

# THE IMPACT OF SELECTED ADAPTED SPORTS ON THE QUALITY OF LIFE OF PEOPLE WITH PHYSICAL DISABILITIES: A COMPARATIVE ANALYSIS OF DIVING AND WHEELCHAIR RUGBY

Gabriela Henrykowska<sup>1)</sup>, Ewa Zieliński<sup>2)</sup>, Piotr Siermontowski<sup>3)</sup>, Justyna Kęczkowska<sup>4)</sup>

<sup>1)</sup> Department of Epidemiology and Public Health, Medical University of Lodz, Poland

<sup>2)</sup> Department of Emergency Medical Services, Collegium Medicum in Bydgoszcz, Nicolaus Copernicus University in Toruń, Poland

<sup>3)</sup> Department Underwater Work Technology, Polish Naval Academy, Poland

<sup>4)</sup> Kielce University of Technology, Poland

## ABSTRACT

Adaptive sport is a recognized tool for improving the quality of life (QoL) of people with physical disabilities. However, the existing literature rarely delves into diverse impact of specific disciplines. The purpose of this study was to conduct a quantitative comparative assessment of quality of life of four groups of people with physical disabilities: scuba divers (G1), wheelchair rugby players (G2), those active in other sports (G3), and a physically inactive group (G4). The cross-sectional study involved 134 wheelchair users. The WHOQOL-BREF questionnaire was used to assess the quality of life. Statistically significant differences were found between the groups in the domains such as social relationships ( $p=0.012$ ), environmental ( $p=0.009$ ) and physical health ( $p=0.048$ ). The scuba diving group (G1) scored highest in all domains, rating their quality of life in the environmental domain significantly higher than group G3 ( $p=0.005$ ). Group G3 ("other sports") rated the domain of social relationships significantly higher than wheelchair rugby players (G2) ( $p=0.007$ ). The type of sport practiced is a significant factor that differentiates the impact in various aspects of the quality of life. Scuba diving, due to the unique properties of the aquatic environment, may offer exceptional psychophysiological benefits. In contrast, the confrontational nature of rugby, despite the advantages of teamwork, may influence the perception of social relationships differently.

**Keywords:** quality of life, adaptive sport, scuba diving, wheelchair rugby, spinal cord injury, WHOQOL-BREF.

---

## ARTICLE INFO

PolHypRes 2025 Vol. 91 Issue 2 pp. 33 – 44

**ISSN:** 1734-7009 **eISSN:** 2084-0535

**DOI:** 10.2478/phr-2025-0009

Pages: 12, figures: 0, tables: 2

**page www of the periodical:** [www.phr.net.pl](http://www.phr.net.pl)

**Original article**

**Submission date:** 14.02.2025 r.

**Acceptance for print:** 13.03.2025 r.

## Publisher

Polish Hyperbaric Medicine and Technology Society

## INTRODUCTION

Quality of Life (QoL), defined by the World Health Organization as an individual's perception of their position in life in the context of the culture and value systems in which they live, is a key indicator of their well-being [1]. It is a multidimensional assessment that encompasses both objective living conditions and subjective well-being [2,3].

Physical disability introduces numerous functional limitations that can negatively affect independence, mental health, and the ability to fully participate in social life [4]. Spinal cord injury (SCI) is recognized as one of the most severe causes and predictors of disability, having a devastating impact on the quality of life of an individual [5]. The direct consequence of the injury is impaired motor and sensory function, leading to paralysis or paresis, which in turn has profound consequences in the physical, psychological, social, and economic spheres [6,7]. Other congenital or acquired dysfunctions can also lead to these outcomes.

Individuals who use a wheelchair (as a result of SCI or other conditions) experience significant challenges that adversely affect their daily functioning [5,8,9]. The scientific literature indicates substantial limitations in returning to professional activities and hobbies, as well as lower rates of participation in physical activity compared to the able-bodied population. Consequently, they often score lower in the domains of health-related quality of life (HRQoL), particularly in the social and psychological spheres [5-9]. Therefore, there is an urgent need to identify and implement effective interventions that can not only mitigate the physical effects of the injury, but also support social adaptation and enhance overall satisfaction with life.

In this context, adaptive sports emerge as a promising tool for rehabilitation and social activation. Numerous studies confirm a wide range of benefits from participating in adaptive sports [10-12]. These include, among others, improved physical fitness and functional ability, increased independence in daily life, and a positive impact on mental health, including stress reduction and increased self-esteem [13-15]. Adaptive sports are also recognized as an effective social integration mechanism that enables the formation of relationships, the building of bonds, and the enhancement of a sense of belonging [16]. Numerous studies and systematic reviews provide evidence of its positive impact on improving physical fitness, increasing independence, reducing depressive symptoms, and strengthening social networks and self-efficacy [17-21].

Despite the well-established position of sport as a therapeutic tool, the scientific literature often approaches physical activity holistically, without differentiating between the influence of specific disciplines. This generalization overlooks the fact that different types of sports—for example, team versus individual or confrontational versus recreational—can affect the various QoL domains in different ways.

A particularly interesting area of research is the comparison of disciplines having completely different characteristics, such as the team-based, confrontational sport of wheelchair rugby and the individual activity of scuba diving. Wheelchair rugby is a high-intensity sport that requires strategic teamwork and direct competition [21,22]. In contrast, scuba diving, beyond its recreational

aspect, immerses the participant in a unique hyperbaric environment. This generates specific psychophysiological experiences: a sense of weightlessness resulting from the aquatic environment, which can temporarily negate the feeling of disability; altered sensory perception; and the need for concentration and breath control. These unique properties of the aquatic environment may constitute a significant, yet insufficiently studied, factor influencing mental and physical well-being [23-25].

The purpose of this study was a quantitative comparative assessment of the quality of life (QoL) of four groups of people with physical disabilities: those practicing scuba diving, those playing wheelchair rugby, those active in other sports, and a control group of physically inactive individuals. It was hypothesized that the specific nature of the practiced discipline differentially affects the various domains of the quality of life: physical, psychological, social relationships, and environmental. Filling this existing research gap could provide valuable information for clinicians and therapists in recommending targeted forms of physical activity to maximize rehabilitative benefits and improve the overall satisfaction of the patient with life.

## MATERIALS AND METHODS

### PARTICIPANTS AND PROCEDURE

The study was conducted using a cross-sectional design. Participants were recruited through national associations, foundations that work on behalf of people with disabilities, and sports clubs for athletes with physical disabilities. Inclusion criteria were age over 18 years and physical disability that required permanent use of a wheelchair, and providing informed voluntary consent to participate. The study was conducted through an online survey. Exclusion criteria were cognitive impairments that prevented the independent and conscious completion of the questionnaire and an incompletely completed survey.

The study received approval from the Bioethics Committee. All participants were informed about the purpose and voluntary nature of the study and gave their informed consent before completing the survey.

A total of 140 questionnaires were collected. After verifying the completeness of the data, 6 surveys were discarded. Ultimately, 134 correctly and fully completed research forms were qualified for statistical analysis.

### RESEARCH TOOLS

A two-part survey questionnaire was used as the research tool. The first part, designed by the study authors, was used to collect data such as sex, age, cause of disability, time since disability onset date, and detailed information about physical activity (discipline, training experience, frequency of training). Based on these data, four comparative groups were created: (G1) scuba divers, (G2) wheelchair rugby players, (G3) individuals practicing other adaptive sports, and (G4) physically inactive individuals.

The second part of the survey consisted of the WHOQOL-BREF Quality of Life Questionnaire [26]. To assess Health-Related Quality of Life (HRQoL), the Polish adaptation of the short version of the World Health

Organization's questionnaire—the WHOQOL-BREF—was used. It is a widely used and validated tool that allows assessing quality of life in four key domains: physical (e.g., pain, energy, sleep, mobility), psychological (e.g., self-esteem, negative and positive feelings), social relationships (e.g., social support, personal relationships) and environmental (e.g., safety, finances, access to healthcare).

WHOQOL-BREF scores were calculated according to the official guidelines provided by the authors of the tool [XX]. The raw scores of individual questions were transformed to obtain values for the four qualities of the domains of life. Subsequently, to allow for comparisons, these results were scaled for a range of 4-20 points. The two general questions, concerning subjective assessment of the quality of life and health status, were analyzed on their original 1-5 scale.

#### STATISTICAL ANALYSIS

Statistical analyzes were performed using the Python programming language (version 3.12). The data processing and analysis process was based on open-source libraries: pandas (for data management), scipy.stats (for statistical tests), and statsmodels (for regression modeling). The level of statistical significance was set at  $\alpha = 0.05$ . The normality of the distribution was verified using the Shapiro-Wilk test and the homogeneity of the variance was checked with the Levene test. To compare means in the QoL domains, a one-way analysis of

variance (ANOVA) was used, and in the case of significant differences, a post-hoc analysis with Bonferroni correction was performed. The Kruskal-Wallis test was used to analyze the two general questions (non-parametric variables).

## RESULTS

#### CHARACTERISTICS OF THE STUDY GROUP

Questionnaires completed by 134 respondents (59 women, 44%; 75 men, 56%) who use wheelchairs were included in the final analysis. The mean age of the entire study population was 34.1 ( $\pm 10.0$ ) years. The majority of participants were professionally active (49%) and had a significant degree of disability (84%). The distribution of disability by etiology was even (50% congenital, 50% acquired).

For comparative analysis purposes, the participants were divided into four groups according to their declared regular sports activity: G1: scuba divers ( $n=33$ ); G2: wheelchair rugby players ( $n=34$ ); G3: individuals who practice other sports ( $n=29$ ); G4: individuals who do not practice sports ( $n=38$ ). For the clarity of further discussion of the results, the authors will use abbreviations to describe the respective subgroups. A detailed characterization of the analyzed group, broken down by research subgroups, is presented in Table 1.

Tab. 1

Characteristics of the analyzed group.

| Variable             | Category      | G 1<br>( $n=33$ ) | G 2<br>( $n=34$ ) | G 3<br>( $n=29$ ) | G4<br>( $n=38$ ) | Total<br>( $n=134$ ) |
|----------------------|---------------|-------------------|-------------------|-------------------|------------------|----------------------|
| Age (years)          | Mean $\pm$ SD | 37.6 $\pm$ 11.2   | 32.9 $\pm$ 8.0    | 32.5 $\pm$ 10.3   | 33.2 $\pm$ 10.1  | 34.1 $\pm$ 10.0      |
| Gender               | Female        | 9 (27%)           | 7 (21%)           | 16 (55%)          | 27 (71%)         | 59 (44%)             |
|                      | Male          | 24 (73%)          | 27 (79%)          | 13 (45%)          | 11 (29%)         | 75 (56%)             |
| Employment Status    | Working       | 16 (48%)          | 21 (62%)          | 13 (45%)          | 16 (42%)         | 66 (49%)             |
|                      | Not working   | 11 (33%)          | 6 (18%)           | 10 (34%)          | 17 (45%)         | 44 (33%)             |
|                      | Studying      | 6 (18%)           | 7 (21%)           | 6 (21%)           | 5 (13%)          | 24 (18%)             |
| Type of Disability   | Acquired      | 24 (73%)          | 18 (53%)          | 11 (38%)          | 14 (37%)         | 67 (50%)             |
|                      | Congenital    | 9 (27%)           | 16 (47%)          | 18 (62%)          | 24 (63%)         | 67 (50%)             |
| Degree of Disability | Severe        | 17 (52%)          | 30 (88%)          | 29 (100%)         | 36 (95%)         | 112 (84%)            |
|                      | Moderate      | 9 (27%)           | 3 (9%)            | 0 (0%)            | 1 (3%)           | 13 (10%)             |
|                      | Mild          | 7 (21%)           | 1 (3%)            | 0 (0%)            | 1 (3%)           | 9 (7%)               |
| Years in wheelchairs | > 10 years    | 6 (18%)           | 17 (50%)          | 12 (41%)          | 10 (26%)         | 45 (34%)             |
|                      | 6-10 years    | 14 (42%)          | 3 (9%)            | 1 (3%)            | 1 (3%)           | 19 (14%)             |
|                      | 1-5 years     | 4 (12%)           | 9 (26%)           | 1 (3%)            | 1 (3%)           | 15 (11%)             |
|                      | From birth    | 9 (27%)           | 5 (15%)           | 3 (10%)           | 9 (24%)          | 26 (19%)             |

## EVALUATION OF QUALITY OF LIFE IN THE ANALYZED GROUPS

A descriptive analysis of the results shows differences in the perception of the quality of life depending on the type of activity. The group practicing scuba diving achieved the highest mean scores in most of the assessed domains, including the physical,

psychological, and environmental domains, as well as in the general assessment of the quality of life and health status. In contrast, the lowest values in these areas were observed in the groups practicing "other sports" and the physically inactive group. Detailed results for each domain of the WHOQOL-BREF questionnaire are presented in Table 2.

Tab. 2

Results of the WHOQOL-BREF questionnaire in the analyzed groups.

| Group | Size (n) | Physical Domain | Psychological Domain | Social Relationships | Environmental Domain | Overall Quality of Life | Overall Health Status |
|-------|----------|-----------------|----------------------|----------------------|----------------------|-------------------------|-----------------------|
| G1    | 33       | 14.86           | 15.26                | 14.67                | 15.58                | 4.12                    | 3.85                  |
| G2    | 34       | 14.64           | 14.76                | 13.92                | 14.71                | 3.94                    | 3.74                  |
| G3    | 29       | 13.72           | 14.94                | 15.15                | 14.50                | 3.79                    | 3.79                  |
| G4    | 38       | 13.89           | 14.39                | 14.07                | 15.26                | 3.76                    | 3.74                  |

The most unequivocal conclusion from the analysis is the exceptionally beneficial impact of scuba diving on the participants' quality of life. The divers group (Group 1) consistently showed the highest mean scores in all four WHOQOL-BREF domains assessed: physical (14.86), psychological (15.26), social relationships (14.67) and environmental (15.58). Furthermore, this group also achieved the highest scores in the general assessment of the quality of life (4.12) and perceived health status (3.85).

This suggests that scuba diving, as a form of activity, can provide unique benefits that extend beyond those offered by other sports. The potential mechanisms for this phenomenon could be related to the psychological sense of freedom and the transcendence of bodily limitations resulting from perceptual weightlessness in the aquatic environment. The change to a unique underwater setting, which requires focus and control, can also have a therapeutic effect, diverting attention from daily difficulties and pain.

A comparison of the active groups (1, 2, and 3) with the inactive group (G4) generally confirms the positive impact of sports on the quality of life, which is well-established in the literature. The non-sporting group had one of the lowest scores in the psychological domain (14.39) and in the general self-assessment of the quality of life (3.76).

However, the analysis indicates that the type of sport performed can affect different areas of life in different ways. A particularly interesting observation is the relatively low score in the social relationships' domain for the rugby players' group (13.92), especially compared to the "other sports" group (15.15), which achieved the highest score in this domain. Considering the team-based and integrative nature of rugby, this result is counter-intuitive and may be a subject for further, in-depth qualitative research on the dynamics within highly competitive team sports.

Equally interesting is the observation that in the environmental domain, the inactive group (15.26) scored comparable to the scuba divers' group (15.58). This suggests that the perception of the physical environment, safety, and access to resources is moderated by factors

other than sport activity itself.

Statistical analyzes were conducted to compare the results among the four independent groups. The results of the Shapiro-Wilk test showed that the distribution of data in almost all QoL domains between all groups was consistent with a normal distribution (15 of 16 cases,  $p > 0.05$ ). The only exception was the domain of social relationships in G3 ( $p = 0.041$ ). In contrast, the response distributions for the two general questions (on quality of life and health status) were not consistent with a normal distribution in any group ( $p < 0.001$  in all cases). Levene's test indicated a lack of homogeneity of variance for the physical domain ( $p = 0.043$ ) and the environmental domain ( $p = 0.016$ ), which was considered during the interpretation of the results.

Analysis of variance (ANOVA) revealed statistically significant differences between the study groups in the domain of social relationships' ( $p=0.012$ ), the environmental domain ( $p=0.009$ ) and the physical domain ( $p=0.048$ ). For the psychological domain, the observed difference did not reach the statistical significance threshold ( $p=0.052$ ).

To identify the source of the statistically significant differences detected by ANOVA, a series of pairwise comparisons (post-hoc tests) was performed using the Bonferroni correction (significance threshold  $p \leq 0.0083$ ). The results of this analysis are presented in Table 3. In the domain' of "social relationships", the most distinct difference was observed—the "other sports" group (G3) rated this sphere significantly higher than the rugby players group (G2) ( $p=0.007$ ). In the physical domain, the difference between the divers (G1) and the "other sports" group (G3) ( $p=0.021$ ) indicated a trend but did not meet the strict significance threshold after applying the Bonferroni correction ( $p > 0.0083$ ).

Despite certain data trends, the post-hoc analysis also did not show statistically significant differences in any domain between the physically inactive group (G4) and the other active groups. This may suggest that, while the general trend supports the benefits of practicing sports, in this study, significant differences only become apparent when comparing specific types of activities.

Comparison of HRQOL in individual domains between the assessed groups (results of post-hoc ANOVA with Bonferroni correction).

| Comparison | Physical Domain |                                        | Domain of Social Relationships |                           | Environmental Domain |                           |
|------------|-----------------|----------------------------------------|--------------------------------|---------------------------|----------------------|---------------------------|
|            | p-value         | Statistically Significant              | p-value                        | Statistically Significant | p-value              | Statistically Significant |
| G1 vs G2   | 0.605           | No                                     | 0.101                          | No                        | 0.038                | Nie                       |
| G1 vs G3   | <b>0.021</b>    | <b>Yes (at the level of p&lt;0.05)</b> | 0.323                          | No                        | <b>0.005</b>         | <b>Yes</b>                |
| G1 vs G4   | 0.053           | No                                     | 0.246                          | No                        | 0.444                | No                        |
| G2 vs G3   | 0.088           | No                                     | <b>0.007</b>                   | <b>Yes</b>                | 0.589                | No                        |
| G2 vs G4   | 0.208           | No                                     | 0.902                          | No                        | 0.814                | No                        |
| G3 vs G4   | 0.748           | No                                     | 0.059                          | No                        | 0.044                | No                        |

The non-parametric analysis for the two general questions did not show statistically significant differences between the four study groups, neither for the overall assessment of the quality of life ( $H = 3.51$ ,  $p = 0.319$ ) nor for the overall assessment of health status ( $H = 0.28$ ,  $p = 0.963$ ). This means that membership in a group did not significantly differentiate the general quality of life of a single-item and the health ratings.

## DISCUSSION

The key conclusions from the analysis of the results obtained confirm that while a general trend towards reporting higher quality of life is observed in physically active groups, statistically significant differences only emerge when comparing specific sports disciplines, not in a general "active vs. inactive" comparison. This is in apparent contradiction with the broad literature, which often reports a clearly higher quality of life in active individuals compared to inactive ones [10-13,27]. This suggests that binary categorizations can mask the subtle, yet crucial mechanisms through which different forms of physical activity influence well-being.

A surprising result of the study is the higher quality of life scores in all domains in the scuba divers' group compared to other groups. The significantly higher rating of the environmental domain compared to the "other sports" group and the leading positions in the remaining domains indicate that scuba diving may provide unique and multifaceted benefits. This interpretation is supported by the literature - showed, among other things, a reduction in spasticity and PTSD symptoms after a scuba diving program [29-31].

These findings are consistent with results obtained by other authors who have assessed the therapeutic impact of scuba diving on people with various types of disabilities [32,33]. Scuba diving has been shown to significantly improve mental condition, self-esteem, self-efficacy, and quality of social interactions among people with disabilities [34,35]. Like our study, the group of respondents practicing diving in these studies also emphasized the unique benefits of interacting with the aquatic environment, such as a sense of lightness, relief from pain, and an increase in motor skills [27].

In the context of team sports such as wheelchair rugby, surprisingly lower scores in the domain of social relationships' can stem from differences in the quality and nature of social experiences. Although team sports

theoretically promote social interaction and integration, it is possible that the high level of competition and the specific demands of this sport also generate stress or conflicts that affect the subjective assessment of the hypothesis of this domain, which requires further research. Other authors raise similar points about the complexity of the impact of adaptive sports, highlighting that while scuba diving and other forms of physical activity improve social and psychological aspects, each form of activity has its own specific challenges and potential limitations [9,13,17,21].

In the case of group G3, which was more diverse and with a higher percentage of women, the results for the social relationships domain were higher than in groups G2 and G4. Practicing a variety of disciplines, both individual and team-based, including those of a less confrontational nature, may foster the development of more open relationships, which was reflected in the higher rating of this domain.

Another interesting result is the high rating of the environmental domain in the physically inactive group, comparable to the scuba divers' group. This domain includes, among other things, financial resources, physical safety, and access to healthcare. One might hypothesize that inactive individuals, who do not bear the significant financial and logistical costs associated with practicing adaptive sports (equipment, travel, training), may perceive their material and domestic situation as more stable and less burdensome. This presents an intriguing contrast to physically active groups, where the benefits of sport can be partially offset by its associated challenges.

The results suggest that rehabilitation and physical activity support programs should be tailored to the individual needs and preferences of the participants and should consider the specific psychological and social benefits that can be derived from particular disciplines. Scuba diving may be a particularly valuable intervention for individuals seeking freedom, unique sensory experiences, and improvement in the psychological and neurological spheres. In turn, team sports such as rugby, despite their physical benefits and the building of strong bonds, require a deeper understanding of the dynamics of competition and their impact on the perception of interpersonal relationships.

The main limitation of this study is its cross-sectional design, which makes it impossible to draw cause-and-effect conclusions. It cannot be definitively stated whether practicing a specific discipline improves

quality of life or whether individuals with certain predispositions and higher baseline QoL are more inclined to choose a particular sport (e.g., scuba diving). Furthermore, the small size of the research subgroups, although sufficient for statistical analysis, limits the generalizability of the results to a broader population.

## CONCLUSIONS

Scuba diving demonstrates a unique and multifaceted positive impact on the quality of life of people with physical disabilities, exceeding other disciplines studied, particularly in the environmental, psychological, and physical spheres.

Team sports, such as wheelchair rugby, while offering potential physical and social benefits, can be associated with challenges that affect the subjective perception of the quality of social relationships. This

requires further research and optimization of social support within these disciplines.

Rehabilitation measures based on scuba diving, considering the specifics of the aquatic environment, can effectively support the improvement of physical fitness, psychological comfort, and social integration for wheelchair users.

The broader implementation and promotion of scuba diving as a form of adaptive sport should be accompanied by further research on its long-term health effects, equipment adaptation, and safety and accessibility aspects.

A comparative analysis of different adaptive sports disciplines is essential to precisely tailor recommended forms of activity to the individual needs of people with disabilities and to maximize benefits in the physical, psychological, and social dimensions.

## REFERENCES

1. The WHOQOL Group. The World Health Organization quality of life assessment (WHOQOL): Position paper from the World Health Organization. *Soc. Sci. Med.* 1995; 41, 1403–1409.
2. Mayo, N. Dictionary of Quality of Life and Health Outcomes Measurement; International Society for Quality of Life Research: Milwaukee, WI, USA, 2015.
3. Haraldstad, K.; Wahl, A. A systematic review of quality of life research in medicine and health sciences. *Qual. Life Res.* 2019, 28, 2641–2650.
4. WHO - World Health Organisation. International Classification of Functioning, Disability and Health. Geneva, 2001. <http://www.who.int/classifications/icf/en/>
5. Gill M. Psychosocial implications of spinal cord injury. *Crit Care Nurs Q* 1999;22:1–7. 10.1097/00002727-199908000-00002
6. Geyh S, Ballert C, Sinnott A, et al. Quality of life after spinal cord injury: a comparison across six countries. *Spinal Cord* 2013;51:322–6. 10.1038/sc.2012.128
7. Barker RN, Kendall MD, Amsters DI, et al. The relationship between quality of life and disability across the lifespan for people with spinal cord injury. *Spinal Cord* 2009;47:149–55. 10.1038/sc.2008.82
8. Wood-Dauphinée S, Exner G, Bostanci B, et al. Quality of life in patients with spinal cord injury-basic issues, assessment, and recommendations. *Restor Neurol Neurosci* 2002;20:135–49.
9. Jaarsma EA, Dijkstra PU, Geertzen JH, et al. Barriers to and facilitators of sports participation for people with physical disabilities: a systematic review. *Scand J Med Sci Sports* 2014;24:871–81. 10.1111/sms.12218
10. Labbé D, Miller WC, Ng R. Participating more, participating better: health benefits of adaptive leisure for people with disabilities. *Disabil Health J.* 2019;12(2):287–295. doi: 10.1016/j.dhjo.2018.11.007.
11. Anneken V, Hanssen-Doose A, Hirschfeld S, et al. Influence of physical exercise on quality of life in individuals with spinal cord injury. *Spinal Cord* 2010;48:393–9. 10.1038/sc.2009.137
12. Ginis K a M, Jorgensen S, Stapleton J. Exercise and Sport for Persons With Spinal Cord Injury. *Phys Med Rehabil* 2012;4:894–900
13. Ellapen T.J., Hammill H.V., Swanepoel M., Strydom G.L. The health benefits and constraints of exercise therapy for wheelchair users: A clinical commentary. *Afr. J. Disabil.* 2017;6:337. doi: 10.4102/ajod.v6i0.337.
14. Henrykowska, G.; Soin, J.; Pleskacz, K.; Siermontowski, P. Influence of Scuba Diving on the Quality of Life of People with Physical Disabilities. *Healthcare* 2022, 10, 761. <https://doi.org/10.3390/healthcare10050761>
15. Richardson, E.V.; Papathomas, A.; Smith, B.; Goosey-Tolfrey, V.L. The psychosocial impact of wheelchair tennis on participants from developing countries. *Disabil Rehabil.* 2017, 39, 193–200.
16. Yazicioglu K, Yavuz F, Goktepe AS, Tan AK. Influence of adapted sports on quality of life and life satisfaction in sport participants and non-sport participants with physical disabilities. *Disabil Health J.* 2012 Oct;5(4):249–53. doi: 10.1016/j.dhjo.2012.05.003. Epub 2012 Jul 20.
17. Aitchison B, Rushton AB, Martin P, et al. The experiences and perceived health benefits of individuals with a disability participating in sport: a systematic review and narrative synthesis. *Disabil Health J.* 2021;2021:1–15.
18. Lipert A, Wróbel K, Spychala M, Rasmus P, Timler D, Marczak M, Kozłowski R. The Effectiveness of Active Rehabilitation Camp on Physical Performance of Disabled People Moving in Wheelchairs. *Int J Environ Res Public Health.* 2021 Jul 16;18(14):7572. doi: 10.3390/ijerph18147572.
19. Biagini A, Bastiani L, Sebastiani L. The impact of physical activity on the quality of life of a sample of Italian people with physical disability. *Front Sports Act Living.* 2022 Oct 13;4:884074. doi: 10.3389/fspor.2022.884074.
20. Goraczko A, Zurek A, Lachowicz M, Kujawa K, Zurek G. Is Self-Efficacy Related to the Quality of Life in Elite Athletes after Spinal Cord Injury? *Int J Environ Res Public Health.* 2021 Oct 15;18(20):10866. doi: 10.3390/ijerph182010866
21. Kotarska K, Timoszyk-Tomczak C, Nowak L, Sygit K, Gaska I, Nowak MA. Self-Assessment of Physical Fitness and Health versus Motivational Value of Physical Activity Goals in People Practicing Fitness, Football, Martial Arts and Wheelchair Rugby. *Int J Environ Res Public Health.* 2022 Sep 2;19(17):11004. doi: 10.3390/ijerph191711004.Sport adapt
22. Nowak MA, Kolbowicz M, Kuska M, Sygit K, Sygit M, Nowak L, Kotarska K. The Intensity of the Health Behaviors of People Who Practice Wheelchair Basketball, Wheelchair Rugby and Para-Rowing. *Int J Environ Res Public Health.* 2022 Jun 27;19(13):7879. doi: 10.3390/ijerph19137879.
23. Santiago Perez, T., Crowe, B. M., Townsend, J. N., Rosopa, P. J., & Kaufman, M. R. (2023). Can scuba diving transform the lives of people with physical impairments? A mixed methods study. *Disability and Rehabilitation*, 46(21), 4965–4978. <https://doi.org/10.1080/09638288.2023.2291183>
24. Carin-Levy G, Jones D. Psychosocial aspects of scuba diving for people with physical disabilities: an occupational science perspective. *Can J Occup Ther.* 2007;74(1):6–14. doi: 10.2182/cjot.06.07.
25. Blumhorst E, Kono S, Cave J. An exploratory study of adaptive scuba diving's effects on psychological well-being among military veterans. *Ther Recreation J.* 2020;54(2):173–178.
26. The World Health Organization: The WHOQOL Group. Whoqol-Bref: Introduction, Administration, Scoring and Generic Version of the Assessment, 1996.
27. Henrykowska G, Soin J, Siermontowski P. Scuba diving as a form of rehabilitation for people with physical disabilities. *Int J Environ Res Public Health.* 2021;18(11):5678. doi: 10.3390/ijerph18115678.
28. Côté-Leclerc F, Boileau Duchesne G, Bolduc P, Gélinas-Lafrenière A, Santerre C, Desrosiers J, Levasseur M. How does playing adapted sports affect quality of life of people with mobility limitations? Results from a mixed-method sequential explanatory study. *Health Qual Life Outcomes.* 2017 Jan 25;15(1):22. doi: 10.1186/s12955-017-0597-9.
29. Abdelkarem MK. Relation between scuba diving and the happiness among paraplegia persons. *Assiut J Sport Sci Arts.* 2019;219(2):150–166.

30. Morgan A, Sinclair H, Tan A, et al. Can scuba diving offer therapeutic benefit to military veterans experiencing physical and psychological injuries as a result of combat? A service evaluation of dephtherapy UK. *Disabil Rehabil.* 2019;41(23):2832–2840. doi: 10.1080/09638288.2018.1480667.
31. Aganovic Z. Effects of scuba diving programmed classes on Bosnian war veterans with amputations. *Int J Sport Exerc Train Sci.* 2019;5(1):6–14. doi: 10.18826/useeabd.506032.
32. Santiago Perez T, Crowe BM, Rosopa PJ, et al. Diving into health: a mixed methods study on the impact of scuba diving in people with physical impairments. *Healthcare.* 2023;11(7):984. doi: 10.3390/healthcare11070984.
33. Cheng JF, Diamond M. SCUBA diving for individuals with disabilities. *Am J Phys Med Rehabil.* 2005;84(5):369–375. doi: 10.1097/01.phm.0000159974.01251.e2.
34. Carin-Levy, G.; Jones, D. Psychosocial aspects of scuba diving for people with physical disabilities: An occupational science perspective. *Can. J. Occup. Ther.* 2007, 74, 6–14
35. Krpalek, D.; Achondo, N.; Daher, N.; Javaherian, H. Reducing Veterans' Symptoms of Depression, Anxiety, Stress, and Posttraumatic Stress, and Enhancing Engagement in Occupations with SCUBA Diving and Occupational Therapy. *J. Veter. Stud.* 2020, 6, 98.

**dr n. med. Gabriela Henrykowska**  
Zakład Epidemiologii i Zdrowia Publicznego,  
Uniwersytet Medyczny w Łodzi  
gabriela.henrykowska@umed.lodz.pl