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Ana Geppert , [Emma M Smith](#) ^{*} , [Malcolm MacLachlan](#)

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Article

Every Day Assistive Products Support Participation and Engagement in Sport

Ana Geppert ^{1,2}, Emma M. Smith ^{1,*} and Malcolm MacLachlan ¹

¹ Assisting Living and Learning Institute, Maynooth University, Ireland

² Sport and Health Science, University of Iceland, Iceland

* Correspondence: emma.smith@mu.ie

Abstract: The benefits of engagement in sport are widespread, and include not only improved health and wellness, but also engagement in social participation and the realization of rights. Research on the use of assistive products in sport participation has previously focused largely on the use of specialized products in elite sport and has not addressed the importance of every-day assistive products for facilitating sport participation. This research aims to highlight the use of the 50 products on the World Health Organization's Priority Assistive Product List for sport participation. We found that all 50 products are relevant to sport participation, and support participants to engage directly in sport, but also in social engagement with other sport participants, and as observers and fans of sport.

Keywords: assistive technology; sport; participation; disability

Introduction

The multiple benefits of engaging in sport have been widely documented (Warburton et al., 2006) and include a wide range of physical, mental and social benefits (Bragaru et al., 2011; Eigenschenk et al., 2019; Saxena et al., 2005). On a physical level, engaging in sports by actively exercising (e.g., walking, running, swimming) is associated with reduction in obesity and a reduction in cardiovascular diseases (Adams & Linke, 2019). Some of the health challenges which people with disabilities experience, such as rates of obesity compared to people without disabilities, may be partially addressed through participation in sport (Martin, 2013). Research also shows a strong improvement in self-esteem amongst people with disability who engage in sport (Bragaru et al., 2011). In addition engagement with sport has been linked to increased social connectedness and community life (Eigenschenk et al., 2019).

Sport is a broad concept. According to the UN's KAZAN action plan (2006) sport can be "anything, including, physical play, recreation, dance, organized, casual, competitive, traditional and indigenous sports and games in their diverse forms" (UNESCO, 2017). Engagement in sport for people with disability is also considered to be a human right, acknowledged in the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) as the right to engage in culture through sport (UN, 2006). People both have a right to access sport, and can use sport to access rights (Yelamos et al., 2023).

A critical contributor to the achievement of these rights is the use of assistive technology. Assistive technology (AT) is an umbrella term which encompasses assistive products (AP) and the systems, services, and policies necessary to make them available to those who need them (WHO, 2023). Assistive products can be understood to be those products—either hardware or software—which promote engagement and participation in daily life for those with functional limitations including those associated with disability and/or ageing. There has been significant research on the use of assistive products for sport engagement, however this has primarily focused on the use of these products in elite level sport (Burkett, 2010).

The Priority Assistive Product List (APL) is a list of 50 every-day assistive products which was developed by the World Health Organization and comprises those products which should be available to all individuals in WHO member states through universal health care. (World Health Organization, 2016a). These 50 products were selected based on their use by older persons and people with disability to maintain or improve the quality of life or well-being (World Health Organization, 2016b). These products differ substantially from those used in elite sport as they represent those products which support the every-day needs of those with functional limitations, and are not typically considered as sport-specific technologies.

As the majority of research relating to assistive technology and sport participation has focused on elite sport and sport specific technologies, there is a gap in our understanding of how basic assistive products can help individuals with functional limitations to engage participation in sport. Furthermore, aligned with the definition of sport from the KAZAN Action Plan, conceptualizing sport as broader than elite sport provides an avenue for exploration that encompasses a greater segment of the population, and speaks more to engagement in sport as central to realization of the right to engage in culture, and to sport as a conduit for accessing rights. Understanding how the 50 every-day assistive products on the WHO APL relate to sport participation could provide valuable information for promoting participation in sport at all levels, from recreational play to elite competition. Therefore, the objective of this study was to explore how the products on the WHO priority APL relate to participation in sport.

Methods

Study Design

The study was conducted as a qualitative online survey conducted on the Qualtrics survey platform.

Participants

Participants included individuals aged 18 or over who were Assistive Product (AP) users, as well as caregivers, coaches or teachers of persons with disabilities who participate in sport (proxy respondents).

Informed Consent

All participants were provided with information about the study, including data confidentiality through an informed consent process at the start of the survey. Proceeding to answer survey questions indicated consent to participate. Participants were not required to answer any question they were not comfortable answering. The study was approved by the Maynooth University Social Research Ethics Committee.

Survey Distribution and Data Collection

The survey was distributed widely via social media, through personal and professional networks of the investigators, and via assistive technology umbrella and sport-specific organizations. Wherever possible, umbrella organizations were asked to share the survey with smaller partner organizations thereby reaching a larger range of participants with a more global focus.

The survey design used branching questions to allow each participant group (AP users, caregivers and coaches/teachers) to exclusively answer questions relevant to them. Each branch (category of participant) had three blocks of questions: 1) Demographic information; 2) Assistive product use; 3) Experience with assistive products for sport participation.

The survey consisted of both closed and open-ended questions. Questions relating to age, level of education, and assistive product use were multiple-choice or checkbox style questions. Questions relating to gender, primary condition/impairment and describing how the AP is used, were open-ended questions. The survey was piloted amongst a group of AP users for content, language and accessibility and revised according to their feedback before distribution.

For the purpose of this study, sport participation was conceptualized broadly, and included everything from engagement in sport as an observer or fan to elite level sport participation as an athlete or competitor. The definition of sport also included a range of both individual and team-based activities (e.g., team sports, hiking, swimming, dancing, sailing etc.), and was not limited to competitive sport.

Analysis

Data was exported from the survey platform to Microsoft Excel for analysis of both closed-ended as well as open-ended questions. Records were retained for analysis if the participant had completed the demographic questions, and at least one question related to assistive product use. Participants were considered to have withdrawn from the study if no questions relating to assistive product use were answered. Demographic questions were represented as counts and proportions (see Table 1). Open-ended responses regarding AP use for sports participation were reviewed to identify representative uses of each of the 50 products from the WHO APL (see Tables 2–7).

Table 1. Survey Respondent Demographics.

Country of Residence Grouped by WHO Health Regions	
WHO Regions	n= Participants (Countries)
African (AFR)	16 (12)
Americas (AMR)	18 (5)
Europe (EUR)	27 (12)
Eastern Mediterranean (EMR)	3 (2)
South East Asian (SEAR)	4 (2)
Western Pacific (WPR)	7 (4)
Not reported	6
Age and Age-groups	
Respondent Group	Respondents
AT Users	Mean: 44.78 (sd 14.01)
AT Users as Reported by Caregivers ¹	0-5 (22.2%)
	6-12 (44.4%)
	13-18 (44.4%)
	19-50 (55.6%)
	51-75 (44.4%)
AT Users as Reported by Coaches ¹	75+ (33.3%)
	0-5 (14.6%)
	6-12 (43.6%)
	13-18 (45.8%)
	19-50 (75.0%)
	51-75 (29.9%)
	75+ (33.3%)

¹Totals may add up to more than 100% if a caregiver, coach, teacher, or supporter reported more than one category.

Table 2. Relationship of Mobility APL Products to Sport Participation.

Priority Assistive Product	#	Summary of AP use for sport participation	Selected participant quotes
5. Canes/sticks	22	Used for mobility (getting to and from the venue independently), but also for sport participation (e.g., playing soccer for a person with CP), to support stability and mobility during practice.	“Moving to a place” (AT user)
			“To be independent before and after training” (Coach/Teach)
			“Allows balance while participating” (Caregiver)
			“Provides stability and mobility” (Coach/Teacher)
			“Enables young people with CP to ambulate during soccer” (Coach)

		"Hiking sticks that provide additional stability for race walking, etc." (Coach)
8. Club foot braces	10	To support foot positioning (e.g., while running), as well as to stabilize in order to facilitate participation in sport (e.g., In a ski boot or sporting wheelchair) "Stabilizes ankle to facilitate participation" (Caregiver) "They assist in foot positioning while seated in a sporting wheelchair." (Coach) "Support foot positioning in running, stabilizing foot in e.g., ski boot." (Coach)
11. Crutches, axillary/elbow	19	For independent ambulation before, during and after engaging in sport. This promotes access to sporting venues, or direct participation in sport (i.e., playing volleyball, skiing). "Enhances balance and ambulatory ability to allow participation." (Caregiver) "While playing volleyball if they have any muscle weakness." (Coach) "Crutches are used to support persons with mobility challenges when moving from one point to the wheelchair." (Coach/Teacher) "Corporal stability and balance, e.g., Alpine Ski." (Coach/Teacher)
23. Orthoses, lower limb	21	Assist with balance, positioning, fatigue and injury prevention (e.g., reduction of falls). Used for training, competition or to access the venue. "Some players with lower limb weakness needs these devices to ... provide support to the weak limbs." (Coach/Teacher) "Special sports orthoses used in training and competition." (Coach) "Access to venue." (Coach/Teacher)
24. Orthoses spinal	11	Provide support and stability during sport engagement for individuals with spinal injuries or other conditions affecting trunk stability. "Some athletes need good posture for effective control while playing wheelchair tennis." (Coach/Teacher) "Positioning and set up in sports chair." (Coach/Teacher) "Stability for athletes with SCI." (Coach/Teacher)
25. Orthoses, upper limb	12	Support the position and movement of the upper limb engagement in sport (i.e., while playing tennis, grip on bike handlebar or brakes, during ski slalom). Prevention of secondary injury while wheeling. "Grip on bike handlebar or brakes." (Coach/Teacher) "These ... support weak upper limbs while playing tennis." (Coach/Teacher) "Special sports orthoses used in training and competition." (Coach/Teacher) "Help with pushing wheelchair to reduce injury." (Coach/Teacher) "Stability and balance, e.g., navigating ski slalom course with UL impairment." (Coach/Teacher)
29. Pressure relief cushions	27	To protect the body, prevent pressure injuries, and provide comfort while participating in sport. "If I didn't have a pressure release cushion, I wouldn't be able to sit for long periods of time when training/playing powerchair football." (AT user) "Reduces the pain in certain yoga positions." (AT user) "Playing pickle ball ... Using skin protection / prevention techniques." (Caregiver) "Managing seating pressure on a wheelchair in order to avoid pressure ulcers as basketball is a physical game and result in a lot of sweating." (Coach/Teacher) "Pressure relief in bi-ski as per their own wheelchair or seating." (Coach/Teacher)
31. Protheses, lower limb	20	To access sporting venues and provide increased independence, and for direct use in sport by the athlete. "Rock climbing—makes it easier to climb a wall. Also allows me to cycle around or walk

		around. I only have one prosthesis." (AT user) "The lower limb prosthesis provides independence for the athlete with limb loss to move about. The prosthesis compensate[s] for the limb loss and provides equal distribution of body mass which ensures balance." (Coach/Teacher)
32. Ramps, portable	24	To access areas of sport engagement when using a wheelchair or other mobility AT, particularly when venues are not accessible. "Access to training places, competition arena etc." (AT user) "Use a ramp to access my pontoon powerboat." (AT user) "Navigation of venues using a wheelchair." (Coach/Teacher) "Access due to shitty [sic] society design." (Caregiver)
34. Rollators	11	To provide stability and mobility for sport participation, including play. "Helpful for ... kids to participate in play." (Coach/Teacher)
38. Standing frames, adjustable	10	To provide stability and balance during specific sport activity. To promote health and reduce risk of secondary complications associated with sitting. "Reduced risk of pressure sores." (AT user) "As a form of low intensity exercise and a way to play with adapted equipment." (Coach/Teacher) "Standing frame allow them to gain weight bearing for balancing themselves during ball shooting training and used for transportation on the road for those with lower-level spinal cord injury." (Coach/Teacher)
39. Therapeutic footwear; diabetic, neuropathic, orthopedic	14	To protect the feet of the participant and provide stability for sport engagement. "Protects feet and provides stability to enhance participation." (Caregiver) "Protects the foot of an athlete with diabetes." (Coach/Teacher) "They make it possible to walk, reach and move around during classes." (Coach/Teacher)
42. Tricycles	18	To enhance participation in sporting events and training that would otherwise not be possible (e.g., cycling and racing). Allows for independent mobility and engagement in the community. "I became more mobile." (AT user) "Enables riders with poor trunk control and balance to cycle." (Coach/Teacher) "For training... to propel longer distance to gain power in upper limbs." (Coach/Teacher) "The team and coach also are involved in racing and sometimes use tricycle for racing due to limited racer wheelchairs in Zimbabwe." (Coach/Teacher) "Mobility to attend trainings, for many of them [this] is their means of transport." (Coach/Teacher)
44. Walking frames/walkers	17	Support for ambulatory mobility, as well as enhancing participation in sport. "Allows increased ability to get around and enhances participation." (Caregiver) "To provide support to athletes with mobility impairment." (Coach/Teacher)
46. Wheelchairs, manual for active use	38	Allows access and engagement in sports, including sport participation in the wheelchair or mobility between locations. Means of gaining more ability of wheelchair control, balance and power in upper limbs. "Makes me mobile and gives me accessibility in sports activities like table tennis, badminton, wheelchair cricket, wheelchair basketball." (AT user) "It allows me to move freely in places without being seen as a burden to other, it allows me even to involve in sport like

		wheelchair table tennis. When I possess a manual wheelchair it allows me to enjoy sport.” (AT user) “To get between car, boats, sailing locations.” (AT user) “Specialized lighter tennis wheelchairs is the main assistive devices used to play tennis by an athlete with physical disability.” (Coach/Teacher) “The manual active wheelchair makes me mobile and gives accessibility in sports activities like table tennis, badminton, wheelchair cricket, wheelchair basketball.” (Coach/Teacher)
47. Wheelchairs, manual assistant controlled	24	For accessing sporting venues and for participation in sports. “Freedom of movement in general.” (AT user). “When unable to use a power wheelchair due to access issues of venue, uses manual wheelchair with assist.” (Caregiver) “To attend sporting events, participate in stationary sports.” (Caregiver)
48. Wheelchairs, manual with postural support	26	To allow stability, positioning, and postural support for more effective participation in wheelchair sports and sport engagement as an observer. “It gives me a chance to relax ... while enjoying sport as observer,” (AT user) “Stability and positioning for more effective participation in ... wc sports” (Caregiver) “Mobility while safeguarding posture.” (Coach/Teacher)
49. Wheelchairs, electrically powered	13	For accessing sport venues or for seated positioning during sports engagement. May be used for specific sport participation. “I sit in my wheelchair anytime I am watching sport on tv or am attending a game. This is for comfort, I would not be able to sit on a standard seat in a stadium as it would be too painful and I would be unable to watch the game.” (AT user) “Used to participate in sports like bocce or powerchair football.” (Coach/Teacher)

Table 3. Relationship of Self-Care APL Products to Sport Participation.

Priority Assistive Product	#	Summary of AP use for sport participation	Selected participant quotes
6.Chairs for shower/bath/toilet	29	Chairs promote independence in activities of daily living (i.e., shower after sporting event), as well as access to toilet and shower facilities in sport venues.	“Pursue sport with confidence” (AT user) “I feel peace when I get a chance to access washroom so a ... chair in toilet environment attracts me to attend sport, otherwise I fear to go.” (AT user) “When at tournaments, I would need access to a shower chair to shower after games etc.” (AT user) “Ability to take shower after swimming session.” (AT user) ““When away at competitions involving overnight stays” (Coach)
13. Fall detectors	5	Promoting safety and independence, to detect and alert if a fall occurs while engaging in sport alone.	

15. Global positioning system (GPS) locators	17	Navigation to sport facilities, or during sport participation (i.e., hiking), and increased independence during sport engagement. GPS can also help analyzing training outdoors.	"Hiking: for mapping and personal orientation on hills. Companion dog: tracking their whereabouts on walks." (AT user) "Gives speed and distance traveled while boating or handcycling" (AT user) "Permits some freedom while carers can monitor location." (Caregiver) "Analyzing training." (Coach/Teacher)
16. Hand rails/grab bars	19	Promote safety and enhance access for AT users (i.e., access to toileting facilities. Facilitating transfers between surfaces, including to and from sports equipment.	"Used when using the toilet." (AT user) "Access to toilet facilities at training." (Coach/Teacher) "(...) to facilitate transfers." (Caregiver) "Handrails along the stairs make it easier to navigate stairs, ramps, footpaths." (Coach/Teacher)
19.Incontinence products, absorbent	17	Incontinence products ensure individuals can pursue sport with confidence and security.	"Pursue sport with confidence" (AT user) "Needed after bowel nights if traveling." (AT user) "Personal confidence and security during participation." (Caregiver) "Minimise impact bladder/bowel accidents during sport." (Coach/Teacher)
30. Pressure relief mattresses	14	In preparation for, or recovery from, sport participation.	"My pressure relief mattress ensures that I can sleep comfortably and get good rest prior to and during tournaments for powerchair football. Without this, I would wake many times during the night which would affect my performance when playing." (AT user) "If they want to break and take rest while lying." (Coach/Teacher)
41. Travel aids, portable	12	To facilitate independent sport participation while traveling.	"When able to attend sports in person, uses items to maintain independence and dignity while out of the home." (Caregiver) "They facilitate the use of transport and accommodation." (Coach/Teacher) "Independent travel." (Coach/Teacher)

Table 4. Relationship of Vision APL Products to Sport Participation.

Priority	Assistive Product	#	Summary of AP use for sport participation	Selected participant quotes
	2.Audioplayers with DAISY capability	4	Audioplayers can be used to socialize and communicate with other players.	"Socializing independently." (Coach/Teacher) "Communication" (Coach/Teacher)
	3.Braille displays (note takers)	7	Braille displays can be used to to read manuals, team strategies and newsletters.	"Reading newsletter" (AT user) "Reading the manual or team strategy" (Coach)
	4.Braille writing equipment/brailers	5	Braille writing equipment can be used to support coaches in preparing for sport in visual impairment	"Rules and coaching" (Coach)
	21. Magnifiers, digital hand-held	4	Review of sports documentation including manuals, newsletters, and team documentation.	"ADL functionality of athletes with vision impairment." (Coach/Teacher)
	22. Magnifiers, optical	8		
	35. Screen readers	7	Facilitate communication for athletes with vision impairment.	"Facilitating athletes with vision impairment." (Coach/Teacher) "Communications." (Coach/Teacher)

37. Spectacles; low vision, short distance, long distance, filters and protection	19	To accommodate for visual impairment during sport participation, increasing participation options, and increasing confidence. May be used for better results during sport engagement (e.g., when shooting) and offer UV or flying object protection.	"I can't see well without correction so it helps me see." (AT user) "Aside from seeing also as eye protection from UV & flying objects." (Caregiver) "Vision permits expansion of participation options." (Caregiver) "They allow you to read instructions, device indicators, move around, shoot (aim)." (Coach/Teacher) "Increases confidence." (Coach/Teacher)
50. White canes	12	For mobility around, to and from the sport venue.	"Mobility aid." (Coach/Teacher) "Safety in mobility." (Coach/Teacher)

Table 5. Relationship of Hearing APL Products to Sport Participation.

Priority Assistive Product	#	Summary of AP use for sport participation	Selected participant quotes
1.Alarm signallers with light/sound/vibration	8	Alarm signallers can be used to alert AT users during their performance in sport (e.g., the start of timed events), and for communication of officials during sports participation.	"If I was playing international deaf basketball match they were supposed to have flashing lights on the court to alert the players if the referee blew the whistle as you were not allowed to wear your hearing aids" (AT user) "Early morning starts for sports participation." (AT user)" "Visual starting gun for timed events. Conveying if personal time on track within the event." (AT user)
7. Closed captioning displays	8	Closed captioning displays can be used to communicate, and to support access to live proceedings at sports events, ceremonies, and commentary for team events.	"I use subtitles on TV so any matches/sport on TV they have commentators, the live captions picks up on what they are saying." (AT user) "Live proceedings at sports ceremony events. Commentary at team games in progress. Following TV sports and analysis around games." (AT user) "Communication" (Coach/Teacher)
14.Gesture to voice technology	5	To promote communication between sport participants and coaches/teachers, carers, and other sport participants	
17. Hearing aids (digital) and batteries	12	To promote communication during sport participation, including commands, coaches' words, communication from teammates, and sporting officials.	"I used to play mainstream sport this was important so I could hear my team mates/coach/referee etc." (AT user) "I am able to better hear players and coaches when they need to communicate with me." (AT user) "Permits auditory involvement including commands, start signals, coaches words." (Caregiver)

18. Hearing loops/FM systems	9	Hearing loops/FM systems can be used to better hear players and coaches when they need to communicate with the AT user both during sports performance but also before or after sport participation (e.g., during presentations/conferences).	"I am able to better hear players and coaches when they need to communicate with me." (AT users) "Hearing loops: for hearing in loud sports halls and for salsa dance classes. FM systems : for hearing coach/teacher/instructor in different sports. E.g., badminton, hockey, swimming." (AT user) "Attendance at talks/presentations etc." (Coach/Teacher)
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Table 6. Relationship of Communication APL Products to Sport Participation.

Priority Assistive Product	#	Summary of AP use for sport participation	Selected participant quotes
9.Communication boards/books/cards	10	Communication boards/books/cards can be used when introducing new vocabulary about a certain activity or to communicate about sport with coaches/teachers/caregivers.	"Yes/no cards." (Caregiver) "Introducing new vocabulary about the activity, communication with instructors." (Coach/Teacher)
10.Communication software	17	Communication software can be used to communicate (e.g.,chatting with friends) or to introduce new vocabulary about an activity.	"Chatting with friends" (AT user) "To communicate." (Caregiver) "Introducing new vocabulary about the activity, communication with instructors." (Coach/Teacher)
12.Deafblind communicators	6	Communication with coaches, teachers, caregivers and other sport participants during sport.	
20. Keyboard and mouse emulation software	10	Engagement in sports on the internet, communication between athletes.	"Viewing, commentary, following idols." (Caregiver) "Needs tools to access internet so they can watch sports." (Caregiver) "Facilitating [visually impaired] athletes in communication." (Coach/Teacher)
43. Video communication devices	8	To enable communication about sport, and specific sport training.	"They facilitate interpersonal contacts and information sessions." (Coach/Teacher) "It helps them to visualize all the exercises." (Coach/Teacher)

Table 7. Relationship of Cognition APL Products to Sport Participation.

Priority Assistive Product	#	Summary of AP use for sport participation	Selected participant quotes
26. Personal digital assistant (PDA)	5	Engagement in sports as a fan, time and life management tool for participation in sport organizations.	"Enjoying sports broadcast." (AT user) "Time, life management. Permits active participation as an officer of a governing board." (Caregiver)
27. Personal emergency alarm systems	6	To request assistance during sport participation.	"A help button." (Caregiver) "ADL activity for athletes with high support needs." (Coach/Teacher)

28. Pill organizers	9	Support access to necessary medication during tournaments and while travelling for sport participation.	
33. Recorders	4	Memory aid for instructions related to sport participation, memory of events during sport participation.	
36. Simplified mobile phones	6	For engagement with others, for instance communication with carers and coaches. They can also provide easier access to relevant information.	"Permits engagement with others, and communication with carers and coaches." (Caregiver); "Easy access to info." (Coach/Teacher)
40. Time management products	7	To support time management tasks, including sport management, and enjoyment of sport.	"Client now provides programming of sport for bodies." (Caregiver) "It helps them to enjoy the Activity in present Time." (Coach/Teacher)
45. Watches, talking/touching	13	To access relevant information before, during or after engagement in sport, and to monitor useful information about the moment of sport performance (e.g., physiological factors such as BP and heart rate).	"There are features on the watches for biking and for race walking. They can be used for information." (Coach/Teacher) "Records activities, monitoring of physiological factors (e.g., BP, heart rate)." (Coach/Teacher)

Results

The 78 survey respondents which were included in the analysis represented 37 different countries of residence, from all WHO Health Regions. The highest percentage of the respondents (67.9%) were coaches/teachers, followed by AP-users (29.5%) and caregivers (11.5%). Of those, 5 AP users and 2 caregivers also identified as coaches/teachers/supporters, resulting in a total greater than 100%. The AP user respondents' average age was approximately 45 years. Over half (59.10%) of the AP-users self-defined as men, and the remaining women. The majority of AT users had been Assistive Product users for over 15 years. Participants reported engaging in a wide range of different sport disciplines. All survey respondent demographics of location and age are also depicted in more detail in Table 1.

All survey respondents indicated either they, or the individual(s) they provided caregiving, coaching, teaching, or support services for used at least one product in the list of 50 priority products on the WHO Assistive Product List. Of the 50 priority products, all products were used by 4 or more respondents. Specific comments regarding how the product was used for sport participation were provided for 45 of the 50 products on the APL, excluding only deafblind communicators, fall detectors, gesture to voice technology, digital handheld magnifiers, and voice recorders.

Tables 2–7 provide a description of how each of the 50 products on the APL promote participation in sport, with selected quotes from participant responses. Each of the tables represents a domain of functioning: mobility, self-care, hearing, vision, cognition and communication. Where a product may fit in multiple domains, it is provided in the domain most closely aligned with the identified purpose during sport participation.

The number of respondents who selected each product as being important for sport participation is indicated in the second column. In the final column, direct quotes from participant responses are provided. Wherever possible, responses from assistive technology users were prioritized for presentation. For five of the products on the APL, no written response was provided by participants regarding their use of the product for sport participation, although the product was selected by the participant as supporting engagement in sport. In these cases, we have provided a narrative of how the product may be used, based on the authors' experiences, but no participant quotes have been provided.

Mobility products (Table 2) were the most used products for sport participation, with manual wheelchairs for active use being selected by nearly half (48.7%) of survey respondents. Mobility

products served a variety of roles including access to, around, and from venues, as well as use during individual sport participation. Mobility products also provided support for seating and positioning during sport participation—both during sport play, or during sport participation and engagement as a fan or observer.

Self-care products (Table 3) include those products necessary for ensuring one's physical health and wellness, including bathing and toileting. Chairs for the shower/bath/toilet were the most selected self-care product for use in sport participation, selected by 37.2% of respondents. Self-care products were typically identified as important for use before and after sport participation, as well as for use to enhance access to toileting facilities in sporting venues. In the case of both chairs for shower/bath/toilet and absorbent continence products, several participants specifically noted the importance of these products for confidence in sport participation.

Vision assistive products (Table 4) support those athletes who have visual impairment in a variety of ways. Magnifiers and screen readers may support access to information about sports including team manuals or instructions, and white canes support access to sporting venues. Spectacles, the most selected product used by sport participants (24.4%) may accommodate for visual impairment and provide support for specific sport participation.

Assistive products for hearing, including products designed to enhance hearing or compensate for hearing loss, are used primarily to support communication between sports participants and other participants or coaches and officials. Hearing aids were the most selected hearing assistive product by survey respondents (15.4%) They may also be used for specific sport participation to signal the start and end of play, or other player notifications.

Communication products are used primarily to support communication between sport participants and others engaged in sport, while also supporting learning and engagement about sport for those with communication impairments. Communication software was the most selected communication product, with 21.8% of respondents indicated it could be used to support sport participation.

Finally, products to support cognition were used for sport participation to support engagement in sport programming and management, as well as to facilitate day-to-day participation as an athlete or sports fan.

Discussion

The findings of our research suggest that all 50 assistive products on the WHO APL support sport participation in some way. This is the first research of its kind to demonstrate the link between assistive products intended for daily use and engagement in sport. These findings clearly link assistive products with the realization of Article 30 of the UN Convention on the Rights of Persons with Disabilities, the right to "Participation in cultural life, recreation, leisure, and sport."

Products on the APL facilitated participation in sport in a variety of ways. These products not only facilitated active sport participation, but also facilitated engagement with other sport participants, preparation for sport, and enjoying sports as a fan or observer. For many respondents, participation in sport is contingent not only on their ability to participate in the sport itself, but also to access sporting venues, communicate with other participants and coaches, and to engage in self-care related activities at home, in sporting venues, and while travelling for tournaments or other activities. The different ways in which products can contribute to sport participation is further described in the Assistive Products for Participation in Sport Model (Geppert et al., 2022). This Model emerged from thematic analysis of the data and explores the importance of the different levels of sport engagement and the relevance of the APL products in this engagement. The recently developed Rights In and Through Empowering Sport Questionnaire (RITES—Q)(Yelamos et al., 2023) has demonstrated how the concepts of promoting rights both *in* sport and *through* sport are distinct, but complimentary. Thus the use of AT in sport can also enhance human rights through sport.

The breadth of products selected is also an important finding. Out of the 50 products on the APL, respondents provided specific examples of how 45 of those products contribute to participation in sport. This strengthens the validity of the APL list, not only as every-day products, but highlights

how those products may be critical for realization of human rights, and participation in daily life beyond basic needs.

In many cases when assistive technology is discussed in relation to disability and sport within the research literature, or even within public discourse, the discussion is focused primarily on athletes competing in elite-level sport with sport specific assistive products. The conversation has largely not included the breadth of assistive technologies that are needed to engage in sports. Moreover, most literature considers participation in sport merely as actively exercising/playing (Evans et al., 2018; Grima et al., 2017) and measures engagement by looking at frequency and intensity of sports participation (Department for Culture Media & Sport DCMS, 2010). However, research which considers participation in sport more broadly, including everything from engagement in sports as a fan, occasional recreational play and competitive sports as defined in the Kazan Action plan (UNESCO, 2017), seems to be missing. This study shows that assistive technology users engage in a great range of sports and are highly interested in following and participating in sports through all levels of engagement.

Efforts to promote greater inclusion in sport should consider the mediating and moderating effects of assistive technology (Tebbutt et al., 2016). Many of the non-sport specific technologies are critical to that performance and participation in other ways. AT should not simply be an object to help people with disabilities or functional impairments fit into the existing society, but rather to also create new opportunities for them (Owuor et al., 2018).

It is clear that more research is needed to understand and explore many aspects surrounding every-day assistive products in relation to disability and sport. Future research may help to address some of the limitations of this study. First, due to the small sample size, we have provided indicative rather than representative data. The results of this survey serve as a starting point of discussion on how to improve participation in sports for AT users. Further, the study was conducted only in English and may not reflect a global reality. Finally, this survey did not specifically address issues surrounding access to assistive products, which is understood to be a significant barrier. Further research may consider how access to assistive products (or lack thereof) may promote or hinder access to sport participation.

Conclusions

All 50 everyday assistive products from the WHO APL are relevant in facilitating engagement with and participation in sport. Assistive technology users require assistive products not only to engage in the moment of sport participation, but also to support access to venues, engagement with other sport participants, and to prepare for and recover from sport participation. Access to assistive products is therefore critical to ensuring the realization of Article 30 of the UNCRPD.

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