World Academy of Science, Engineering and Technology
International Journal of Architectural and Environmental Engineering
Vol:18, No:2, 2024

Design Criteria Recommendation to Achieve Accessibility In-house to Different Users

C. Valderrama-Ulloa, C. Schmitt, J.-P. Marchetti, V. Bucarey

***Abstract*—**Access to adequate housing is a fundamental human right and a crucial factor for health. Housing should be inclusive, accessible, and able to meet the needs of all its inhabitants at every stage of their lives without hindering their health, autonomy, or independence. This article addresses the importance of designing housing for people with disabilities, which varies depending on individual abilities, preferences, and cultural considerations. Based on the components of the International Classification of Functioning, Disability and Health, wheelchair users, little people (achondroplasia), children with autism spectrum disorder and Down syndrome were characterized, and six domains of activities related to daily life inside homes were defined. The article describes the main barriers homes present for this group of people. It proposes a list of architectural and design aspects to reduce barriers to housing use. The aspects are divided into three main groups: space management, building services, and supporting facilities. The article emphasizes the importance of consulting professionals and users with experience designing for diverse needs to create inclusive, safe, and supportive housing for people with disabilities.

***Keywords*—**Achondroplasia, autism spectrum disorder, disability, down syndrome, wheelchair user.

I. Introduction

ACCESS to adequate housing is a basic human right and a fundamental aspect of the health of its inhabitants. Housing design must adjust to the various needs of users through all stages of their lives, regardless of their condition. Moreover, simultaneously, it must not be an impediment that risks the occupant's health, autonomy, or independence. For people with disabilities, their home is where they spend most of their time since other buildings and public spaces still imply many challenges. WHO [1] defines disability as the stormy relationship of the environment with a person's functional capacities or structure and, therefore, the limitation in carrying out activities or restrictions in social participation. Therefore, limited accessibility to services and difficulties, impediments and barriers created by the built environment will make a person with a disability be disabled.

Homes that are not accessible could have emotional and psychological impacts on this group of people, leading to frustration, dependency, or a reduced sense of autonomy and independence. This situation can also have a negative effect on the person's mental well-being and overall quality of life. Studies indicate that homes of people with disabilities are not adapted to their needs [2]-[5], and when adjustments are made, they are not always optimal or even safe [6], [7]. Thus, existing housing raises several challenges for this group of people. There is an insufficient housing stock that meets accessibility standards [3], [8], as well as a lack of funding or socioeconomic means to buy or rent accessible housing [9]. In addition, implementation of new regulations on the subject has been slow and, depending on the country, information and statistics on the required quantity of accessible housing is limited [10]. An alternative to tackle these challenges is developing criteria to properly adjust these homes since relocation can isolate people from their social networks.

Most studies on people with disabilities focus on elderly persons [11]-[13] since this group has shown significant growth rates in several countries. As a result, groups like children, young adults or caregivers have not been significantly considered in research and local accessibility policies [14]. Regarding the type of disabilities, studies tend to analyse physical mobility since it is not difficult to observe limitation conditions and, therefore, the interference presented by the surroundings [2]. The impact of the built environment on other types of disabilities, such as sensory (visual or acoustic) [15] or cognitive [10], has not been studied in depth.

The WHO addresses a new approach to the disability with a tool named International Classification of Functioning, Disability and Health (ICF) [1] that considers a biopsycho and social approach and leaves behind a solely medical concept. This approach states that accessibility is the condition that enables people to commute, arrive, enter, leave and use spaces and services available to the community in general [16], autonomously, safely and comfortably. Accessible spaces and a positive attitude towards this population group will increase their opportunities to participate in the community and, therefore, their quality of life and personal development.

The ICF model has been widely adopted globally and has been used in various settings - including healthcare, rehabilitation programs, policy-making and research - to promote a comprehensive understanding of disability and health, as well as to guide policies that promote diversity,

C. Valderrama-Ulloa is with Centro de Investigación en Tecnologías para la Sociedad, Faculty of Engineering, Universidad del Desarrollo, Las Condes, 7610658, Santiago, Chile (corresponding author, phone: +56-22-3279104; e-mail: claudia.valderrama@udd.cl).

C. Schmitt is with the Faculty of Architecture, Art and Design, Universidad Católica de Temuco, Rudecindo Ortega 02950, Temuco, Chile (e-mail: cschmitt@uc.cl).

J.-P. Marchetti is with the Civil Engineering Department, Faculty of Engineering, Universidad del Desarrollo, Las Condes, 7610658, Santiago, Chile (e-mail: jmarchettim@udd.cl).

V. Bucarey is with the Faculty of Architecture, and Urbanism, Universidad de Chile, Santiago 8360012, Santiago, Chile (e-mail: viviana.bucarey@ug.uchile.cl).

This research was funded by Fondecyt Iniciación (Agencia Nacional de Investigación y Desarrollo de Chile—ANID) grant number 11220460.

inclusion, equity and participation of people with disabilities in the society. This research employs ICF model components to analyse barriers faced by little people, wheelchair users and children with autism spectrum disorder and Down syndrome regarding their home's functionality. Then, architectural and design features are proposed to be applied at homes and decrease these obstacles.

II. Research Methodology

A descriptive study of the health model developed by WHO is carried out. This model understands disability not as an impairment of people but as the obstacles set by the environment so that these people cannot use it. Based on this model, necessary actions are identified to analyse the home improvement requirements.

Two groups of people with disabilities are identified who, due to their features, present similar obstacles and challenges. The first group considers people with physical and motor disabilities: wheelchair users and little people (achondroplasia). This group focus on overcoming architectural barriers when designing for the "average" user. The second group considers people with cognitive disabilities: children with autism spectrum disorder and Down syndrome. The second group focuses on assessing the home`s environmental, safety and comfort issues.

For both cases, the housing design aspects required to improve the quality of life of these people are identified and described based on the collection of information from various reference documents.

With the description of these needs, a list of recommendations is developed to improve the quality of life of the previously selected groups in their homes.

III. Results

A. The International Classification of Functioning, Disability and Health

The ICF is a model developed by WHO [1] that provides a comprehensive framework for understanding and describing the characteristics and needs of people with disabilities. The ICF model takes a holistic approach, considering not only people's physical impairments or health ailments but also the impact of these conditions on their functional abilities, activities, and participation in society.

The ICF model is based on a biopsychosocial approach where disability is not determined solely by the individual's condition or deterioration of health but also by the interaction between their health, personal conditions and environmental conditions. This model emphasizes the relevance of assessing the individual's functioning and disability within their environment's context and unique features.

The ICF model consists of two main components: Functioning and Disability and Contextual Factors [1].

Functioning and Disability: this component addresses the individual's health condition or disability and its impact on bodily functions and structures, activities, and participation. The following four features shape it:

- Body Functions: indicates the physiological or psychological functions of the human being, such as sensory, muscle and mental functions, among others.
- Body Structures: alludes to the anatomical parts of the human body, such as organs, limbs, and related structures.
- Activities: refers to the execution of tasks or actions by an individual, such as self-care, mobility, communication and other daily routine labours.
- Participation: alludes to the person's participation in social life, such as work activities, education, social interactions and community activities.

Contextual Components: this component addresses environmental and personal circumstances that may influence a person's functioning and disability. It includes the following two features:

- Environmental Components: refers to the physical, social, and attitudinal aspects of the individual's external environment, such as the built environment, social support network, attitude of other individuals, and accessibility to services.
- Personal Component: indicates the personal data of the individual, such as age, gender, education level, occupation, and other components that may impact their functioning and disability. These components are not analysed in this research.

Fig. 1 shows a diagram of the aims for each ICF component and the activities that were analysed to propose architectural indicators for housing design.

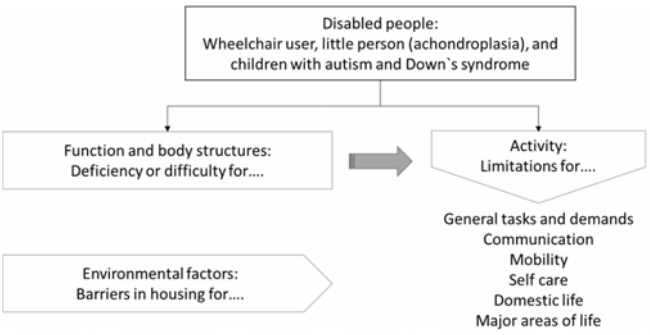

Fig. 1 Diagram for each ICF component analysed

B. Features of Study Subjects: Function and Body Structures and Environmental Factors

The study addresses two types of disabilities -physical and cognitive- therefore, four types of individuals. The physical conditions have been analysed for wheelchair users and little people (achondroplasia), where the study focuses on home design standards. The cognitive conditions group addresses children with autism spectrum disorder and people with Down syndrome. In this case, the analysis focuses on the design and sensory features of the home residence. Each individual presents distinctive characteristics and challenges in their daily routine at home.

Wheelchair users are people who require a transport chair to carry out their activities independently or with the assistance of

others. According to WHO [17], more than 75 million people worldwide require a wheelchair, but only 5% to 15% have access to this equipment. Users present mobility issues due to injury or illness and main challenges are related to manoeuvrability and reach of objects [2]. Wheelchair users have issues with their freedom of movement on daily activities and manoeuvring problems to transfer from and to the wheelchair in bedrooms or bathrooms [18]. Narrow spaces do not allow turning or opening doors, while uneven floors present risk of tipping or slipping. Reach issues can be identified as manual difficulties - objects or furniture located in high places- as visual difficulties - the angle of vision from the wheelchair is limited - and auditory difficulties - there is a long distance from a wheelchair user to a standing interlocutor.

Achondroplasia is the most frequent skeletal dysplasia (i.e., abnormal development) of short limbs due to a genetic mutation that affects endochondral ossification. The estimated incidence is approximately 1 in every 25,000 births worldwide. Features of a person with achondroplasia are short height, short limbs, the disproportion between the body trunk and limbs, small and broad hands, and limited movement of the elbows [19]. Little people have difficulties with the height of all items designed for an average-height person, as well as the restricted movement of arms, legs, trunk and hands [20]. This represents issues regarding the usability and accessibility of products [21].

Autism spectrum disorder is a condition related to brain development that affects how a person perceives and socializes with their environment, as well as showing atypical patterns of activity and behaviour. In some cases, they may present akinesia (loss of movement), hypotonia (low muscle tone) and bradykinesia (slowness of movement). Approximately one in 100 children have this condition [24], [25]. This disability is called a spectrum condition as the capacity level of each person can significantly vary according to the extent of the disability. Main issues at home pertain to their relation with the sensory environment, either due to hypersensitivity or hyposensitivity to acoustic, visual or tactile stimuli, affecting home comfort and safety conditions [26]. Persons with autism spectrum disorder showing lack of movement and muscular problems, may experience difficulties using appliances and accessories.

Down Syndrome is a genetic alteration produced by the presence of an extra chromosome and has an incidence of approximately 1 in every 1,000 births [22]. This cognitive disability manifests in tasks with a high level of reconcentration. Children with Down syndrome are comparatively better at visuospatial tasks than visual working memory tasks. However, as processing requirements increase, these children may experience difficulties with visuospatial working memory [23]. These children have difficulties executing tasks independently and, therefore, with chores and safety at home. They also show spatial orientation problems and, depending on the degree of cognitive delays, they may present mobility problems. Adults are assisted in helping them live independently rather than customize their homes according to their needs [8].

Table I summarizes the main barriers and needs (environmental factors) inside the residence to carry out activities and chores classified according to the definitions of the ICF model and each group of people with disabilities.

TABLE I
BARRIERS AND NEEDS

Activity	*Physical*		*Cognitive*	
	Wheelchair user	*Little person*	*Autism spectrum disorder*	*Down's syndrome*
General tasks and demand	Displacement, manoeuvrability, and reach	Reach	Navigation and use of spaces within the home	
Communication	Communication by the height of the interlocutor		Dependence on visual support for communication, routine, and management	Easy eye-reading of the use of furniture
Mobility	Obstacles, slopes, narrow spaces	Slopes (falls)	Limitation of spatial orientation between the use of different areas	Wander, slopes
Self-care	Range of accessible heights in sanitary appliances	Accessible height range in sanitary fixture and ergonomics in sanitary accessories	Ergonomics of sanitary accessories (due to movement and muscular problems)	Simplicity of sanitary fixtures and fittings
Domestic life	Height of furniture affects tasks such as cooking, cleaning, tidying and organizing. Safety issues (falls)		Inadequate safety features in bathrooms and kitchen	
Major areas of life	Autonomy in the kitchen and independence in using the bathroom		Comfort in space, high sensitivity to light, noise, or textures	Importance of autonomy

A design criterion was developed based on a bibliographical review of these environmental components and six home activities identified in the ICF model. These criteria aim to improve the quality of life, autonomy, security and independence of people with disabilities inside their homes.

C. Design Criteria Recommendation

To elaborate on the design criteria proposal, several scientific articles were studied. Although more of the selected criteria are available in the literature, priority was given to those that should be considered to reduce the main barriers identified in the previous section and from the perspective of the interior design of a dwelling. Thus, the proposal is divided into three major areas: i) space management with definitions for heights, widths, areas, and layout of spaces; ii) building services with instructions for safe and comfortable use of electrical and sanitary services, as well as indoor environment standards; and iii) supporting facilities with data related to finishes of the building elements, and for 18 groups of sub-criteria.

Table II describes the different design criteria for the four types of disabilities.

TABLE II
DESIGN CRITERIA RECOMMENDATION

Design criteria			*Physical*		*Cognitive*	
			Wheelchair user [18], [27], [28]	*Little person* [20], [21], [29]	*Autism spectrum disorder* [6], [26], [30]	*Down's syndrome* [31], [32]
Space management	Space planning	1. Size and layout of rooms	Open spaces: 1.5 m turn radius. Corridors: Width from 0.9 to 1.5 m. No curves.		Layout: Simple spaces with a sense of order according to use and circulation. Symmetrical organization is recommended. Rooms: Personal and intimate room for the child. Space isolated from stimuli for relaxing. Avoid sharp corners. Spacious hallways. Clear visual aid with information for each room.	Layout with clear outline of room functions, day/night zoning and wet/dry areas. Use of signs of pictograms to identify rooms and wayfinding for spatial orientation. Open plans with clear lines of view are recommended. Avoid hallways. Bathroom outside the bedroom is recommended. Presence of exterior spaces, protected terraces or balconies are recommended. Consider importance of autonomy and independence for household chores.
		2. Kitchen	Countertop height: from 0.7 to 0.8 m. Clearance under work table. Lever faucets.	Consider proper height and width of kitchen furniture and cabinets to reach objects and water taps. Countertop height < 0.85 m	Consider modifications in kitchen to make it safe. Countertop protection. Faucet automatic sensor. Acoustic insulation in kitchen and plumbing.	Open kitchen is not recommended. Countertops with easy-to-read information.
		3. Design and layout of furniture	Space between objects: 1.5 m Bed: dimensions L 1.755 m x W 1.5 m x H 0.5 m. Rounded or smooth corners. Position must allow the PM to see the door. Cabinets: D 0.5 m. Hanger height 1.35 m. Handle height 0.9 m. Room for feet: H 0.25 m x D 0.15 m. Rounded corners. Work table: dimensions W 0.76 m. x D 0.5 m x H 0.7 to 0.8 m. Antislip texture and rounded corners	Consider proper height of furniture to reach objects, clothes, food, etc.	Proper height and organization for functional and accessible furniture. Mobile or modifiable furniture is recommended. Avoid climbable furniture and sharp corners.	Signs or pictograms to identify furniture's function.
Building services	Electricity	4. Switches and outlets. Electrical appliances	Outlet height: 0.4 m min, 1.2 m max. 0.5 m to 0.9 m recommended. Switch height: 1.2 m max, 0.9 m recommended. Push button light switches are recommended.	Lower the height of light switches, install additional ones or use an extender.	Tamper-resistant outlets	Visible switches located at proper height. Avoid switches at eye level and behind doors. Electrical outlet protectors. Avoid electrical appliance with the same colour of doors or furniture
	Bathroom	5. Toilet	Height: 0.46 to 0.48 m. Side transfer area: 0.96 to 1.65 m^2. Grab bars	Height: 0.45 to 0.50 m. Proper height of the flush button.		
		6. Bath cubicle	Shower area: 0.96 to 1.82 m^2. Lateral shower transfer area: 0.96 to 1.44 m^2. Entrance step: 0 to 0.05 m. Walk-in shower is recommended. Proper faucet height. Grab bars.	Proper opening of the bathroom and shower cubicle doors. Walk-in shower is recommended.		
		7. Design of the sink	Height: 0.7 to 0.8 m Free space under the sink	Proper sink height. Width: < 0.60 m.		
		8. Design of the taps and bath appliances	Lever faucets. Proper height of the washer. Clearance space under the laundry room furniture.	Proper height of toilet paper dispenser, towel bars and soap dish. Mirror height: < 0.90 m. Lever faucets	Consider safety in the bathroom. Accessible faucets with automatic sensor. Ergonomics personal hygiene items. Mirrors at children height. Acoustic insulation in bathroom and plumbing.	Consider proper height for bathroom fixtures. Faucets with automatic sensor. Ergonomics personal hygiene items.

	Design criteria		*Physical*		*Cognitive*	
			Wheelchair user [18], [27], [28]	*Little person* [20], [21], [29]	*Autism spectrum disorder* [6], [26], [30]	*Down's syndrome* [31], [32]
	Indoor environmental quality	9. Artificial light	Proper height of light fixtures. Guide night lights.		Use of technology is recommended for lighting control. Avoid fluorescent, bright and flashing lights.	Consider proper lighting levels.
		10. Natural light			Maximize natural lighting and consider options to control lighting levels.	Consider proper lighting levels.
		11. Indoor temperature	Between 21°C and 24°C		Digital temperature controller.	Digital temperature controller.
		12. Indoor noise			Soundproofing to reduce exterior obnoxious noises.	
Supporting facilities	Windows and doors	13. Design of doors	Colour contrasted doors. Door width: 0.9 m Doors opening: 90-degree outwards. Sliding doors are recommended. Automatic opening is recommended. Handle height: 0.90 to 1.20 m. Lever door handles with contrasting colour and no pointed edges. Length: 0.1 m. D type pull handle length: 0.14 m.	Lever door handles. Lock height: 0.7 to 1.20 m or use an extender. Door weight: < 25N	Accessible and easy to use lever door handles. Consider proper height.	Use colour or textures on doors to identify different rooms. The automatic opening is recommended.
		14. Design of windows	Window length: 0.57 to 1.65 m. Window sill height: 0.6 m. Sliding windows with handle lock. Must be operable with one hand.	Window handle height: 0.8 to 1.10 m or use an extender.	Accessible and easy to use window handles. Consider proper height. Protection in windows located in high places.	Protection in windows located in high places.
	Finishes	15. Design of walls and ceilings			Low ceilings with moderate dimensions. Use of soft and soothing colours. Avoid wallpaper with motifs.	Use different colour for walls and doors.
		16. Design of floors and stairs	Proper slope on ramps. Avoid steps, gaps and joint covers. Use of non-slip surface, but not too rough. Wood, tile or vinyl floors are recommended. Avoid carpet floors.	Avoid steps	Soft flooring is recommended i.e., carpet or wood flooring. Stairs must be protected and have no gaps.	Stairs must be protected and have no gaps. Use different flooring to differentiate rooms. Avoid steps and uneven floors.
	Security	17. Safety alarm services	Wireless emergency phone. Remote monitoring system	Consider the height of the interlocutor for communication devices.	Consider home safety	Consider home safety
	Accessibility	18. Handrails	Handrails in the home and on ramps. Toilet grab bars.	Toilet grab bars.		

IV. Conclusion

As it is relevant to consider that home design criteria for people with disabilities may significantly vary according to the capabilities, preferences, and cultural considerations of each condition, thus, this research incorporates some groups of people that usually have not been considered in comparable studies, such as little people and children with disabilities.

Four types of people with disabilities were characterized based on the ICF model: wheelchair users, little people and children with autism spectrum disorder and Down syndrome. Then, home activities and chores were classified into six fields: tasks and general needs, communication, mobility, self-care (i.e. personal hygiene), domestic chores (i.e. cooking, cleaning, organizing) and autonomy and independence. Subsequently, the main obstacles in the home environment were described according to an analysis of home activities and the limitations of the disability groups. For wheelchair users and little people, the main issues are mobility, reaching objects and safety (due to the risk of falls) simultaneously. At the same time, children with autism spectrum disorder and Down syndrome face comfort and security issues. Thus, it is required to incorporate architectural features that simplify these people's daily activities.

From the previous data and an analysis of various scientific documents, a checklist of architectural and design features that reduce obstacles to executing home activities was developed. These features were classified into three groups: space management with definitions for heights, widths, areas, and layout of spaces; building services with instructions for safe and comfortable use of electrical and sanitary services, as well as indoor environment standards; and supporting facilities with data related to finishes of the building elements.

As the results of this study are part of a larger project on accessibility in housing, further research will organize the design criteria generated according to their relevance. As part of this process, feedback from users and professionals, such as architects and occupational therapists, can provide valuable information and guidance to generate homes that are inclusive, safe and coherent for people with diverse abilities.

REFERENCES

[1] World Health Organization (WHO). Towards a Common Language for Functioning, Disability and Health: ICF; WHO: Geneva, Switzerland, 2002.
[2] X. Ferrada., C. Valderrama, and C. Fuentes-Contreras. "Economic and Technical Analysis of Universal Accessibility in Social and Private Housing in Chile." IOP Conference Series: Earth and Environmental Science, vol. 503, no. 1. 2020, pp 1-10
[3] Harvard University—Centre for Housing Studies. America's Rental Housing: Expanding Options for Diverse and Growing Demand. 2015. Available online: http://jchs.harvard.edu/sites/jchs.harvard.edu/files/americas_rental_housing_2015_web.pdf (accessed on 1 March 2023).
[4] National Disability Services. State of the Disability Sector Report; National Disability Services: Deakin, Australia, 2015. Available online: https://disabilitysectorreport.nds.org.au/#page/12 (accessed on 1 March 2023).
[5] Muscular Dystrophy United Kingdom. Breaking Point: The Crisis in Accessible Housing and Adaptations. 2015. Available online: https://www.housinglin.org.uk/_assets/Resources/Housing/OtherOrganisation/Housing-adaptations-briefing-final.pdf (accessed on 1 March 2023).
[6] L. Stephens, K. Spalding, H. Aslam, H. Scott, S. Ruddick, L. Young and P. McKeever. "Inaccessible childhoods: evaluating accessibility in homes, schools and neighbourhoods with disabled children". Children's geographies, vol 15, no 5, 2017, pp 583-599.
[7] Y. Wang and V. McCall V. "Evidence review of home adaptations in the UK and other OECD countries". UK Collaborative centre for housing evidence. UK. 2022, 47pp
[8] S. Cumella and S. Heslam, S. "Supported housing for people with Down's syndrome". British Journal of Learning Disabilities, vol 42, no 4, 2014, pp 251-256.
[9] C. Kramer and C. Pfaffenbach. "Should I stay or should I go? Housing preferences upon retirement in Germany". J Hous and the Built Environ vol 31, 2016, pp 239–256
[10] C. Valderrama-Ulloa, X. Ferrada and F. Herrera. "Breaking Down Barriers: Findings from a Literature Review on Housing for People with Disabilities in Latin America". International Journal of Environmental Research and Public Health, vol 20, no 6, 2023, pp 4972-4995.
[11] E. Mulliner, M. Riley and V. Maliene. "Older people's preferences for housing and environment characteristics". Sustainability, vol 12, no 14, 2020, pp 5723-5735.
[12] J. Powell, S. Mackintosh, E. Bird, J. Ige, H. Garrett and M. Roys. "The role of home adaptations in improving later life". Centre for ageing better. 2017, 40pp
[13] D. Sánchez-González, F. Rojo-Pérez, V. Rodríguez-Rodríguez and G. Fernández-Mayoralas. "Environmental and psychosocial interventions in age-friendly communities and active ageing: a systematic review". International journal of environmental research and public health, vol 17, no 22, 2020, pp 8305-8315.
[14] L. Struckmeyer, J. Morgan-Daniel, S. Ahrentzen, and C. Ellison. "Home modification assessments for accessibility and aesthetics: A rapid review". Health Environ. Res. Des. J. vol 14, 2021, pp313–327
[15] J. Percival and J. Hanson. "I don't want to live for the day any more': visually impaired people's access to support, housing and independence". British journal of visual impairment, vol 25, no 1, 2007, pp 51-67.
[16] A. Raggi, R. Quintas, E. Russo, A. Martinuzzi, D. Costardi, G. Frisoni, and M. Leonardi. "Mapping SAGE questionnaire to the International Classification of Functioning, Disability and Health (ICF)". Clinical psychology & psychotherapy, vol 21, no 3, 2014, pp 199-203.
[17] WHO, 2018. Assistive technology. Online in: https://www.who.int/news-room/fact-sheets/detail/assistive-technology
[18] C. Valderrama-Ulloa, X. Ferrada, and F. Rouault. "A tool for universal accessibility assessment in the interior of dwellings". Informes de la Construcción, vol 75, no 570, 2023, pp 491-503.
[19] Orphanet, 2019. Acondroplasia. Disponible en: https://www.orpha.net/consor/cgi-bin/
[20] B. Parisi, C. Matos, K. de Oliveira and R. de Araújo. "Acessibilidade e inclusão social da pessoa com nanismo: da legislação à realidade". Revista Baru-Revista Brasileira de Assuntos Regionais e Urbanos, vol 7, no 1, 2021, pp 19-29.
[21] A. Tavares, R. Cardoso, J. Santos and G. Sampaio. "Acessibilidade para pessoas com deficiência: algumas dificuldades em projetar para indivíduos com nanismo". Anais do VI Encontro Nacional de Ergonomia do Ambiente Construído & VII Seminário Brasileiro de Acessibilidade Integral, vol 2, no 7, 2016, pp 609-620.
[22] Naciones Unidas sf, Síndrome de Down, Disponible en https://www.un.org/es/observances/down-syndrome-day
[23] B. Brusilovsky. "Modelo para diseñar espacios accesibles. Espectro cognitivo". La ciudad Accessible. 2014, 232pp Disponible en http://riberdis.cedid.es/handle/11181/5484
[24] WHO, 2022. Autismo Disponible en https://www.who.int/es/news-room/questions-and-answers/item/autism-spectrum-disorders-(asd)
[25] WHO, 2023. Austismo Datos y cifras. Disponible en https://www.who.int/es/news-room/fact-sheets/detail/autism-spectrum-disorders
[26] M. Mostafa. "An architecture for autism: Concepts of design intervention for autistic user", International Journal of Architectural Research, vol 2, no 1, 2008, pp. 189–211.
[27] A. Meyers, J. Anderson, D. Miller, K. Shipp and H. Hoenig. "Barriers, facilitators, and access for wheelchair users: substantive and methodologic lessons from a pilot study of environmental effects". Social science & medicine, vol 55, no 8, 2002, pp 1435-1446.
[28] N. Rahmawati and B. Jiang. "Develop a bedroom design guideline for progressive ageing residence: A case study of Indonesian older adults". Gerontechnology, vol 18, no 3, 2019, pp 180-192
[29] Observatorio estatal de la Discapacidad. "Requerimientos de accesibilidad y diseño para personas con acondroplasia y otras displasias esqueléticas con enanismo (ADEE). Propuestas normativas, modelos prescriptivos y prácticas recomendables", 2020, 137 pp. España.
[30] W. Nagib and A. Williams, A. "Toward an autism-friendly home environment". Housing Studies, vol 32, no 2, 2017, 140-167
[31] E. Briggs Fonseca. "Creando espacios inclusivos. Accesibilidad cognitiva en edificios de viviendas para personas con Síndrome de Down". Trabajo Fin de Grado. Universitat Politécnica de Valencia. 2020, 85pp
[32] A. Rico Guardiola. "Estrategias de accesibilidad cognitiva: accesibilidad cognitiva en edificios de vivienda para personas con Síndrome de Down". Trabajo Final de Grado. Universitat Politecnica de Valencia. 2021, 75pp