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ORIGINAL ARTICLE

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The global state of play: A study of the demographic characteristics of disability golfers

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Abstract

Background: Golf is a moderate-intensity physical activity that provides positive physical and mental health benefits. However, the inclusiveness of the sport for individuals with disabilities globally is unknown.

Objective: To characterize the demographics and disability characteristics of individuals engaging in disability golf globally. It was hypothesized that the majority of participants would be middle-aged, male, and from countries with higher gross domestic product, similar to the nondisabled population.

Design: Descriptive, cross-sectional analysis using European Disability Golf Association (EDGA) database.

Setting: Various international golf tournaments.

Participants: Golfers ($n = 1734$) with disability from 44 countries registered with the EDGA (2017–2021).

Interventions: Not applicable.

Main Outcomes: Descriptive analyses of frequencies, distributions, and means differences of demographic characteristics (age, gender, type of disability, level of handicap, golf cart use, and country of origin) of golfers with disability were performed. Data provided analysis of the association between number of participants and a country's gross domestic product (GDP).

Results: Individuals had a mean age of 52.5 (±15.6) years: 1589 (91.6%) male and 145 (8.4%) female. Twenty-three countries had female participation. The most commonly reported primary disability diagnoses were neurologic (24.8%), orthopedic (21.4%), and amputation below the knee (14.4%). Neurologic impairments (24.7%) were most common in men and orthopedic impairments (29.7%) were most common in women. Individuals with neurological impairments (27.4%) most frequently required golf carts to play. The GDP of a country had a positive correlation ($r = 0.68$) with the number of registered golfers with disability.

Conclusion: Golf is played by individuals with a variety of disabilities and provides numerous benefits. However, there is an underrepresentation of youth, women, and individuals with certain impairments and from lower-income countries. These are the potential areas of opportunity to improve engagement and inclusiveness of golf.

INTRODUCTION

The World Health Organization (WHO) states that ~15% of the world's population is living with some type of disability.[1] As chronic health conditions and medical advancements continue to prolong the aging process, the number of individuals with a reported disability continues to increase.[1] Physical activity has been shown in these individuals to be of benefit in improving health and quality of life.[2] However, studies have shown that in individuals with disabilities, there is also an increased risk of physical inactivity due to their physical impairments and environmental and socioeconomic barriers.[3–5]

A potential physical activity intervention for individuals with disabilities is engagement in the sport of golf. Playing golf is a moderate-intensity physical activity that has health and social benefits to persons of all ages.[6–9] Regular engagement in the sport has been associated with improved cardiovascular health, balance, muscular function, and strength.[10–14] Studies in able-bodied individuals have shown that the sport is more commonly played by middle- to older-aged men from higher socioeconomic groups, suggesting potential issues with diversity and inclusiveness of the sport.[15,16] In addition, there is a growing population of individuals with disabilities who are engaging in the sport. Recent programmatic, technological (e.g., sports orthotics, prosthetics) and environmental advancements in the accessibility of golf courses have enabled these individuals to enjoy the psychological and physical benefits of golf.[17] For example, individuals who are unable to independently ambulate due to lower extremity impairments can use motorized golf carts or Paragolfers (Ottobock) for transportation around the course.[17] The development of more advanced prostheses has allowed individuals with upper extremity amputations to more effectively play golf.[18] Due to the golf handicap system, the sport of golf allows the unique opportunity for individuals with disabilities to play competitively against able-bodied individuals.

However, as golf for the disabled grows as a sport, the inclusiveness and global outreach of the sport remains unknown. According to the 2018 International Consensus on Golf and Health, multiple global leaders in the sport identified diversity in golf participation as a challenge to the sustainability of the number of able-bodied individuals playing the sport but this does not extend to players with disabilities.[19] The use of adaptive equipment, such as the use of a golf cart, in these individuals has not been assessed. Determining the diversity of disability golf is pivotal in highlighting the needs and areas of potential opportunity to improve the sport's inclusiveness and global outreach. In addition, understanding the relationship between type of disability and golf handicap would also give an indication of the needs of individual groups for adaptive sports classifications. The purpose of the present study was to describe and analyze the demographic, playing needs, geographic location, and disability characteristics of individuals with disabilities participating in golf from a large worldwide database. Our hypothesis was that in this cohort of individuals with disabilities who regularly play golf, the majority of participants would be middle-aged, male, and from countries with higher gross domestic product (GDP).

METHODS

Study design and database

This study was a descriptive, cross-sectional analysis that was deemed institutional review board (IRB) exempt. All potential protected health information had been removed and players were de-identified prior to data analysis. Data in this study were collected from golfers with disability who were registered with the European Disabled Golf Association (EDGA), the predominant organization in the world through which individuals with disabilities can register to play competitive golf and can optionally receive world ranking points. The EDGA database has grown over a 15-year period with expansion of eligibility criteria. In the last 3 years, visual impairment and intellectual impairment were included as new categories. The current categories used by the EDGA now mirror the Paralympic list of eligible impairments with standards aimed to include all those significant impairments in each category. This database also includes both elite and non-elite golfers. Participants in this study were registered in the database between January 2017 and August 2021.

Data collection

Individual player information that was collected included age, gender, type of disability, country of origin, level of golf handicap, and whether or not they used a golf cart. Country of origin was further subcategorized into level of GDP of the respective country.[20]

Disability characteristics

The sub-classification of disability included amputations, spinal cord injuries, congenital (e.g., Down syndrome), and acquired intellectual disabilities (e.g., secondary to traumatic brain injury), neurological (e.g., stroke), orthopedic (e.g., achondroplasia), and visual impairments.

Golf-playing variables

Golfing-related variables were also collected, specifically the self-reported golf handicap and whether the player required the use of a golf cart (buggy) or Paragolfer, which allows individuals with disabilities into

TABLE 1 Golfers population and disability demographics

Average age	Male		Female	
	52.6 years [range: 12–86] ± 15.6		52.5 years [range: 14–83] ± 14.9	
	N (Total number)	Percentage (%)	N (Total number)	Percentage (%)
Gender (n = 1734)	**1589**	**91.6**	**145**	**8.4**
Region of origin (n = 1734)				
Central and South America	13	0.8	0	0
Middle East	12	0.8	0	0
Caribbean	2	0.1	0	0
North America	330	20.8	18	12.4
Oceania	97	6.1	6	4.1
Africa	66	4.2	4	2.8
East Asia	30	1.9	2	1.4
Northern Europe	443	27.9	37	25.5
Western Europe	50	3.1	8	5.5
Southern Europe	147	9.3	16	11.0
Central and Eastern Europe	399	25.1	54	37.2
Primary diagnosis (n = 1734)				
Amputation	648	40.7	39	26.9
Spinal cord lesion	72	4.5	8	5.5
Intellectual	50	3.1	6	4.1
Mental	2	0.1	1	0.7
Neurologic	380	23.9	35	24.1
Orthopedic	317	19.9	41	28.3
Visual impairment	68	4.3	8	5.5
Not reported	52	3.3	7	4.8

Note: Regions of Europe: https://www.worldatlas.com/articles/the-four-european-regions-as-defined-by-the-united-nations-geoscheme-for-europe.html. Northern Europe: Denmark, Finland, Iceland, Ireland, Norway, Sweden, United Kingdom. Western Europe: Belgium, Switzerland. Southern Europe: Greece, Italy, Portugal, Slovenia, Spain. Central and Eastern Europe: Austria, Czech Republic, France, Germany, The Netherlands, Ukraine, Slovakia. Caribbean: Bermuda, Costa Rica. Middle East: United Arab Emirates, Israel, Turkey.

stance to aid with golf swing. The golf handicap is a numerical measure that allows players of different abilities to compete fairly against each other, with better players having lower handicaps. The current World Handicap System (WHS) was started globally in 2020 after extensive review from major golf handicapping authorities from around the world.[21]

Statistical analyses

STATA 15.1 was used to calculate frequencies and distributions of the demographic data collected, enabling a descriptive analysis of the EDGA database.[22] Two-sample *t*-tests were used to assess differences between total number of participants from each gender across countries as well as differences in average handicaps of different disability groups. The association of a country's GDP with the number of registered participants in golf around the world was assessed using multiple linear regression, controlling for each country's population.

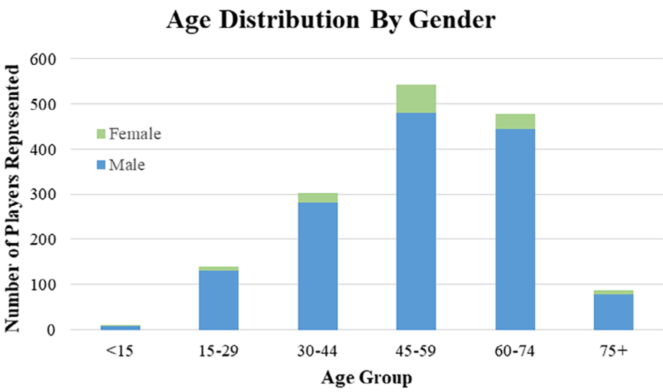

FIGURE 1 Distribution of age groups by gender. This graph shows the number of male and female golfers in each age group

RESULTS

Demographics (Table 1)

There was a total of n = 1734 registered competitive golfers with disability ranging in age between 12 and

86 years of age who were registered with EDGA by summer 2021, representing 44 different countries. The average age of participants was 52.5 (±15.6) years, with mean age for women being 52.5 (±14.9) years and men being 52.6 (±15.6) years. The median ages for women and men were 55 and 54 years of age, respectively. Of the participants, 1589 (91.6%) self-reported as being male and 145 (8.4%) stated that they were female. The majority of the participants in the EDGA database came from North America (predominantly the United States and Canada) and European countries, especially Northern (i.e., United Kingdom and Sweden) and Central Europe (i.e., France and Germany).

There was no difference in mean ages between male and female players ($p > .05$). For both genders, the majority of participants were older than 45 years of age (71.1% of total participants), with participants 45 to 59 years being the largest overall age group (34.9% of total participants, Figure 1).

Twenty-three countries (of 44) had at least one female participant, with the frequency described in Figure 2.

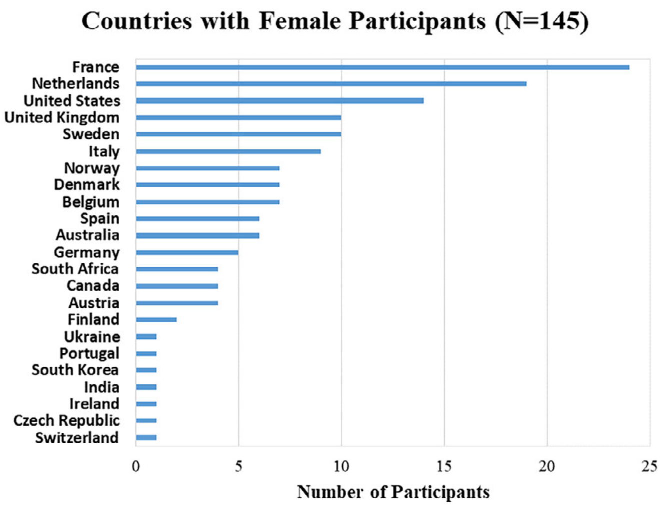

FIGURE 2 Female participation by country. The countries with the most female participation included France (16.6%), The Netherlands (13.1%), United States (9.7%), Sweden (6.9%), and UK (6.9%)

Disability type

Overall, individuals who are amputees made up the majority of the participants (Table 1), with players with amputations below the knee predominating. The amputee group was stratified into amputations above or below the knee and amputations above or below the elbow. After further stratifying the amputee group, the highest overall reported primary diagnosis classification was neurologic impairment (24.8%), followed by orthopedic (21.4%) and amputation below the knee (14.9%). For men, neurologic impairment (24.7%) was the most reported diagnosis, and orthopedic impairments (29.7%) were the most reported in women. The least represented diagnosis was cognitive/intellectual impairment (0.2%). An analysis of the individual subtype of disabilities across different continents can be seen in Figure 3. Amputees were the largest percentage of individuals from each continent, except for in South America, which had equal representation (44.4%) of amputees and individuals with spinal cord injuries. Individuals with mental and intellectual impairments were only

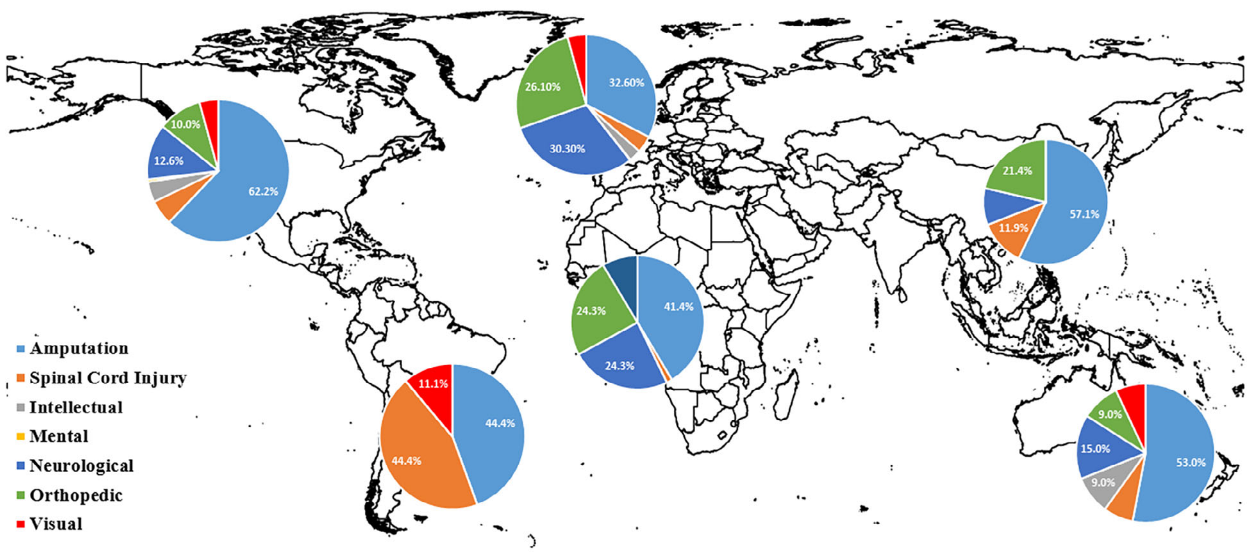

FIGURE 3 World map of the distribution of disabilities of participants from each participating continent: North America, South America, Europe, Africa, Asia, and Oceania. This world map indicates the proportion of disabilities represented by the golfers participating from each continent around the world

represented from Europe and North America. From South America, there were no individuals with neurologic or orthopedic impairments; in addition, there were no individuals with visual impairments from Asia.

Golf-related variables

Golfers with disability who had the lowest mean golf handicaps were those with an amputation above the knee (15.2; 95% confidence interval [CI]: 13.2–17.2), amputation below the knee (15.1; 95% CI: 13.6–16.6), and orthopedic impairments (15.7; 95% CI: 14.3–17.2). Golfers with disability who presented significantly higher handicaps were those with neurologic diagnoses (20.5; 95% CI: 19.1–21.8), spinal cord injury (24.1; 95% CI: 21.3–26.8), and visual impairments (23.4; 95% CI: 20.1–26.7). The average handicaps for individuals with spinal cord and visual impairments were significantly higher than those for individuals with amputations above the knee ($p < .001$, $p = .002$, respectively), amputations below the elbow ($p = .001$, $p = .037$), amputations below the knee ($p < .001$, $p = .001$, respectively), and orthopedic impairment ($p < .001$, $p = .003$), respectively.

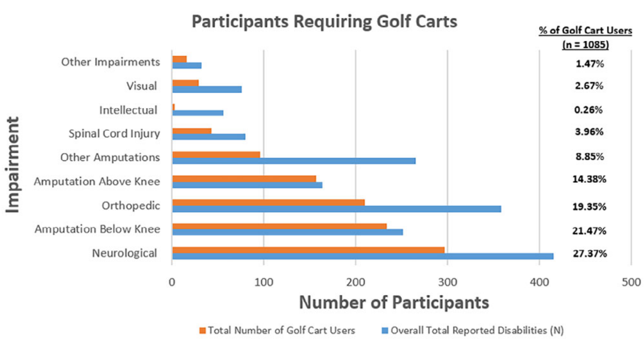

FIGURE 4 Participants requiring golf carts. A bar graph of the total number of participants in each impairment category requiring golf carts. The rightmost side of the chart indicates the percentage of golf cart users represented by each of the impairment categories

Transportation around the course (Figure 4)

Of the 1734 players, 1085 (62.6%) reported requiring a golf cart. There was a significant association between the primary diagnosis of the participants and the need for a golf cart during a round of golf (X^2, $p < .001$). Of the individuals with primary impairments who required golf cart use, individuals with neurological impairments (27.4%) were the majority, followed by golfers with amputations below the knee (21.4%) and orthopedic impairments (19.4%). Within individual groups, golfers with disability with amputations below the knee (98.3%), amputation above the knee (99.3%), and neurologic impairments (83.7%) had the highest percentage of participants who required golf cart use.

Geographical Descriptors (Figure 5)

Individuals with disabilities participating in golf in this cohort were from 44 different countries around the world. The countries with the most participants were United States (16.3%), France (12.5%), United Kingdom (10.4%), Sweden (8.0%), Spain (5.8%), The Netherlands (5.8%), and Australia (5.3%). These six countries (13.6% of the represented countries) made up 64% of all participants. Thirteen countries (29.5% of the represented countries) had only one participant, including Chile, Colombia, Central African Republic, Nicaragua, and Iceland. The worldwide distribution of players can be seen in Figure 5. The GDP is an indicator of the economic activity of a country.[20] When controlling for population, the GDP of a country was determined to have a positive correlation with the number of registered individuals with disabilities playing golf ($R^2 = 0.49$, F (2, 41)

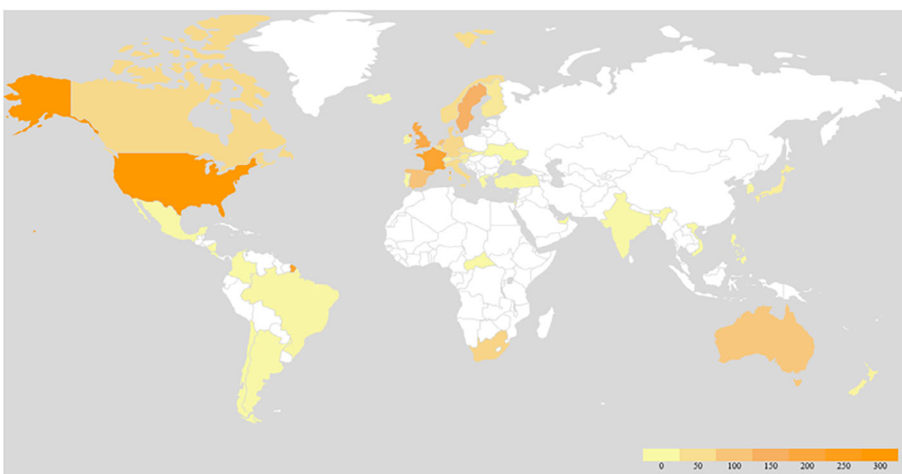

FIGURE 5 Global density map indicating registered golfers with disabilities (GwDs) in the European Disability Golf Association (EDGA) database from around the world. Caption: Global density map shows that countries with darker orange color had a greater number of participants compared to the lightest yellow countries, which had the least number of golf participants in the EDGA

$= 20.02$, $p = .005$), that is, the higher the GDP of a country, the greater the number of registered golfers with disability.

DISCUSSION

To our knowledge, this is the first study to explore the demographic and disability characteristics of individuals participating in disability golf. Results from this study show that similar to able-bodied players, registered golfers with disability are generally older, male, and primarily from countries with a higher GDP. The gender disparity is even greater in this population compared to reports of able-bodied golfers in Europe and the United States (23%–25% compared to 8% in this study).[23,24] This disparity is even more striking, as it is known that the global prevalence of women with disabilities is greater than that of men.[25,26] Our study also found a low proportion of young disability golfers (1.4%), defined in this study as players younger than 18 years of age, which is similar to reports in able-bodied individuals showing low percentages of youth participation in the sport.[23]

Per our study findings, the majority of golfers with disability require a golf cart for transportation around the course, particularly those with neurologic diagnoses such as multiple sclerosis, stroke, cerebral palsy, or orthopedic conditions. Although there has been controversy around the use of the golf cart in major tournaments, the golf cart improves the accessibility and inclusiveness of the sport for individuals with disabilities in particular.[27] This is important because golf has been described as a moderate-intensity physical activity that could be a beneficial rehabilitation intervention for individuals with disabilities who are known to be at risk for physical inactivity and sedentary lifestyles.[9,28] For example, a recent study in individuals with knee osteoarthritis showed that golf cart use compared to walking the course still allowed these individuals to easily attain the recommended daily physical activity thresholds.[29] Individuals with disabilities may also have additional difficulties participating in sport due to several factors, including available and accessible playing facilities.[30] Improvements in the architecture of golf courses such as the removal of curbs, borders, or narrow openings and environmental barriers such as steep slopes around the tee boxes, allowing individuals to traverse the environment with minimal difficulty, could improve accessibility for players.

As expected, registered golfers with disabilities predominantly represented countries with higher GDP, which is similar to studies in able-bodied individuals.[31] It is important to note that the top 10 countries in terms of participation (France, United States, UK, Sweden, Spain, The Netherlands, Australia, South Africa, Denmark, and Germany), are also in the top 20 countries with the highest concentration of golf courses.[31] Our findings are also similar to those from the International Paralympic Committee competitions that found that participation and success were dominated by countries of higher income (higher GDP), population size, and a history of hosting Paralympic games. This suggests more widespread issues with inclusiveness and outreach of adaptive/disability sport in general that are not isolated to golf alone.[32,33] Although an association between number of golf courses in a country and participation in golf could not be accurately assessed in this study, our results showed that there could be future implications for investigating the association of concentration of golf courses on access to golf for individuals with disabilities. Our results also showed that geographically, individuals with amputations, neurologic impairments, and orthopedic impairments were consistently the most represented in this population. However, individuals with intellectual impairments were the least represented, with no participants from Africa, Asia, or South America with intellectual or mental impairments in the database. Based on our study, it is unknown if this is due to a lack of knowledge of the benefits of the sport on mental and cognitive health or a lack of access, outreach, or interest for these individuals. Due to many barriers of access to services for individuals with intellectual disabilities and the negative social attitudes toward intellectual disability around the world, there is lower likelihood of these individuals registering for the EDGA.[34–36]

Individuals with disability are at higher risk for physical inactivity, community segregation, and mental health conditions. Due to the multiple known positive effects of golf, these benefits should be shared with these individuals globally as part of an exercise treatment.[1,37,38] Improving the understanding of golf as a potential rehabilitation intervention for multiple ailments and disabilities could also improve engagement in the sport internationally. For example, Dobrosielski et al. found that patients with heart disease exerted a significantly higher percentage of their functional capacity when walking a 9-hole game compared to baseline, so much so, that golf was thought to be an adequate source of physical activity for cardiac rehabilitation.[10] In addition, studies have identified the positive effects that golf can have on musculoskeletal health, as well as mental wellness, for individuals with disabilities.[9,39]

Our study also identifies the lack of gender inclusion for golfers with disability. This issue is not unique to golf, and remains a problem for adaptive/disability sports organizations worldwide.[40–42] A recent study assessing gender disparities in power (wheelchair) soccer found that, despite the elimination of physical differences between men and women through the use of a power wheelchair, ~80% of the players were male.[42] Due to disparities such as this, organizations like the

International Paralympic Committee (IPC) are aiming to increase the awareness of the issue and improve the diversity and inclusion in adaptive sports through media exposure and the promotion of role models.[43] Increasing the visibility of the disability community in the world of overall sport and, in particular, golf participation alongside able-bodied populations can further improve awareness of disability and influence changes to the current societal perspectives, attitudes, and stereotypes toward individuals with disabilities.

Limitations

This study has significant limitations. First, the study inclusion criteria (i.e., only including participants registered with EDGA) may exclude people who play golf but who have not registered with EDGA. In this study, individuals with visual and intellectual impairments were more underrepresented due to these categories being most recently included in the EDGA database in the past 3 years. Most participants from this group were from higher income countries, and mostly located in Europe and North America. This may be reflective of the lack of access to resources in lower income countries to be able to register and input demographic data. This study also uses a single database that is non-validated and primarily gathers data through self-reporting, which may not be representative of the adaptive golf population globally. For individuals to receive world ranking points and/or be an official disability golf participant they must register with EDGA and be included in the database. Therefore the database may not represent the totality of golfers with disabilities worldwide but is the most accurate means we have currently to assess the outreach of the sport. Countries must also have resources to build golf courses, whereas individuals with disabilities may lack access to the resources to participate in the sport. Unfortunately, individuals with disabilities around the world are disproportionately affected by low socioeconomic status and discrimination.[1] Whether our findings are related purely to a lack of access to courses or reduced awareness of the sport in general, remain unknown and requires further evaluation. Over time, the generalizability of the participants in the EDGA database to the general population has continued to improve due to various steps toward improvement of data collection during events and inclusion/eligibility criteria for different impairment categories to make this population more representative.

CONCLUSION

Our study suggests that golf for the disabled, similar to golf in able-bodied individuals, is predominantly played by older, male individuals in countries with a higher GDP. However, the sport is played by individuals with wide-ranging disabilities, providing a means for physical activity engagement. As the sport continues to grow, these findings provide an opportunity to improve the diversity of the sport in certain regions of the world with fewer resources. These results also provide a framework for research investigating current barriers and facilitators for individuals with disabilities participating in golf around the world. A global mixed-methods study evaluating barriers and enablers to golf participation in individuals with disabilities is presently ongoing.

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AUTHOR CONTRIBUTIONS

Stanley Guillaume: study development, developed hypothesis, database review, data analysis, manuscript write-up (first author).

Tony Bennett: database steward and review, data collection, manuscript write-up.

Peter Allen: database review, data analysis, manuscript write-up.

Andrew Morrisson: database review, data analysis, manuscript write-up.

Roger Hawkes: database development, data collection, manuscript write-up.

Prakash Jayabalan: study development, developed hypothesis, database review, data analysis, and manuscript write-up (corresponding and senior author).

DISCLOSURE

Dr Bennett is President of EDGA (volunteer); Head of Disability and Inclusion to the International Golf Federation (IGF) as a consultant. All other authors declare that they have nothing to disclose.

DATA AVAILABILITY STATEMENT

Data presented in this article will be made available on request.

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