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A new model of performance classification to standardize the research results in swimming

Jesús J. Ruiz-Navarro[1], Óscar López-Belmonte[1], Ana Gay[1], Francisco Cuenca-Fernandez[1], and Raúl Arellano[1].

[1]Aquatics lab, Department of Physical Education and Sports, Faculty of Sport Sciences, University of Granada, Granada, Spain.

Corresponding author: Arellano, Raúl. Email: r.arellano@ugr.es

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Abstract

The level of expertise must be defined for the sample studied when report research in sport. Concretely in swimming, apart from the participants' background, the competitive status is based on the level that swimmers participate. Thus, the International Swimming Federation (FINA) points are added to improve the sample level characterization. The aim of this study was two-fold: 1) to assess whether national and regional swimmers from different countries differ in their performance level (based on FINA points), and 2) to propose a model that allows standardizing the research results in swimming. The FINA points of 5876

participants (males = 2962 and females = 2914) in 100 m butterfly, backstroke, breaststroke, and freestyle were retrieved from nationals (n = 21) and regionals (n = 44) swimming competitions. One-way analysis of variance was conducted to test the difference in FINA points between swimmers of different countries. Significant disparities (100 to 350 FINA points; $p<0.001$) were observed in national and regional competitions for male and female swimmers among the different countries analyzed. This could lead to misleading conclusions when comparing studies with national or regional swimmers from different countries. In this regard, a new model of performance classification based on national and regional worldwide competition is proposed. This might be used to standardized the swimming research results.

Keywords: Experience, expertise, FINA points,

Highlights

- The current classification of swimmers' status could lead to misleading conclusion when comparing studies from different countries using national or regional swimmers.
- The proposed model will allow to better standardize the research results in swimming, aiding to draw more accurate conclusion when comparing results from different studies.

Keywords: Experience, expertise, FINA points, comparison.

Introduction

Swimming, as an Olympic sport from the beginning of the modern Olympic Games in 1896, is one of the most popular sports worldwide due to its effect on health and wellbeing (Howells & Jarman, 2016; Swim England's Swimming and Health, 2017); however, the aquatic environment complicates its research. One of the first attempts to explain the swimming techniques and training procedures based on empirical data was the textbook "The science of swimming", first released in 1968 (Counsilman & Counsilman, 1968). From that moment on, a solid and large scientific community has emerged to investigate competitive swimming (Barbosa, Costa, & Marinho, 2013).

As a result of that work, it may be concluded that the success in swimming performance depends on several aspects such as biomechanical, physiological, or anthropometrical factors (Barbosa et al., 2013). Hence, researchers have tried to understand which are the ones that make top swimmers to excel over the rest of the swimmers (Barbosa et al., 2010). This fact is indeed observed in the amount of studies comparing elite

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with non-elite swimmers (Arellano, Pardillo, & Gavilan, 2003; Arellano, Pardillo, & Gavilán, 2002; Jones, Pyne, Haff, & Newton, 2017), or among the aspects that differentiate the finalists from the non-finalists (Sánchez, Arellano, & Cuenca-Fernández, 2021)

Contrary to other sports, such as cycling, where guidelines to classify the research subjects have been established (De Pauw et al., 2013; Decroix, De Pauw, Foster, & Meeusen, 2016), the criteria used to define the level of the sample in swimming studies are not clearly described. When reporting the research results, the skill level of the swimmers is important; however, there is an inconsistency among researchers that makes it difficult to draw conclusions when comparing the results from different studies (Swann, Moran, & Piggott, 2015). For instance, the term "elite" or "expert" have been used from the "ten years rule" or to describe athletes with two years of accumulated practice (Hayes, Chipman, Segal, & Glaser, 1985). Whereas, the level of participants in swimming research has also been reported as a function of the level of competition that swimmers reach (Morais, Barbosa, et al., 2020), such as: international (Arellano et al., 2002), national (Connaboy et al., 2016), regional (Ruiz-Navarro, Morouço, & Arellano, 2020) or age group swimmers (Ruiz-Navarro et al., 2021). Hence, it is possible that national swimmers from different countries might differ significantly in their skill level due to the size and popularity of the sport within the country (Swann et al., 2015) or the qualification criteria established by the corresponding swimming federation.

Together with these terms, the swimmer's personal best time (Costa et al., 2009), the percentage to the world record (Ruiz-Navarro et al., 2020), or the most commonly observed in the literature, the International Swimming Federation (FINA) points (i.e., a value of the swimmer's best mark relative to the world best mark) (Morais, Forte, Nevill, Barbosa, & Marinho, 2020), are often also reported. These terms are indeed easy to understand and aid to objectively compare results between studies. However, it seems to be no other standards to classify swimmers' status rather than the level of competition that swimmers participate. Therefore, the aim of this study was two-fold: 1) to assess whether national and regional swimmers from different countries differ in their performance level, and 2) to propose a new model that allows standardizing the research results based on FINA points.

Material and methods

Participants

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A total of 8320 competitor records (65 competitions × 16 swimmers [finalists and semifinalists] × 2 sexes × 4 events [100 m butterfly, backstroke, breaststroke, and freestyle]), were retrieved from (n = 21) nationals and (n = 44) regionals swimming events in long course (i.e., 50 m swimming pool) celebrated during 2019. The number of swimmers analyzed was 5876 (2962 males and 2914 females), as some of them participated in more than one race (e.g., butterfly and freestyle) or event (e.g., national and regional competition). Since it is not the aim of the current study to compare which country have higher or lower swimming performance level, the anonymity of the results will be kept throughout the rest of the manuscript.

Data collection

All the FINA points were retrieved from publicly accessible database 'swimrankings.net'. The database lists are the results of registered races which are in accordance with the official FINA rules (FINA, 2019c), including electronical time keeping and limits to in-pool current (Born et al., 2020). The data were retrieved by two of the authors, entered manually into an Excel spread sheet file, and double-checked by a third author. The FINA points, which are calculated as $1000\times(\text{World Record time (s)} / \text{swim time (s)})^3$) are assigned every year based on the World Record time for each event (FINA, 2011). In this study, the 2019 FINA points reference values were used.

It was intended to include a representation of countries with some international success, thus only those that had achieved at least a medal in one of the last four main international competition were included (n = 30) (i.e., London 2012 and Rio 2016 Olympic Games; Budapest 2017 and Gwangju 2019 Long Course World Championships). There was no available information regarding any national or regional competition for some of the countries previously determined to inclusion, leading to a total of 21 countries analyzed. One national championship and different regional championships were analyzed in the 21 countries.

The regional events were competition of at least two days' duration that were qualifiers for national events. When possible, at least three different regionals competitions were analyzed and averaged to use a representation of different regions within the country. In Table S1, the competitions analyzed are shown. From the 21 national and 44 regional competitions analyzed, the FINA points obtained by the 16 best national swimmers (finalists and semifinalists) in 100 m butterfly, backstroke, breaststroke, and freestyle events for both male and female swimmers were obtained. To ensure the representation of swimmers from the countries analyzed, only national swimmers of the country where the championship was held were assessed, and therefore foreign swimmers were not included.

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The FINA points for the A and B standard qualification time, of the events analyzed, for the Tokyo Olympic Games (FINA, 2019d) and Gwangju World Championships (FINA, 2018) were obtained. These FINA points were computed using the FINA point scoring 2019 for either males and females (FINA, 2019b, 2019a) and the mean of the FINA points of these two major championships was calculated and used as international events.

Statistical analysis

Shapiro-wilk test and visual inspection of histogram was used to test the normality of the sample. Although some variables did not exhibit a normal distribution, for analytical purposes these variables were not transformed. One-way analyses of variance (ANOVA) was used to test differences in FINA points between countries for national and regional competitions. Analyses were replicated with the non-parametric Kruskal–Wallis test. Since the results were similar between the parametric and non-parametric test, only one-way ANOVA results are reported. Bonferroni corrections were used for post-hoc comparisons. To accomplish the second aim of this study, the mean of the lowest FINA points obtained in each event were also calculated. The significance level was set at 0.05 and the analyses were conducted using the Statistical Package for Social Sciences (SPSS, v. 24.0, IBM SPSS Statistics, IBM Corporation, Chicago, IL, USA).

Results

The mean ± standard deviation (SD) values of the FINA points obtained in the national and regional competitions analyzed and the lowest FINA points obtained in each competition are presented in Table 1 and 2, respectively. The A standard qualification time for the international events showed a mean of 875 ± 14 (males: 881 ± 12, females: 868 ± 13) and the B standard qualification time for the international events showed a mean of 795 ± 16 (males: 800 ± 14, females: 789 ± 17).

One-way ANOVA revealed differences for 100 m butterfly (males, F: 12.70, $p<0.001$; females, F: 24.65, $p<0.001$), backstroke (males, F: 14.49, $p<0.001$; females, F: 25.08, $p<0.001$), breaststroke (males, F: 13.18, $p<0.001$; females, F: 16.71, $p<0.001$), and freestyle events (males, F: 11.73, $p<0.001$; females, F: 28.60, $p<0.001$) in national championships. Also, differences were found for 100 m butterfly (males, F: 12.30, $p<0.001$; females, F: 17.02, $p<0.001$), backstroke (males, F: 13.12, $p<0.001$; females, F: 11.52, $p<0.001$), breaststroke (males, F: 8.42, $p<0.001$; females, F: 9.36, $p<0.001$), and freestyle (males, F: 10.61, $p<0.001$; females, F: 10.32, $p<0.001$) events in regional competitions.

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When comparing national competitions, significant differences were observed between countries after post-hoc Bonferroni corrections in every event, for male (Figure 1) and female swimmers (Figure 2). Those disparities ranged between 100 to 350 FINA points (Table 1). In regional competitions, significant differences were also observed after post-hoc Bonferroni corrections in every event, for male (Figure 3) and female swimmers (Figure 4). The disparities between countries ranged between 100 to 225 FINA points (Table 2).

Five swimming performance levels were proposed based on the FINA point results obtained (Figure 5) using the following criteria:

i) The first level is based on the A qualifying standards set to participate at the international events, which correspond to ≥ 875 FINA points.

ii) The second level is based on the B qualifying standards set to participate at the international events, which correspond to 800 FINA points (Note that the mean was 794, but to facilitate its uses 800 is proposed).

iii) The third threshold is established at 650 FINA points, since it is the mean of the lowest FINA points obtained in national championship (Table 1) (Note that the mean was 654, but to facilitate its uses 650 is proposed).

iv) The fourth threshold is set at 450 FINA points, as the mean of the lowest FINA points obtained in regional competitions (Table 1)(Note that the mean was 467, but to facilitate its uses 450 is proposed).

v) The fifth threshold would involve all the performances below 449 FINA points.

Discussion

The aim of this study was two-fold: 1) to assess whether national and regional swimmers from different countries differ in their performance level, and 2) to propose a new model that allows standardizing the research results based on FINA points. The results demonstrated that the best 16 national swimmers are

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significantly different in FINA points, and therefore in skill level in 100 m butterfly, backstroke, breaststroke, and freestyle events among countries. This also happened with the regionals. Therefore, we proposed a five-level system of classification to standardize the research results in swimming (Figure 5).

In sport research is very important to define the level of expertise of the sample studied (Hodges, Starkes, & MacMahon, 2006). This definition must be based on the athletes´ highest standard of performance (Swann et al., 2015); however, the standards around the world are different between each other. For example, two swimmers achieving international participation could still be differentiated by a mere participation (around ~800 FINA points), or by a participation with options to achieve a medal or a new world record (> 950 FINA points). For national and regional swimmers of different countries, our results showed differences in performance level in the four strokes in males (Figure 1 and 3) and females (Figure 2 and 4). These differences in performance level are related to biomechanical, physiological, or anthropometric differences (Arellano et al., 2002; Leblanc, Seifert, Baudry, & Chollet, 2005; Takagi, Sugimoto, & Wilson, 2004; Wells, Schneiderman-walker, & Plyley, 2006). For instance, in female 100 m backstroke there was a difference of more than 200 FINA points between countries, and still, both could be considered as national (Figure 2). On the other hand, the regional level of one country could be even higher than the national level of other country (e.g., see *country 14*). Therefore, this could not only lead readers to draw misleading conclusions when comparing national swimmers from different studies, but also confuse the researchers themselves in explaining and making sense of their own results.

The FINA points have been criticized, because some of the scores used are still based on the polyurethane swimsuit era (Bernhardt, 2014). Therefore, the athletes' competitive experience in years or the training time and/or frequency are often reported instead. Although these facts provide valuable information of the athletes' investment in swimming, they do not provide any indication of performance level (Swann et al., 2015). Hence, two samples with the same training experience might be considered similar if the FINA points were not complementarily reported.

It is worth noting that the mean performance of some countries (Table 1), were above the B standard qualification times for 2021 Tokyo Olympic Games (i.e., around 800 FINA points). However, as only two swimmers are allowed to compete in the Olympic Games per event and country (FINA, 2019d), the rest of the swimmers would be considered as nationals swimmers, while in other countries they might be considered as internationals. As an extreme illustration, swimmers performing one minute over the World Record would be considered as international level if taken part in the Olympic Games (Nauright &

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Magdalinski, 2003). Hence, although the swimmers' status should be based on their skill level, it is perceived a current way of reporting the swimmers' status highly influenced by the popularity of the sport within the country and the size of the country (Swann et al., 2015).

Previously, national and regional swimmers were defined as those reaching between 700-900 and between 500-700 FINA points, respectively (Veiga, Cala, Frutos, & Navarro, 2014). However, this categorization was highly influenced by the popularity of the sport within the country and the size of the country (Swann et al., 2015). In fact, the mean of the national swimmers in some countries did not reach those standards in spite of swimmers participated in national and regional competitions (see Table 1 and 2). More recently, swimmers performance level was divided in four groups: top-elite, elite, sub-elite and high-competitive, and this differentiation was based on swimmers' best season time relative to the world record (Post, Koning, Visscher, & Elferink-Gemser, 2020). Although the differentiation is well argued and clearly defined, the study was focused on those who reached top-elite, without mentioning lower-level swimmers. Indeed, the model proposed in the current study differentiated five groups, and this categorization also included swimmers with a lower performance level than those presented by Post et al. (2020).

We acknowledge a potential limitation, individual medley as well as middle and longer-distance events, were not analyzed. Nevertheless, scientific literature usually reports the performance level based on 100 m events and therefore we thought that the inclusion of middle and longer-distance events would not add relevant information to the aim of this manuscript. Future studies could benefit from the easy method of categorizing competitive level reported in this study.

Conclusion

The current classification of swimmers' status could lead to misleading conclusion when comparing studies from different countries using national or regional swimmers. Together with the background status, FINA points should be always included, since athletes' competitive experience in years or the training time/frequency do not provide indication of performance level. Based on national and regional competition of all over the world, we have proposed a new model of performance classification that might be used to standardize the swimming research results. The proposed model is neither influenced by the popularity of the sport within the country nor the size of the country and this will allow to draw more accurate conclusion when comparing results from different studies.

References

ACCEPTED MANUSCRIPT

Arellano, Raul., Pardillo, S., & Gavilan, A. (2003). Usefulness of Strouhal Number in Evaluating Human Under-water Undulatory Swimming. In *IX International Symposium on Biomechanics and Medicine in Swimming* (pp. 33–38). Saint-Etienne.

Arellano, Raúl, Pardillo, S., & Gavilán, A. (2002). Underwater Undulatory Swimming: Kinematic Characteristics, Vortex Generation and Application During the Start, Turn and Swimming Strokes. In *Proceedings of the XXth International Symposium on Biomechanics in Sports* (pp. 29–41). Caceres, Spain.

Barbosa, T. M., Bragada, J. A., Reis, V. M., Marinho, D. A., Carvalho, C., & Silva, A. J. (2010). Energetics and biomechanics as determining factors of swimming performance: Updating the state of the art. *Journal of Science and Medicine in Sport*, *13*(2), 262–269. https://doi.org/10.1016/j.jsams.2009.01.003

Barbosa, T. M., Costa, M. J., & Marinho, D. A. (2013). Proposal of a deterministic model to explain swimming performance. *International Journal of Swimming Kinetics*, *2*(1), 1–54.

Bernhardt, R. (2014). FINA points: illogical and impractical. *Swimswam*.

Born, D.-P., Lomax, I., Horvath, S., Meisser, E., Seidenschwarz, P., Burkhardt, D., & Romann, M. (2020). Competition-Based Success Factors During the Talent Pathway of Elite Male Swimmers. *Frontiers in Sports and Active Living*, *2*(November), 1–9. https://doi.org/10.3389/fspor.2020.589938

Connaboy, C., Naemi, R., Brown, S., Psycharakis, S., McCabe, C., Coleman, S., & Sanders, R. (2016). The key kinematic determinants of undulatory underwater swimming at maximal velocity. *Journal of Sports Sciences*, *34*(11), 1036–1043. https://doi.org/10.1080/02640414.2015.1088162

Costa, A. M., Silva, A. J., Louro, H., Reis, V. M., Garrido, N. D., Marques, M. C., & Marinho, D. A. (2009). Can the curriculum be used to estimate critical velocity in young competitive swimmers? *Journal of Sports Science and Medicine*, *8*(1), 17–23. https://doi.org/Article

Counsilman, J. E., & Counsilman, B. E. (1968). *The science of swimming*.

De Pauw, K., Roelands, B., Cheung, S. S., de Geus, B., Rietjens, G., & Meeusen, R. (2013). Guidelines to classify subject groups in sport-science research. *International Journal of Sports Physiology and Performance*, *8*, 111–122.

ACCEPTED MANUSCRIPT

Decroix, L., De Pauw, K., Foster, C., & Meeusen, R. (2016). Guidelines to classify female subject groups in sport-science research. *International Journal of Sports Physiology and Performance*, *11*(2), 204–213. https://doi.org/https://doi.org/10.1123/ijspp.2015-0153

FINA. (2011). Fina Points Table, 1.

FINA. (2018). Swimming qualifying procedure for the 18th FINA world championships-Gwangju 2019.

FINA. (2019a). FINA point scoring 2019 men individual - long course (50 m).

FINA. (2019b). FINA Point Scoring 2019 women individual - long course (50 m).

FINA. FINA Swimming Rules 2017-2021 (2019). Retrieved from http://www.springerlink.com/index/10.1007/978-1-60761-977-2

FINA. (2019d). Qualification system - Games of the XXXII Olympiad - Tokio 2020.

Hayes, J. R., Chipman, S. F., Segal, J. W., & Glaser, R. (1985). Three problems in teaching general skills. In *Thinking and learning skills 2* (pp. 391–405).

Hodges, N. J., Starkes, J. L., & MacMahon, C. (2006). Expert performance in sport: A cognitive perspective. In A. K. Ericsson, N. Charness, R. R. Hoffman, & P. J. Feltovich (Eds.), *The cambridge handbook of expertise and expert performance* (pp. 471–488).

Howells, K., & Jarman, D. (2016). Benefits of swimming for young children. *Physical Education Matters*, *11*(13), 20–21.

Jones, J., Pyne, D. B., Haff, G., & Newton, R. (2017). Comparison between elite and subelite swimmers on dry land and tumble turn leg extensor force-time characterisitics. *Journal of Strength and Conditioning Research*, *32*(6), 1762–1769.

Leblanc, H., Seifert, L., Baudry, L., & Chollet, D. (2005). Arm-leg coordination in flat breaststroke: A comparative study between elite and non-elite swimmers. *International Journal of Sports Medicine*, *26*(9), 787–797. https://doi.org/10.1055/s-2004-830492

Morais, J. E., Barbosa, T. M., Forte, P., Bragada, J. A., Castro, F. A. d. S., & Marinho, D. A. (2020). Stability analysis and prediction of pacing in elite 1500 m freestyle male swimmers. *Sports Biomechanics*, *00*(00), 1–18. https://doi.org/10.1080/14763141.2020.1810749

Morais, J. E., Forte, P., Nevill, A. M., Barbosa, T. M., & Marinho, D. A. (2020). Upper-limb kinematics

ACCEPTED MANUSCRIPT

and kinetics imbalances in the determinants of front-crawl swimming at maximal speed in young international level swimmers. *Scientific Reports*, *10*(1), 1–8. https://doi.org/10.1038/s41598-020-68581-3

Post, A. K., Koning, R. H., Visscher, C., & Elferink-Gemser, M. T. (2020). Multigenerational performance development of male and female top-elite swimmers–A global study of the 100 m freestyle event. *Scandinavian Journal of Medicine and Science in Sports*, *30*(3), 564–571. https://doi.org/10.1111/sms.13599

Ruiz-Navarro, J. J., Cano-Adamuz, M., Andersen, J. T., Cuenca-Fernández, F., López-Contreras, G., Vanrenterghem, J., & Arellano, R. (2021). Understanding the effects of training on underwater undulatory swimming performance and kinematics. *Sports Biomechanics*, *00*(00), 1–16. https://doi.org/10.1080/14763141.2021.1891276

Ruiz-Navarro, J. J., Morouço, P. G., & Arellano, R. (2020). Relationship Between Tethered Swimming in a Flume and Swimming Performance. *International Journal of Sports Physiology and Performance*, *15*(8), 1087–1094. https://doi.org/https://doi.org/10.1123/ijspp.2019-0466

Sánchez, L., Arellano, R., & Cuenca-Fernández, F. (2021). Analysis and influence of the underwater phase of breaststroke on short- course 50 and 100m performance. *International Journal of Performance Analysis in Sport*. https://doi.org/10.1080/24748668.2021.1885838

Swann, C., Moran, A., & Piggott, D. (2015). Defining elite athletes: Issues in the study of expert performance in sport psychology. *Psychology of Sport and Exercise*, *16*(P1), 3–14. https://doi.org/10.1016/j.psychsport.2014.07.004

Swim England's Swimming and Health, C. (2017). *The health benefits of swimming*.

Takagi, H., Sugimoto, S., & Wilson, B. D. (2004). Differences in Stroke Phases , Arm-Leg Coordination and Velocity Fluctuation due to Event , Gender and Performance Level in Breaststroke. *Sports Biomechanics*, (1), 15–27.

Veiga, S., Cala, A., Frutos, P. G., & Navarro, E. (2014). Comparison of starts and turns of national and regional level swimmers by individualized-distance measurements. *Sports Biomechanics*, *13*(3), 285–295. https://doi.org/10.1080/14763141.2014.910265

Wells, G. D., Schneiderman-walker, J., & Plyley, M. (2006). Normal physiological characteristics of elite

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swimmers. *Pediatric Exercise Science*, *18*, 30–52.

Table 1. The mean ± standard deviation (SD) values of the International Swimming Federation (FINA) points obtained in the national competitions analyzed and the lowest FINA points obtained in each competition.

	Male				Female				
	Butterfly	Backstroke	Breaststroke	Freestyle	Butterfly	Backstroke	Breaststroke	Freestyle	LFP
Country 1	819 ± 32	788 ± 42	793 ± 60	839 ± 50	831 ± 56	870 ± 50	812 ± 62	833 ± 37	759 ±38
Country 2	779 ± 59	752 ± 79	705 ± 49	795 ± 67	740 ± 58	742 ± 62	704 ± 52	737 ± 48	668 ± 22
Country 3	773 ± 64	799 ± 62	750 ± 85	819 ± 59	770 ± 65	788 ± 65	747 ± 75	832 ± 72	689 ± 35
Country 4	781 ± 58	808 ± 36	799 ± 73	822 ± 43	786 ± 49	819 ± 32	798 ± 45	781 ± 48	737 ± 27
Country 5	770 ± 40	766 ± 52	746 ± 45	807 ± 40	734 ± 51	734 ± 64	743 ± 57	738 ± 30	692 ± 33
Country 6	797 ± 69	831 ± 63	780 ± 74	836 ± 76	752 ± 54	790 ± 69	768 ± 84	795 ± 39	689 ± 33
Country 7	786 ± 58	802 ± 37	756 ± 36	832 ± 44	747 ± 62	766 ± 53	723 ± 39	811 ± 49	724 ± 32
Country 8	703 ± 45	662 ± 52	671 ± 39	747 ±37	680 ± 80	676 ± 60	697 ± 56	696 ± 34	619 ± 39
Country 9	667 ± 69	661 ± 66	690 ± 47	728 ± 42	665 ± 64	697 ± 76	659 ± 57	711 ± 47	594 ± 35
Country 10	768 ± 43	787 ± 47	738 ± 43	810 ± 42	787 ± 57	842 ± 67	778 ± 53	816 ± 45	733 ± 28
Country 11	742 ± 31	735 ± 38	720 ± 36	778 ± 33	703 ± 41	751 ± 33	688 ± 46	729 ± 30	683 ± 34
Country 12	765 ± 45	763 ± 47	763 ± 52	778 ± 43	728 ± 55	765 ± 57	736 ± 46	765 ± 40	701 ± 22
Country 13	715 ± 35	687 ± 41	680 ± 68	755 ± 41	715 ± 63	714 ± 59	702 ± 53	745 ± 55	655 ± 27

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Country 14	657 ± 80	627 ± 80	594 ± 105	707 ± 58	469 ± 74	512 ± 69	556 ± 116	574 ± 34	496 ± 90
Country 15	725 ± 71	687 ± 80	654 ± 84	758 ± 49	637 ± 107	662 ± 83	604 ± 82	686 ± 57	591 ± 54
Country 16	725 ± 64	707 ± 50	685 ± 53	764 ± 42	635 ± 58	664 ± 70	630 ± 54	672 ± 57	607 ± 49
Country 17	709 ± 51	726 ± 78	667 ± 49	766 ± 52	663 ± 74	657 ± 73	658 ± 58	700 ± 42	612 ± 40
Country 18	654 ± 47	628 ± 63	617 ± 64	694 ± 49	654 ± 54	630 ± 82	657 ± 61	673 ± 44	581 ± 38
Country 19	665 ± 60	680 ± 70	676 ± 68	733 ± 41	642 ± 50	705 ± 70	653 ± 66	700 ± 57	605 ± 38
Country 20	775 ± 58	768 ± 55	738 ± 32	800 ± 40	714 ± 46	749 ± 57	711 ± 53	748 ± 46	692 ± 29
Country 21	720 ± 35	741 ± 76	661 ± 71	753 ± 50	655 ± 57	734 ± 64	648 ± 60	694 ± 54	620 ± 54
Total	738 ± 71	700 ± 96	733 ± 83	727 ± 99	709 ± 81	699 ± 88	777 ± 63	735 ± 77	654 ± 64

LFP: lowest FINA points.

Table 2. The mean ± standard deviation (SD) values of the International Swimming Federation (FINA) points obtained in the regional competitions analyzed and lowest FINA points obtained in each competition.

	Male				Female				
	Butterfly	Backstroke	Breaststroke	Freestyle	Butterfly	Backstroke	Breaststroke	Freestyle	LFP
Country 1	627 ± 46	614 ± 59	601 ± 47	661 ± 45	638 ± 49	648 ± 57	591 ± 39	658 ± 44	557 ± 85
Country 2	575 ± 79	514 ± 68	535 ± 100	650 ± 62	584 ± 53	579 ± 70	545 ± 70	612 ± 50	486 ± 74
Country 3	-	-	-	-	-	-	-	-	-
Country 4	554 ± 74	493 ± 96	473 ± 90	598 ± 50	532 ± 69	562 ± 71	497 ± 97	588 ± 46	424 ± 76
Country 5	532 ± 63	515 ± 51	501 ± 42	583 ± 37	552 ± 47	576 ± 51	494 ± 50	602 ± 47	483 ± 56

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Country 6	-	-	-	-	-	-	-	-	-
Country 7	575 ± 55	573 ± 79	534 ± 60	647 ± 47	559 ± 69	529 ± 61	537 ± 65	625 ± 58	500 ± 56
Country 8	569 ± 36	524 ± 56	512 ± 47	615 ± 59	564 ± 51	564 ± 50	573 ± 41	602 ± 36	500 ± 46
Country 9	457 ± 65	422 ± 48	469 ± 79	540 ± 66	399 ± 82	467 ± 56	395 ± 92	536 ± 52	377 ± 58
Country 10	571 ± 45	564 ± 32	520 ± 38	610 ± 40	588 ± 43	615 ± 51	560 ± 42	629 ± 44	526 ± 63
Country 11	592 ± 44	579 ± 31	557 ± 36	642 ± 40	551 ± 51	585 ± 51	539 ± 49	610 ± 39	515 ± 51
Country 12	500 ± 25	499 ± 45	361 ± 74	547 ± 32	503 ± 38	366 ± 52	522 ± 33	501 ± 38	438 ± 68
Country 13	526 ± 47	480 ± 49	471 ± 59	589 ± 40	532 ± 65	521 ± 45	521 ± 45	590 ± 45	444 ± 63
Country 14	530 ± 64	567 ± 70	521 ± 73	628 ± 39	393 ± 125	473 ± 73	505 ± 87	544 ± 41	424 ± 115
Country 15	-	-	-	-	-	-	-	-	-
Country 16	-	-	-	-	-	-	-	-	-
Country 17	629 ± 42	600 ± 58	603 ± 52	655 ± 36	592 ± 49	577 ± 43	580 ± 46	618 ± 43	549 ± 64
Country 18	490 ± 59	445 ± 64	460 ± 60	558 ± 37	527 ± 69	500 ± 55	508 ± 51	562 ± 35	435 ± 96
Country 19	478 ± 71	447 ± 70	444 ± 68	548 ± 46	458 ± 54	485 ± 48	457 ± 56	529 ± 38	381 ± 71
Country 20	608 ± 42	586 ± 77	552 ± 54	654 ± 52	579 ± 50	598 ± 61	534 ± 51	618 ± 45	492 ± 86
Country 21	511 ± 72	513 ± 74	505 ± 66	579 ± 64	543 ± 49	540 ± 92	529 ± 55	578 ± 35	425 ± 87
Total	548 ± 74	526 ± 82	507 ± 84	606 ± 62	535 ± 88	540 ± 88	523 ± 74	591 ± 55	467 ± 54

LFP, lowest FINA points; -, no information found

ACCEPTED MANUSCRIPT

Figure 1. The male national swimmers' differences in the FINA points between countries. Post hoc significant differences are represented by numbers written in white. The number included in each square shows the difference in the FINA points between the countries, being the darker the square the higher the difference. Panel A) 100 m butterfly, Panel B) 100 m backstroke, Panel C) 100 m breaststroke, Panel D) 100 m freestyle.

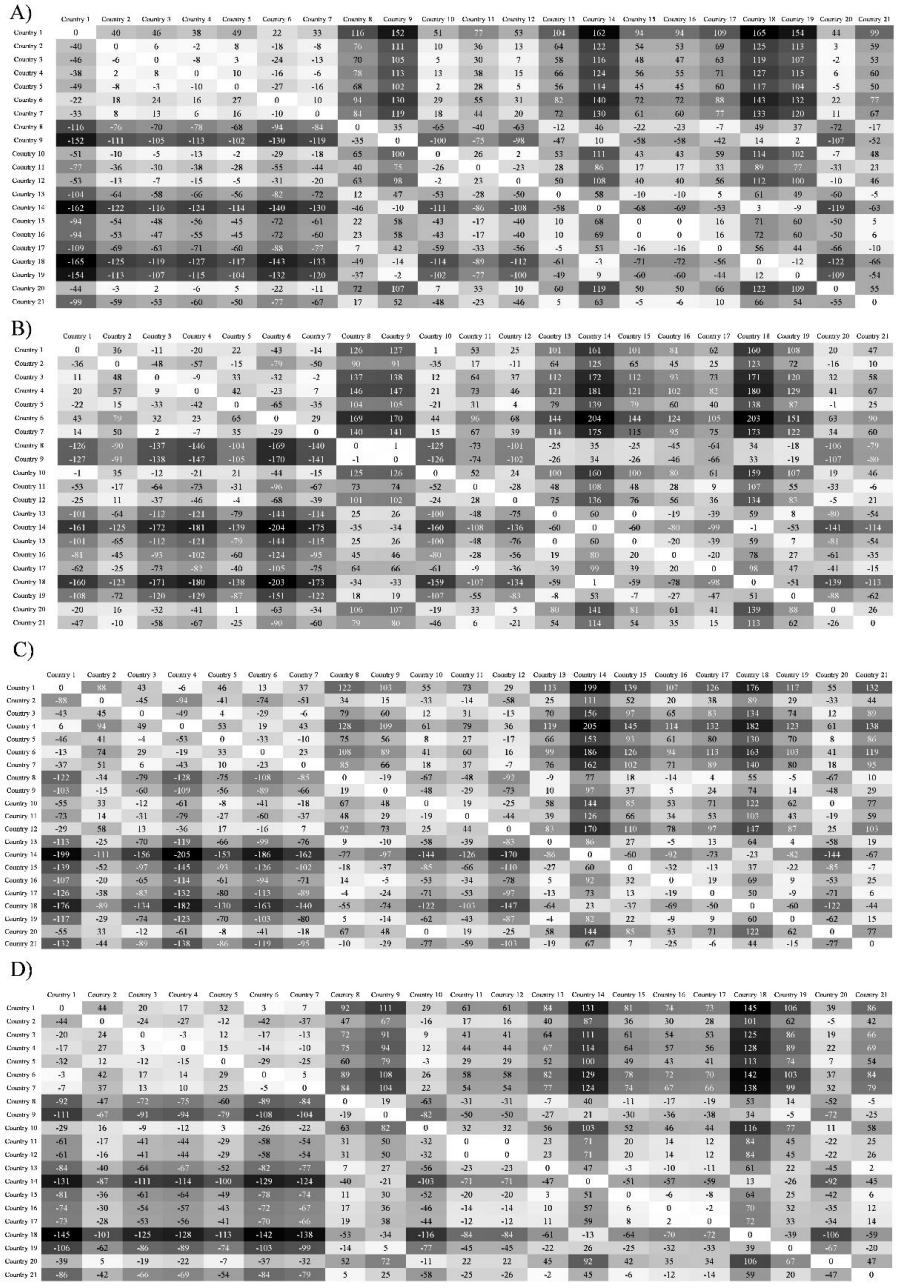


Figure 2. The female national swimmers' differences in the FINA points. Post hoc significant differences are represented by numbers written in white. The number included in each square shows the difference in

the FINA points between the countries, being the darker the square the higher the difference. Panel A) 100 m butterfly, Panel B) 100 m backstroke, Panel C) 100 m breaststroke, Panel D) 100 m freestyle.

A)

	Country 1	Country 2	Country 3	Country 4	Country 5	Country 6	Country 7	Country 8	Country 9	Country 10	Country 11	Country 12	Country 13	Country 14	Country 15	Country 16	Country 17	Country 18	Country 19	Country 20	Country 21
Country 1	0	91	61	46	98	79	84	151	166	44	128	105	116	362	194	196	168	177	189	117	176
Country 2	-91	0	-30	-46	6	-12	-8	60	75	-47	37	12	24	271	102	104	77	86	97	26	85
Country 3	-61	30	0	-16	36	18	22	90	10	-17	67	42	55	301	133	135	107	116	128	56	115
Country 4	-46	46	16	0	52	34	38	105	120	-1	83	58	70	317	148	150	123	132	143	72	130
Country 5	-98	-6	-36	-52	0	-18	-14	54	68	-53	30	6	18	265	96	98	70	80	91	20	79
Country 6	-79	12	-18	-34	18	0	5	72	87	-35	49	24	37	283	115	117	89	98	109	38	97
Country 7	-84	8	-22	-38	14	-5	0	68	82	-40	45	20	32	279	110	112	85	94	105	34	93
Country 8	-151	-60	-90	-105	-54	-72	-68	0	15	-107	-23	-48	-36	211	43	45	17	26	38	-34	25
Country 9	-166	-75	-104	-120	-68	-87	-82	-15	0	-122	-38	-63	-50	196	28	30	2	11	23	-49	10
Country 10	-44	47	17	1	53	35	40	107	122	0	84	59	72	318	150	152	124	133	145	73	132
Country 11	-128	-37	-67	-83	-30	-49	-45	23	38	-84	0	-25	-12	234	66	68	40	49	60	-11	48
Country 12	-103	-12	-42	-58	-6	-24	-20	48	63	-59	25	0	12	259	90	92	65	74	85	14	73
Country 13	-116	-24	-55	-70	-18	-37	-32	36	50	-72	12	-12	0	247	78	80	53	61	73	1	60
Country 14	-362	-271	-301	-317	-265	-283	-279	-211	-196	-318	-234	-259	-247	0	-168	-167	-194	-185	-174	-245	-186
Country 15	-194	-102	-133	-148	-96	-115	-110	-43	-28	-150	-66	-90	-78	168	0	2	-26	-17	-5	-77	-18
Country 16	-196	-102	-135	-150	-98	-117	-112	-45	-30	-152	-68	-92	-80	167	-2	0	-27	-19	-7	-79	-20
Country 17	-168	-77	-107	-123	-70	-89	-85	-17	-2	-124	-40	-65	-53	194	26	27	0	9	20	-51	8
Country 18	-177	-86	-116	-132	-80	-98	-94	-26	-11	-133	-49	-74	-61	185	17	19	-9	0	12	-60	0
Country 19	-189	-97	-128	-143	-91	-109	-105	-38	-23	-145	-60	-85	-73	174	5	7	-20	-12	0	-72	-13
Country 20	-117	-26	-56	-72	-20	-38	-34	34	49	-73	11	-14	-1	245	77	79	51	60	72	0	59
Country 21	-176	-85	-115	-130	-79	-97	-93	-25	-10	-132	-48	-73	-60	186	18	20	-8	0	13	-59	0

B)

	Country 1	Country 2	Country 3	Country 4	Country 5	Country 6	Country 7	Country 8	Country 9	Country 10	Country 11	Country 12	Country 13	Country 14	Country 15	Country 16	Country 17	Country 18	Country 19	Country 20	Country 21
Country 1	0	127	82	50	136	80	104	193	173	28	119	105	156	358	208	206	212	240	165	120	135
Country 2	-127	0	-46	-77	9	-48	-23	66	45	-99	-9	-22	29	230	81	78	85	112	38	-6	8
Country 3	-82	46	0	-31	54	-2	22	112	90	-54	37	23	75	276	127	124	130	158	83	39	54
Country 4	-50	77	31	0	86	30	54	143	122	-22	68	55	106	307	158	155	162	189	115	71	85
Country 5	-136	-9	-54	-86	0	-56	-32	57	37	-108	-17	-31	20	222	72	70	76	104	29	-15	-1
Country 6	-80	48	2	-30	56	0	24	114	93	-52	39	25	76	278	128	126	132	160	85	41	55
Country 7	-104	23	-22	-54	32	-24	0	89	69	-76	15	1	52	254	104	102	108	136	61	17	31
Country 8	-193	-66	-112	-143	-57	-114	-89	0	-21	-165	-75	-88	-37	164	15	12	19	46	-29	-72	-58
Country 9	-173	-45	-90	-122	-37	-93	-69	21	0	-145	-54	-68	-16	185	36	33	40	67	-8	-52	-37
Country 10	-28	99	54	22	108	52	76	165	145	0	90	77	128	330	180	178	184	212	137	93	107
Country 11	-119	9	-37	-68	17	-39	-15	75	54	-90	0	-14	38	239	90	87	94	120	46	2	17
Country 12	-105	22	-23	-55	31	-25	-1	88	68	-77	14	0	51	253	103	101	107	135	60	16	30
Country 13	-156	-29	-75	-106	-20	-76	-52	37	16	-128	-38	-51	0	201	52	49	56	83	9	-35	-21
Country 14	-358	-230	-276	-307	-222	-278	-254	-164	-185	-330	-239	-253	-201	0	-149	-152	-145	-118	-193	-237	-222
Country 15	-208	-81	-127	-158	-72	-128	-104	-15	-36	-180	-90	-103	-52	149	0	-3	4	31	-43	-87	-73
Country 16	-206	-78	-124	-155	-70	-126	-102	-12	-33	-178	-87	-101	-49	152	3	0	7	34	-41	-85	-70
Country 17	-212	-85	-130	-162	-76	-132	-108	-19	-40	-184	-94	-107	-56	145	-4	-7	0	27	-47	-91	-77
Country 18	-240	-112	-158	-189	-104	-160	-136	-46	-67	-212	-120	-135	-83	118	-31	-34	-27	0	-75	-119	-104
Country 19	-165	-38	-83	-115	-29	-85	-61	29	8	-137	-46	-60	-9	193	43	41	47	75	0	-44	-30
Country 20	-120	6	-39	-71	15	-41	-17	72	52	-93	-2	-16	35	237	87	85	91	119	44	0	14
Country 21	-135	-8	-54	-85	1	-55	-31	58	37	-107	-17	-30	21	222	73	70	77	104	30	-14	0

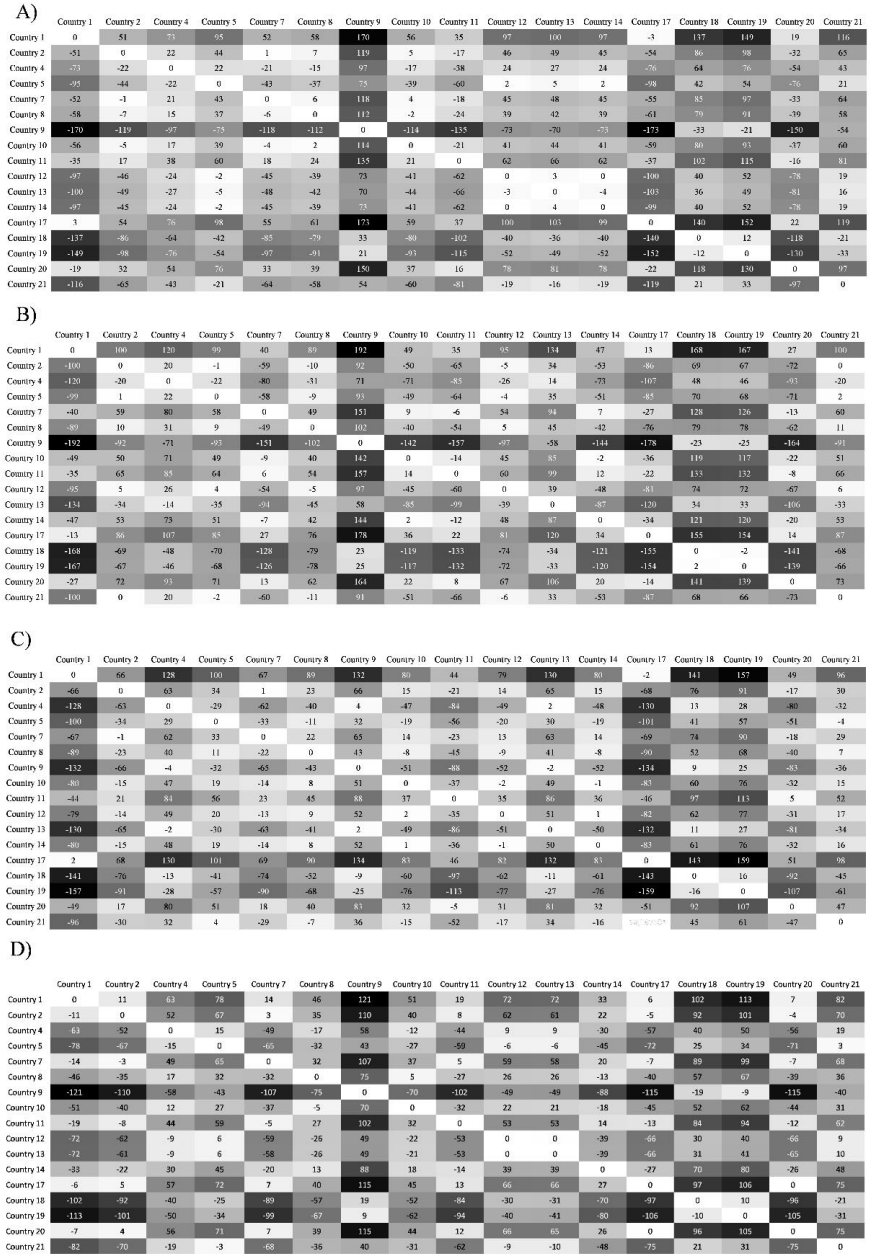
C)

	Country 1	Country 2	Country 3	Country 4	Country 5	Country 6	Country 7	Country 8	Country 9	Country 10	Country 11	Country 12	Country 13	Country 14	Country 15	Country 16	Country 17	Country 18	Country 19	Country 20	Country 21
Country 1	0	108	65	14	69	44	89	115	153	34	125	76	110	256	208	182	154	155	159	101	164
Country 2	-108	0	-43	-94	-39	-64	-18	8	45	-74	17	-32	3	148	100	75	46	47	52	-6	56
Country 3	-65	43	0	-51	5	-21	25	51	89	-31	60	11	46	191	143	118	89	90	95	37	99
Country 4	-14	94	51	0	55	30	75	101	139	20	111	62	96	242	194	168	140	141	145	87	150
Country 5	-69	39	-5	-55	0	-25	20	46	84	-36	55	7	41	187	139	113	85	86	90	32	93
Country 6	-44	64	21	-30	25	0	45	71	109	-10	81	32	66	212	164	138	110	111	115	57	120
Country 7	-89	18	-25	-75	-20	-45	0	26	64	-56	35	-13	21	167	118	93	65	66	70	12	74
Country 8	-115	-8	-51	-101	-46	-71	-26	0	38	-82	9	-39	-5	141	92	67	39	39	44	-14	48
Country 9	-153	-45	-89	-139	-84	-109	-64	-38	0	-120	-29	-77	-43	103	55	29	1	2	6	-52	11
Country 10	-34	74	31	-20	36	10	56	82	120	0	91	42	77	222	174	149	120	121	126	68	130
Country 11	-125	-17	-60	-111	-55	-81	-35	-9	29	-91	0	-49	-14	132	83	58	29	30	35	-23	39
Country 12	-76	32	-11	-62	-7	-32	13	39	77	-42	49	0	34	180	132	106	78	79	83	25	88
Country 13	-110	-3	-46	-96	-41	-66	-21	5	43	-77	14	-34	0	146	97	72	44	44	49	-9	53
Country 14	-256	-148	-191	-242	-187	-212	-167	-141	-103	-222	-132	-180	-146	0	-48	-74	-102	-101	-97	-155	-92
Country 15	-208	-100	-143	-194	-139	-164	-118	-92	-55	-174	-83	-132	-97	48	0	-26	-54	-53	-49	-106	-44
Country 16	-182	-75	-118	-168	-113	-138	-93	-67	-29	-149	-58	-106	-72	74	26	0	-28	-27	-23	-81	-19
Country 17	-154	-46	-89	-140	-85	-110	-65	-39	-1	-120	-29	-78	-44	102	54	28	0	1	5	-53	10
Country 18	-155	-47	-90	-141	-86	-111	-66	-39	-2	-121	-30	-79	-44	101	53	27	-1	0	4	-54	9
Country 19	-159	-52	-95	-145	-90	-115	-70	-44	-6	-126	-35	-83	-49	97	49	23	-5	-4	0	-58	5
Country 20	-101	6	-37	-87	-32	-57	-12	14	52	-68	23	-25	9	155	106	81	53	54	58	0	62
Country 21	-164	-56	-99	-150	-95	-120	-74	-48	-11	-130	-39	-88	-53	92	44	19	-10	-9	-5	-62	0

D)

	Country 1	Country 2	Country 3	Country 4	Country 5	Country 6	Country 7	Country 8	Country 9	Country 10	Country 11	Country 12	Country 13	Country 14	Country 15	Country 16	Country 17	Country 18	Country 19	Country 20	Country 21
Country 1	0	96	1	52	94	37	22	137	122	17	104	68	88	259	147	161	133	159	133	85	140
Country 2	-96	0	-95	-44	-2	-59	-74	41	26	-79	8	-28	-8	163	51	65	37	63	37	-11	44
Country 3	-1	95	0	51	93	36	21	136	121	16	103	67	87	258	146	160	132	158	132	84	139
Country 4	-52	44	-51	0	43	-14	-30	86	71	-35	53	16	36	207	96	109	81	108	81	33	88
Country 5	-94	2	-93	-43	0	-57	-73	43	28	-37	10	-27	-6	165	53	67	38	65	39	-10	46
Country 6	-37	59	-36	14	57	0	-16	100	85	-20	67	30	51	222	110	124	95	122	96	47	103
Country 7	-22	74	-21	30	73	16	0	116	100	-5	83	46	66	237	125	139	111	138	111	63	118
Country 8	-137	-41	-136	-86	-43	-100	-116	0	-15	-120	-33	-70	-49	122	10	24	-5	22	-4	-53	3
Country 9	-122	-26	-121	-71	-28	-85	-100	15	0	-105	-18	-54	-34	137	25	39	11	37	11	-38	18
Country 10	-17	79	-16	35	77	20	5	120	105	0	87	51	71	242	130	144	116	142	116	68	123
Country 11	-104	-8	-103	-53	-10	-67	-82	33	18	-87	0	-36	-16	155	43	57	29	55	29	-20	36
Country 12	-68	28	-67	-16	27	-30	-46	70	54	-51	36	0	20	191	79	93	65	92	65	17	72
Country 13	-88	8	-87	-36	6	-51	-66	49	34	-71	16	-20	0	171	59	73	45	71	45	-4	52
Country 14	-259	-163	-258	-207	-165	-222	-237	-122	-137	-242	-155	-191	-171	0	-112	-98	-126	-100	-126	-174	-119
Country 15	-147	-51	-146	-96	-53	-110	-125	-10	-25	-130	-43	-79	-59	112	0	14	-15	12	-14	-63	-7
Country 16	-161	-65	-160	-109	-67	-124	-139	-24	-39	-144	-57	-93	-73	98	-14	0	-28	-2	-28	-77	-21
Country 17	-133	-37	-132	-81	-38	-95	-111	5	-11	-116	-29	-65	-45	126	15	28	0	27	0	-48	7
Country 18	-159	-63	-158	-108	-65	-122	-138	-22	-37	-142	-55	-92	-71	100	-12	2	-27	0	-26	-75	-20
Country 19	-133	-37	-132	-81	-39	-96	-111	4	-11	-116	-29	-65	-45	126	14	28	0	26	0	-48	7
Country 20	-85	11	-83	-33	10	-47	-63	53	38	-68	20	-17	4	174	63	77	48	75	48	0	55
Country 21	-140	-44	-139	-88	-46	-103	-118	-3	-18	-123	-36	-72	-52	119	7	21	-7	20	-7	-55	0

Figure 3. The male regional swimmers' differences in the FINA points. Post hoc significant differences are represented by numbers written in white. The number included in each square shows the difference in the FINA points between the countries, being the darker the square the higher the difference. Panel A) 100 m butterfly, Panel B) 100 m backstroke, Panel C) 100 m breaststroke, Panel D) 100 m freestyle.



A)

	Country 1	Country 2	Country 4	Country 5	Country 7	Country 8	Country 9	Country 10	Country 11	Country 12	Country 13	Country 14	Country 17	Country 18	Country 19	Country 20	Country 21
Country 1	0	51	73	95	52	58	170	56	35	97	100	97	-3	137	149	19	116
Country 2	-51	0	22	44	1	7	119	5	-17	46	49	45	-54	86	98	-32	65
Country 4	-73	-22	0	22	-21	-15	97	-17	-38	24	27	24	-76	64	76	-54	43
Country 5	-95	-44	-22	0	-43	-37	75	-39	-60	2	5	2	-98	42	54	-76	21
Country 7	-52	-1	21	43	0	6	118	4	-18	45	48	45	-55	85	97	-33	64
Country 8	-58	-7	15	37	-6	0	112	-2	-24	39	42	39	-61	79	91	-39	58
Country 9	-170	-119	-97	-75	-118	-112	0	-114	-135	-73	-70	-73	-173	-33	-21	-150	-54
Country 10	-56	-5	17	39	-4	2	114	0	-21	41	44	41	-59	80	93	-37	60
Country 11	-35	17	38	60	18	24	135	21	0	62	66	62	-37	102	115	-16	81
Country 12	-97	-46	-24	-2	-45	-39	73	-41	-62	0	3	0	-100	40	52	-78	19
Country 13	-100	-49	-27	-5	-48	-42	70	-44	-66	-3	0	-4	-103	36	49	-81	16
Country 14	-97	-45	-24	-2	-45	-39	73	-41	-62	0	4	0	-99	40	52	-78	19
Country 17	3	54	76	98	55	61	173	59	37	100	103	99	0	140	152	22	119
Country 18	-137	-86	-64	-42	-85	-79	33	-80	-102	-40	-36	-40	-140	0	12	-118	-21
Country 19	-149	-98	-76	-54	-97	-91	21	-93	-115	-52	-49	-52	-152	-12	0	-130	-33
Country 20	-19	32	54	76	33	39	150	37	16	78	81	78	-22	118	130	0	97
Country 21	-116	-65	-43	-21	-64	-58	54	-60	-81	-19	-16	-19	-119	21	33	-97	0

B)

	Country 1	Country 2	Country 4	Country 5	Country 7	Country 8	Country 9	Country 10	Country 11	Country 12	Country 13	Country 14	Country 17	Country 18	Country 19	Country 20	Country 21
Country 1	0	100	120	99	40	89	192	49	35	95	134	47	13	168	167	27	100
Country 2	-100	0	20	-1	-59	-10	92	-50	-65	-5	34	-53	-86	69	67	-72	0
Country 4	-120	-20	0	-22	-80	-31	71	-71	-85	-26	14	-73	-107	48	46	-93	-20
Country 5	-99	1	22	0	-58	-9	93	-49	-64	-4	35	-51	-85	70	68	-71	2
Country 7	-40	59	80	58	0	49	151	9	-6	54	94	7	-27	128	126	-13	60
Country 8	-89	10	31	9	-49	0	102	-40	-54	5	45	-42	-76	79	78	-62	11
Country 9	-192	-92	-71	-93	-151	-102	0	-142	-157	-97	-58	-144	-178	-23	-25	-164	-91
Country 10	-49	50	71	49	-9	40	142	0	-14	45	85	-2	-36	119	117	-22	51
Country 11	-35	65	85	64	6	54	157	14	0	60	99	12	-22	133	132	-8	66
Country 12	-95	5	26	4	-54	-5	97	-45	-60	0	39	-48	-81	74	72	-67	6
Country 13	-134	-34	-14	-35	-94	-45	58	-85	-99	-39	0	-87	-120	34	33	-106	-33
Country 14	-47	53	73	51	-7	42	144	2	-12	48	87	0	-34	121	120	-20	53
Country 17	-13	86	107	85	27	76	178	36	22	81	120	34	0	155	154	14	87
Country 18	-168	-69	-48	-70	-128	-79	23	-119	-133	-74	-34	-121	-155	0	-2	-141	-68
Country 19	-167	-67	-46	-68	-126	-78	25	-117	-132	-72	-33	-120	-154	2	0	-139	-66
Country 20	-27	72	93	71	13	62	164	22	8	67	106	20	-14	141	139	0	73
Country 21	-100	0	20	-2	-60	-11	91	-51	-66	-6	33	-53	-87	68	66	-73	0

C)

	Country 1	Country 2	Country 4	Country 5	Country 7	Country 8	Country 9	Country 10	Country 11	Country 12	Country 13	Country 14	Country 17	Country 18	Country 19	Country 20	Country 21
Country 1	0	66	128	100	67	89	132	80	44	79	130	80	-2	141	157	49	96
Country 2	-66	0	63	34	1	23	66	15	-21	14	65	15	-68	76	91	-17	30
Country 4	-128	-63	0	-29	-62	-40	4	-47	-84	-49	2	-48	-130	13	28	-80	-32
Country 5	-100	-34	29	0	-33	-11	32	-19	-56	-20	30	-19	-101	41	57	-51	-4
Country 7	-67	-1	62	33	0	22	65	14	-23	13	63	14	-69	74	90	-18	29
Country 8	-89	-23	40	11	-22	0	43	-8	-45	-9	41	-8	-90	52	68	-40	7
Country 9	-132	-66	-4	-32	-65	-43	0	-51	-88	-52	-2	-52	-134	9	25	-83	-36
Country 10	-80	-15	47	19	-14	8	51	0	-37	-2	49	-1	-83	60	76	-32	15
Country 11	-44	21	84	56	23	45	88	37	0	35	86	36	-46	97	113	5	52
Country 12	-79	-14	49	20	-13	9	52	2	-35	0	51	1	-82	62	77	-31	17
Country 13	-130	-65	-2	-30	-63	-41	2	-49	-86	-51	0	-50	-132	11	27	-81	-34
Country 14	-80	-15	48	19	-14	8	52	1	-36	-1	50	0	-83	61	76	-32	16
Country 17	2	68	130	101	69	90	134	83	46	82	132	83	0	143	159	51	98
Country 18	-141	-76	-13	-41	-74	-52	-9	-60	-97	-62	-11	-61	-143	0	16	-92	-45
Country 19	-157	-91	-28	-57	-90	-68	-25	-76	-113	-77	-27	-76	-159	-16	0	-107	-61
Country 20	-49	17	80	51	18	40	83	32	-5	31	81	32	-51	92	107	0	47
Country 21	-96	-30	32	4	-29	-7	36	-15	-52	-17	34	-16	[illegible]	45	61	-47	0

D)

	Country 1	Country 2	Country 4	Country 5	Country 7	Country 8	Country 9	Country 10	Country 11	Country 12	Country 13	Country 14	Country 17	Country 18	Country 19	Country 20	Country 21
Country 1	0	11	63	78	14	46	121	51	19	72	72	33	6	102	113	7	82
Country 2	-11	0	52	67	3	35	110	40	8	62	61	22	-5	92	101	-4	70
Country 4	63	-52	0	15	-49	-17	58	-12	-44	9	9	-30	-57	40	50	-56	19
Country 5	-78	-67	-15	0	-65	-32	43	-27	-59	-6	-6	-45	-72	25	34	-71	3
Country 7	-14	-3	49	65	0	32	107	37	5	59	58	20	-7	89	99	-7	68
Country 8	-46	-35	17	32	-32	0	75	5	-27	26	26	-13	-40	57	67	-39	36
Country 9	-121	-110	-58	-43	-107	-75	0	-70	-102	-49	-49	-88	-115	-19	-9	-115	-40
Country 10	-51	-40	12	27	-37	-5	70	0	-32	22	21	-18	-45	52	62	-44	31
Country 11	-19	-8	44	59	-5	27	102	32	0	53	53	14	-13	84	94	-12	62
Country 12	-72	-62	-9	6	-59	-26	49	-22	-53	0	0	-39	-66	30	40	-66	9
Country 13	-72	-61	-9	6	-58	-26	49	-21	-53	0	0	-39	-66	31	41	-65	10
Country 14	-33	-22	30	45	-20	13	88	18	-14	39	39	0	-27	70	80	-26	48
Country 17	-6	5	57	72	7	40	115	45	13	66	66	27	0	97	106	0	75
Country 18	-102	-92	-40	-25	-89	-57	19	-52	-84	-30	-31	-70	-97	0	10	-96	-21
Country 19	-113	-101	-50	-34	-99	-67	9	-62	-94	-40	-41	-80	-106	-10	0	-105	-31
Country 20	-7	4	56	71	7	39	115	44	12	66	65	26	0	96	105	0	75
Country 21	-82	-70	-19	-3	-68	-36	40	-31	-62	-9	-10	-48	-75	21	31	-75	0

Figure 4. The female regional swimmers' differences in the FINA points. Post hoc significant differences are represented by numbers written in white. The number included in each square shows the difference in

the FINA points between the countries, being the darker the square the higher the difference. Panel A) 100 m butterfly, Panel B) 100 m backstroke, Panel C) 100 m breaststroke, Panel D) 100 m freestyle.

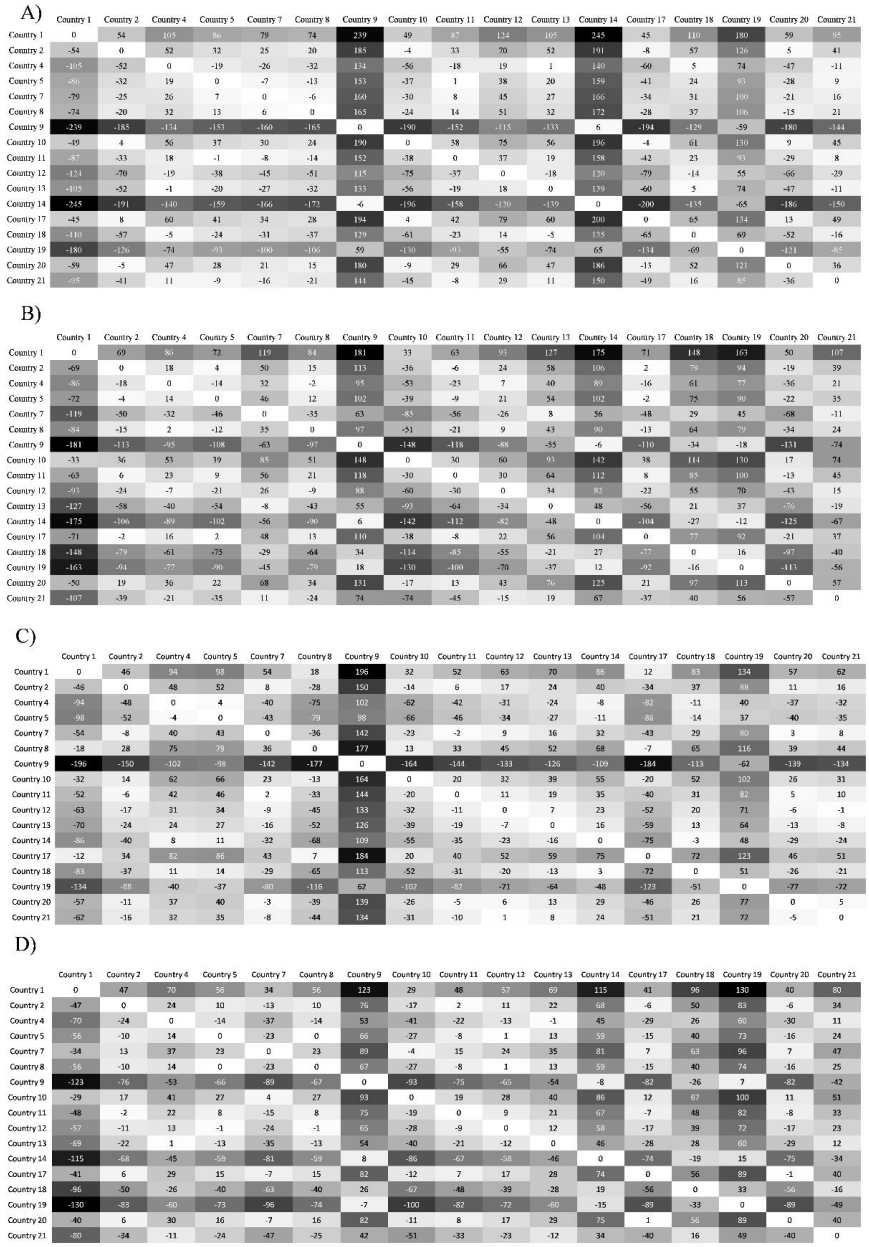
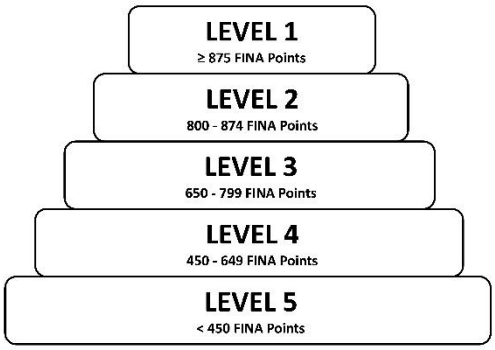


Figure 5. New model of swimmers' performance level classification in swimming. FINA: International Swimming Federation



	National		Regional		Regional		Regional	
Country	Competition	Date	Competition	Date	Competition	Date	Competition	Date
Australia	Australian Championships	7-12 Apr	-	-	-	-	-	-
Belarus	Belarus Championships	17-20 Apr	-	-	-	-	-	-
Canada	Canadian Swimming Trials	3-7 Abr	Eastern Ontario Regional Championships	1-3 Feb	Grand Prix	18-19 Jan	MAC Winter Invitational	10-13 Jan
Denmark	Danish Open og DMJ-L	5-9 Apr	VAT Copenhagen Open	10-12 May	Arena Lyngby Open 2019 Stadion	18-20 Jan	Kronborg Open	1-3 Mar
France	Championnats de France Elite	16-21 Apr	Championnats Regionaux Ete	29-1 Jul	10e Meeting National des Hortillons	18-20 Jan	Championnat Regional Hiver	22-24 Feb
GB	British Championships	16-21 Apr	Leander Spring Reg Qu	30-31 Mar	-	-	-	-
Germany	German Championships	1-4 Ago	Sparkassen – Pokalschwimmen	6-7 Apr	Swim Meeting	10-12 May	Cup	23-24 May
Greece	Greek Championships	2-5 Aug	Tropaio Nirea Agonistika	25-27 Jan	Heimerinoi Agones E-N P-K	22-24 Feb	Panellinioi Heimerinoi Agones Andron Gynaikon	1-3 Mar
Hungary	CXXI. Hungarian swimming championship	27-30 Mar	Championship open	26-29 Jun	JAKED-HOD International Swimming	23-24 Feb	50. Csik Ferenc Memorial	11-12 May

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Italy	Italian Championships	1-4 Aug	II prova qualificazione Campionato Regionale vasca lunga	12-13 Jun	Trofeo Citta Longobarda	15-16 Jun	Prova ASSOLUTI	27-28 Apr
Lithuania	Atviras Lietuvos plaukimo cempionatas	25-27 Apr	Atviras Kauno miesto plaukimo cempionatas	15-16 Mar	Lithuanian winter championships	1-2 Mar	Dzukija Cup	5-6 Apr
Netherlands	Open Nederlandse Kampioenschappen lange baan	21-23 Jun	Voorjaarslimietwedstrijd	23-24 Feb	-	-	-	-
New Zealand	New Zealand Open Championships	17-21 Jun	-	-	-	-	-	-
Norway	Norwegian Championships	4-7 Jul	Marienlyst Open	3-5 May	Skagerrak Swim	25-27 Jan	SSK Kvaliken	27-29 Sep
Poland	Mistrzostwa Polski W Plywaniu Seniorow I Mlodziezowcow	15-19 May	Arena Grand Prix Puchar Polski	23-24 Mar	Arena Grand Prix Puchar Polski	27-28 Apr	Arena Grand Prix Puchar Polski	6-7 Apr
Russia	Russian Championships	8-12 Apr	-	-	-	-	-	-
Spain	Cto. España Absoluto Y Junior De Verano	3-7 Aug	Cto Andalucia Absoluto Junior Verano	12-14 Jul	Autonomico Junior y Absoluto de Verano	13-14 Jul	Cto. Galego Natacion Absoluto Júnior Infantil Ver	4-7 Jul
Sweden	SM/Para-SM/JSM	28-2 Jul	Ullbergstrofen	26-28 Apr	Arena Sprint Meet	2-3 Feb	Meet Vaesteras	30-31 Mar
Switzerland	Swiss Long Course Championship	20-24 Mar	16e Meeting Lemanique	9-10 Mar	RZO: Regionale Sommermeisterschaften	22-23 Jun	48eme Meeting Renens-Jeunesse	25-26 May
Ukraine	Ukrainian Championships	23-26 Apr	-	-	-	-	-	-
USA	US National Championship	4-7 Dec	CA SCS Senior Challenge	15-17 Feb	Southern Zone South Sectional	7-10 Mar	Speedo Grand Challenge	24-26 May

GB, Great Britain; USA, United States of America

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