW5/7, LW6/8, LW9, LWX, LWXI, LWXII	11	Downhill	B1-2, LW2, LW3/4, LW6/8, LWX-XII	5
	Super-G	B1, B2, B3, LW1/3, LW2, LW4, LW5/7, LW6/8, LW9, LWX, LWXI, LWXII	12	Super-G	B1-2, LW2, LW3/4, LW6/8, LWX-XII	5
	Giant slalom	B1, B2, B3, LW1/3, LW2, LW4, LW5/7, LW6/8, LW9, LWX, LWXI, LWXII	12	Giant slalom	B1-2, LW2, LW3/4, LW6/8, LWX-XII	5
	Slalom	B1-2, B3, LW1/3, LW2, LW4, LW5/7, LW6/8, LW9, LWX, LWXI, LWXII	11	Slalom	B1-2, LW2, LW3/4, LW6/8, LWX-XII	5
Turin 2006	Downhill	Visual impaired sitting, standing	3	Downhill	Visual impaired, sitting, standing	3
	Super-G	Visual impaired sitting, standing	3	Super-G	Visual impaired sitting, standing	3
	Giant slalom	Visual impaired sitting, standing	3	Giant slalom	Visual impaired sitting, standing	3
	Slalom	Visual impaired sitting, standing	3	Slalom	Visual impaired sitting, standing	3

Compared to 1976, in which only standing athletes took part, in Lillehammer 1994 and Turin 2006 also sitting and visually impaired athletes are included. Concerning the medals assignment, while in Örnköldvik 1976 and Lillehammer 1994 medals are given to each class, in Turin 2006 athletes are group into categories with one medal each: visual impaired (B1, B2, B3), sitting (LWX-LWXII) and standing (LW1-LW9). Indeed, Turin

2006 is the pivotal year in which athletes of different classes compete together for the same medal (Table 1). Therefore, the number of classes and the assignment medals criteria contribute to explain the fluctuation of the total number of medal events, especially between 1976 and 2006. Other than the number of classes and the assignment medals criteria also the number of competition events and genders influence the total number of medal events. Concerning the next event, Beijing 2022 could be the first event with gender parity, offering equal number of medal events (39 medals) for both men and women (International Paralympic Committee, 2019). In addition to the 39 medal events for men and the 39 medal events for women, 4 mixed events are planned reaching a total of 82 medal events (International Paralympic Committee, 2019).

Comparing the number of medal events for the different sports in the editions in which they have been present in PWG (Figure 6), only Biathlon shows a significant increasing trend between Innsbruck 1988 and PyeongChang 2018 ($p < .01$, $\beta = 0.5$); whereas the other sports do not show monotonic trend. Comparing the number of medal events for the different sports in the same year (Figure 6), Alpine Skiing and Cross-country Skiing have the greatest number of medal events, peaking in Lillehammer 1994. In particular, Alpine Skiing shows greater number of medal events than Biathlon ($p < .05$), Para Ice Hockey ($p < .001$), and Wheelchair Curling ($p < .001$). Cross-country skiing shows greater number of medal events than Para Ice Hockey ($p < .001$) and Wheelchair Curling ($p < .001$).

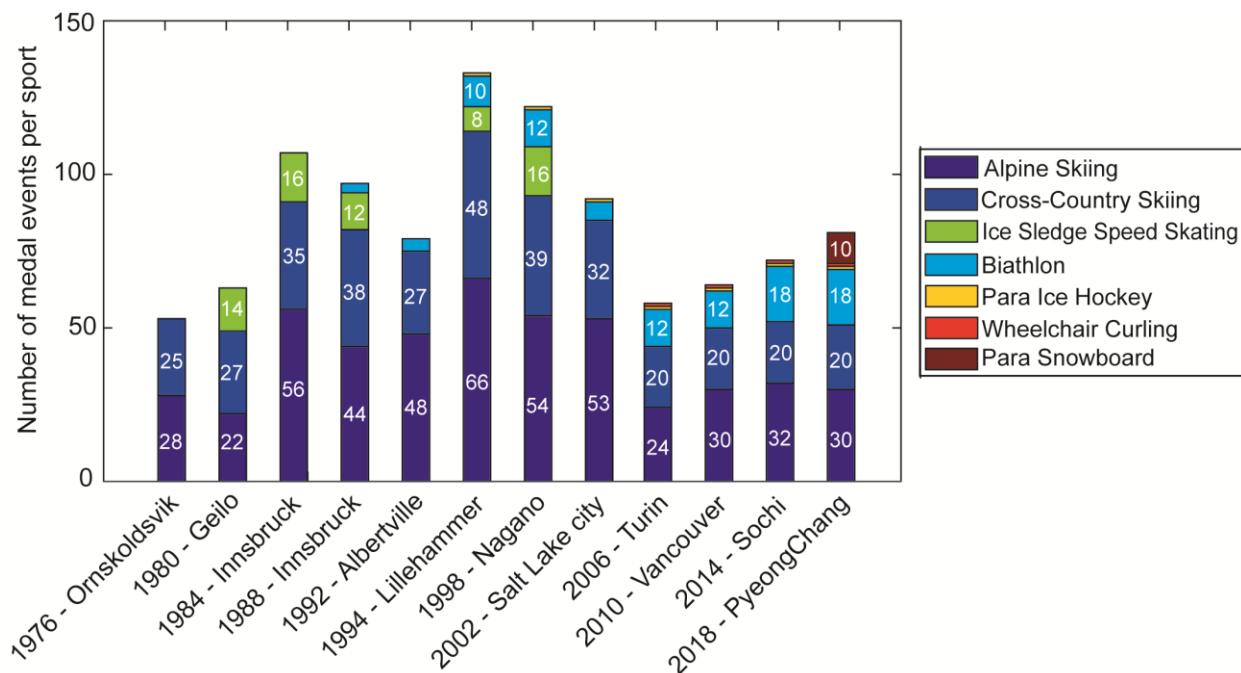


Figure 6. The number of medal events per each of the Paralympic Winter Sports in history. When the number of medal events per sport was lower than 5 it was not reported in the graph.

No other statistical differences between sport are found on medal events. Particular is the case of Para Snowboard that made its first appearance in PyeongChang 2018 with a total of 10 medals events, which may become 12 (6 for men and 6 for women) in Beijing 2022 (International Paralympic Committee, 2019).

Number of participating athletes

The number of total participating athletes (Figure 7) shows a significant increasing trend in history ($p < .001$, $\beta = 7.40$). Overall, the number of participants increases in time even though small fluctuation can be seen

due to changes in the disabilities that can participate in the different editions. In the first PWG, only amputee and visual impaired athletes participate. Then, in Gelió 1980 athletes with spinal cord injury are admitted to the Games for the first time. Finally, in Innsbruck 1984 also athletes with cerebral palsy and Les Autres are included. In Nagano 1998 a new increment is visible; this could be due to the inclusion for the first time of the athletes with intellectual disability.

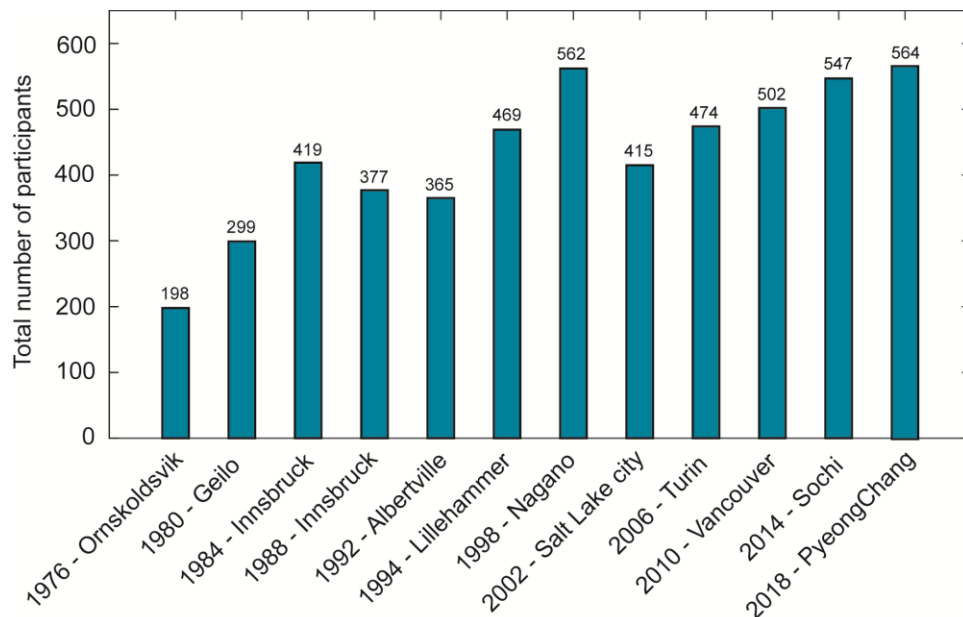


Figure 7. Total number of athletes participating in the Paralympic Winter Games over time.

Due to the 2000 Summer Paralympic Games issue (International Paralympic Committee, 2018a; Lantz & Marcellini, 2018), athletes with intellectual impairment are not allowed to participate to the subsequent Summer and Winter Games editions. This reason together with new and higher qualification standards (Legg & Steadward, 2011) contribute to create a sharp drop in the number of athletes in PWG Salt Lake City 2002 compared to previous Games. However, since Salt Lake City 2002, the number of participants steady increases, peaking in PyeongChang 2018 (567 participating athletes). For the next event in Beijing 2022, it is speculated that around 758 Para athletes will participated in the Games (International Paralympic Committee, 2019).

Figure 8 shows the number of athletes participating in each sport. It should be considered that athletes who compete in Cross-country skiing may also compete in Biathlon; therefore, summing athletes of all sports may not give the total number of participating athletes reported in Figure 7. Considering the number of participants per sport, only Para Ice Hockey shows a significant increasing trend ($p < .01$, $\beta = 3.25$); whereas the other sports do not show an increasing or decreasing trend in the number of participating athletes. Alpine Skiing and Cross-country Skiing are the two disciplines that have the greatest number of athletes over time. Alpine Skiing shows greater number of participants than Ice Sledge Speed Skating ($p < .001$), Biathlon ($p < .01$), Wheelchair Curling ($p < .05$); whereas Cross-country sit skiing shows greater number of participants than Ice Sledge Speed Skating ($p < .001$) and Biathlon ($p < .05$).

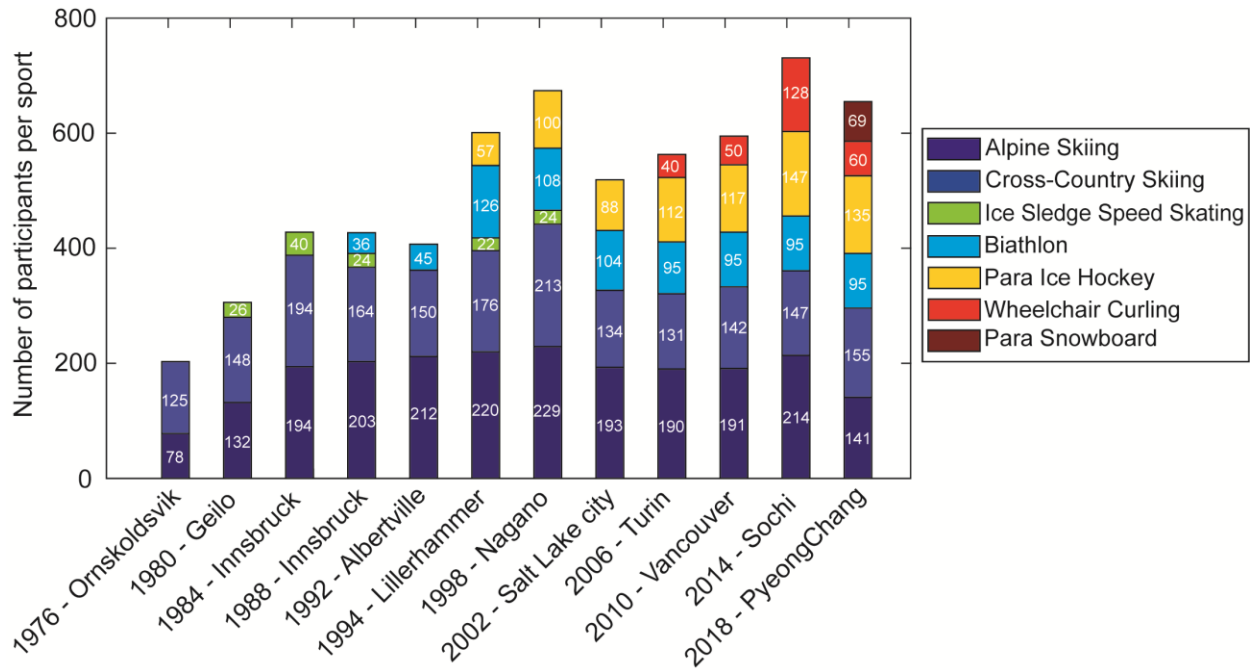


Figure 8. Number of participating athletes in each sport in the Paralympic Winter Games.

Ice Sledge Speed Skating is the sport with the lowest number of athletes over time; indeed, it is removed from the accepted sports list in 2002.

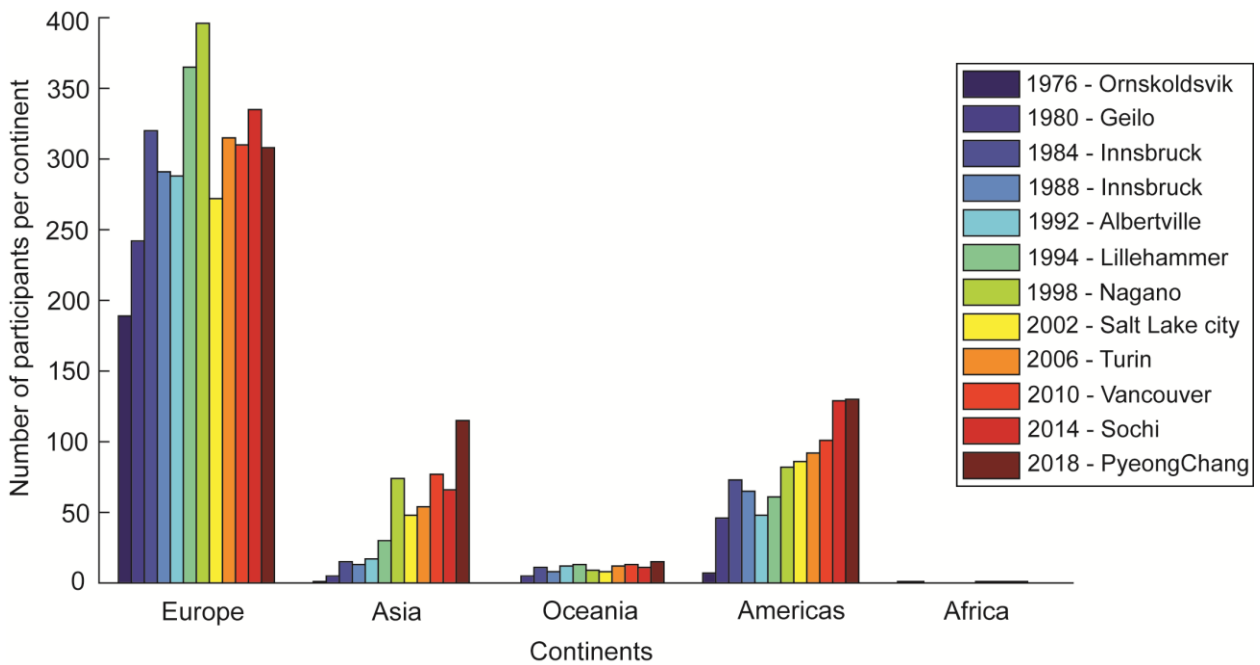


Figure 9. Number of participating athletes grouped per continent in the Paralympic Winter Games.

The number of participants per each continent is reported in Figure 9. Europe and Africa do not show a monotonic trend. In contrast, a significant increasing trend occurs for Asia ($p < .001$, $\beta = 2.14$), Oceania ($p < .05$, $\beta = .24$), and Americas ($p < .001$, $\beta = 2.45$). The highest number of participating athletes comes from Europe, followed by Americas, Asia, Oceania, and finally Africa. Europe shows a significant greater number of participants than Asia ($p < .01$), Oceania ($p < .001$), and Africa ($p < .001$). Americas shows greater number of participants than Oceania ($p < .05$) and Africa ($p < .05$), but no differences with Asia.

Concerning the number of participating athletes grouped per gender and the ratio between the two genders, changes in time are reported in Figure 10.

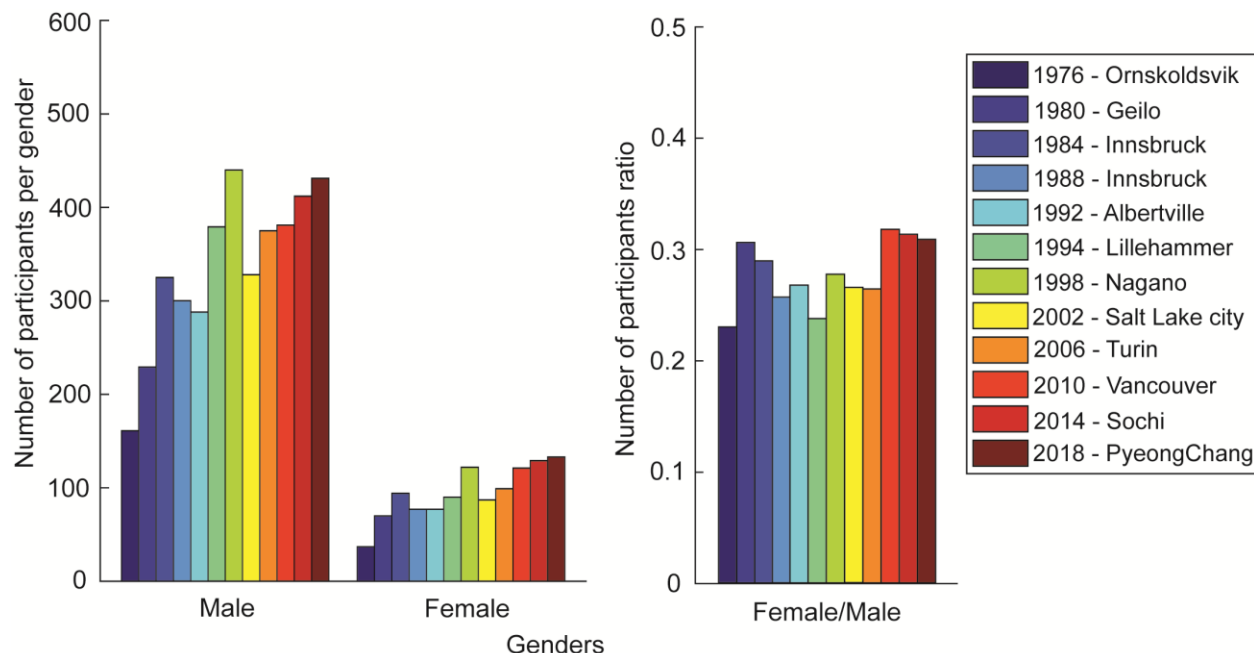


Figure 10. Number of participating athletes grouped per gender in the Paralympic Winter Games.

The number of male athletes shows a significant increasing trend in time ($p < .001$, $\beta = 5.35$); similarly, the number of female athletes has a significant increasing trend ($p < .001$, $\beta = 1.93$). Over the PWG editions, the number of male participants is significantly higher than the number of female participants ($p < .001$) with an overall number of male athletes that is almost triple in comparison with the number of female athletes. The highest participation of male athletes occurs in Nagano 1998 with 440 male athletes across all disciplines; whereas the greatest female participation is reached in PyeongChang 2018 with 133 female participants. The highest number of female athletes reaches in PyeongChang 2018 might mean that a good promotion among female was done in all sports and countries. This consideration can be extended to the three last PWG editions (Vancouver 2010, Sochi 2014, PyeongChang 2018) since the ratio between female and male athletes is higher during the years compared to the previous. This trend is expected to increase sharply for the next event in Beijing 2022 with a total number of female athletes around 234 and a total of male athletes of 514 (International Paralympic Committee, 2019). If the number of athletes who participate in Beijing will be close to the one expected, the ratio between female and male athletes would be the highest ever, around .45.

DISCUSSION

An increment in PWG media coverage has been recorded (Brittain, 2017c). Summarizing and describing the size of PWG in terms of participating data, this study aims to discuss if a growth in size comes together with the increase in media interest. Participating data indicators, such as the number of National Paralympic Committee, the number of sports, the number of medal events, and the number of athletes are discussed.

The IPC strategic plan 2015-2018 reports “*The IPC, together with its development arm the Agitos Foundation, initiates growth and development of para-sport, ensuring opportunities exist for people with an impairment*” (International Paralympic Committee, 2015b). The NPCs represent the national view of the IPC, thus the significant increase in NPCs number over years reflects an overall growth in the IPC and in the para-sports. Concerning the number of NPCs per continent, it is interesting to highlight the participation in the PWG of developing countries (defined according to the Development Assistance Committee, DAC), (Lauff, 2011). In the last four editions of the Games, the developing countries come from all continents, apart from Oceania. Europe and Asia have presented five to seven developing countries, Americas three, and Africa none to one (Development Assistance Committee, 2006, 2010, 2015). While the number of developing countries for Europe is a small percentage of the total number of NPCs, for Asia it corresponds to almost the total number of participating countries. In addition, this indicator is also influenced by the historical political evolution: Yugoslavia participated at the PWG until 1992, but later Slovenia, Croatia, Bosnia and Herzegovina, and Serbia joint the Games contributing to the growth of the number of NPCs. Concerning the number of NPCs, the last consideration is the participation at PWG of those countries, such as Brazil and Mexico, in which it would be difficult to train for winter sports both from financial, topographical, and climatic conditions (Brittain, 2017b). Because the number of NPCs shows significant trend (worldwide and for specific continent) and reflects political and sociocultural aspects of participating countries, this indicator may be of great importance in order to evaluate and compare the Games size over years.

In the last event in PyeongChang 2018, athletes competed in six different sports: Alpine Skiing, Cross-country Skiing, Biathlon, Para Ice Hockey, Wheelchair curling, Para Snowboard. To date, six is the highest number of sports accepted in PWG. Despite the number of sports have showed a significant increasing trend along with history, the list of the included sport has changed considering the exclusion and the inclusion of different sports (Ice Sledge Speed Skating, Para Ice Hockey, Wheelchair Curling, and Para Snowboard) because sports at the PWG are also included on the basis of the athletes' participation (Wilson & Clayton, 2010). To be included as a medal event in Sochi 2014, Para Snowboard has required six years of working among the World Snowboard Federation, the International Paralympic Committee, and rides (International Paralympic Committee, 2012b). Such a long time implies that the number of sports slowly changes over time, suggesting that this indicator would be more appropriate for comparing Games size over a long time period, but difficulty describe and compare Games size over two or three Games editions.

The total number of medal events does not show a significant trend, instead fluctuates along time. This number depends on four aspects: number of competition events, number of categories in which athletes are divided, medals criteria assignment, and genders. The example reported in Table 1 for Alpine Skiing suggests that the greatest variation in total medal events is due to the number of categories and medals criteria assignment. Classification has changed over time, passing from a medical to a functional classification (Tweedy & Vanlandewijck, 2011). In medical classification, athletes are grouped based on their disability; whereas in functional classification athletes are grouped on the basis of how much their impairment affects the performance. At the beginning, in Alpine Skiing and Cross-country Skiing, each category competes for a medal. However, the number of athletes per each category and class is low to create a separate event;

therefore, athletes from different classes compete for the same medal (International Paralympic Committee, 2016a). In this case, coefficients are used to consider different levels of activity limitations. In recent years, the International Paralympic Committee has promoted the development of an evidence-based classification (International Paralympic Committee, 2007, 2015a), in which researches have been conducted for some sports (Connick et al., 2017),(Rosso et al., 2019). Since number of total medal events depends on many changing factors, it could be that this indicator difficulty allows a comparison of PWG size over years.

The last indicator of PWG size evaluated in this study is the number of participating athletes, which significantly increased in time. Considering this indicator, few aspects should be kept in mind. Even though Para Ice Hockey and Wheelchair curling seem to achieve a great success among athletes, they are team sports, which could explain great number of athletes' participation in these sports. However, these sports have a low ratio between medal event and participating athletes. In addition, despite Biathlon and Cross-country Skiing are two separate sports, many athletes who compete for the former usually take part also in Cross-country Skiing competitions. Despite this consideration, number of participating athletes reflects sociocultural aspects: for example, the greatest participation of European athletes can be explained by the high number of European NPCs that participate in the Games. Indeed, if a similar number of athletes came from Canada, United State of America, Japan, Korea, Austria, Finland, France, Great Britain, Italy, Norway, Russia, Sweden, Ukraine, the number of European countries listed is longer than those of other continents. In addition, comparing the male and female number of athletes, female participants are less than one third. This happened for many reasons. For example, Wheelchair Curling requires at least one athlete per gender in each team, but usually teams have the majority of male athletes (Women's Sports Foundation, 2010). For the first time, in PyeongChang 2018, Para ice hockey added eight spots for female athletes (Women's Sports Foundation, 2017). However, during history female participation is limited to only two Norwegian athletes: Britt Mjaasund Øyen (Lillehammer 1994) and Lena Schroeder (PyeongChang 2018) (International Paralympic Committee, 2017). Finally, many NPCs usually do not send female athletes (10 out of 44 in 2010, 12 out of 39 in 2006, and 10 out of 36 in 2002) (Women's Sports Foundation, 2010). Despite the team sports and the possibility of athletes to participate in more than one sport, this indicator reflects also changes in sociocultural aspects, which cannot be ignored when the Games size is evaluated.

CONCLUSION

Paralympic Winter Games is one of the world's biggest sporting events and it is expected to be still growing, as it is suggested by the increase in media interest and by the International Paralympic Committee. In this study, four Games size indicators in terms of participating data are described, summarized, and discussed to identify which reflect the growth in size expressed by the media interest. Number of medal events depending on many factors did not show a trend in time; therefore, this indicator may be less appropriate to describe the Games size. In contrast, because the greatest trend and because they reflect political and sociocultural aspects, number of participating countries and number of participating athletes demonstrate to be more suitable indicators to compare Paralympic Winter Games size over time. Finally, due to the slow, but significant change in time, number of sports may be an index of Games size considering the whole history of Paralympic Winter Games.

AUTHOR CONTRIBUTIONS

V.R. and L.G. took part in the conceptualization and design of the study. V.R. analysed the data and wrote the manuscript. L.G. supervised the analyses and critically revised the manuscript. All authors read and approved the final manuscript.

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