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Product design for people with Rheumatoid Arthritis and its relationship with stakeholder's expectations

Allisson J. F. de Andrade[1]; Ricardo Triska[2]

1 *Programa de Pós-Graduação em Design, Departamento de Design, Universidade Estadual Paulista, Bauru, Brasil*

2 *Programa de Pós-Graduação em Design, Departamento de Design e Exp. Gráfica, Universidade Federal de Santa Catarina, Florianópolis, Brasil*

ABSTRACT

Approximately 6.2% of the Brazilian population has some disability, from which 1.3% declare to have some physical disability. Rheumatoid Arthritis (RA) is a systemic and autoimmune disease that affects about 0.4% to 1.3% of the world population, being more common in women. In advanced stages, the disease can cause severe impairment in small joints, limiting individuals' movements and impairing their independence and autonomy. Assistive Technology (AT) aims to promote actions that enable People with Disabilities or Reduced Mobility to execute their daily activities in the most normal and independent manner possible. However, studies show high rates of abandonment of AT devices for reasons generally related to the effectiveness of the product itself. Thus, this study aims to carry out data collection, organization, and analysis to understand the expectations of stakeholders about the development of new AT devices for individuals with RA. For this, the technical research procedures were segmented as follows: Phase 1 – Theoretical Foundation; Phase 2 – Selection of Target Audience and Sampling; Phase 3 – Data Survey; and Phase 4 – Data Organization and Analysis. Through the procedures adopted, it was possible to verify that there are significant differences between the expectations of stakeholders concerning the development of new AT products for individuals with RA, which can directly imply user satisfaction, consequently generating the abandonment of these devices if they do not meet the expectations.

KEYWORDS

Assistive Technology;
Project Product;
Health.

Projeto de produto para pessoas com Artrite Reumatoide e sua relação com as expectativas das partes interessadas

RESUMO

Aproximadamente 6,2% da população brasileira possui alguma deficiência, dos quais 1,3% declaram ter alguma deficiência física. A Artrite Reumatoide (AR) é uma doença sistêmica e autoimune que afeta cerca de 0,4% a 1,3% da população mundial, sendo mais comum em mulheres. Em estágios avançados, a doença pode causar graves prejuízos em pequenas articulações, limitando os movimentos dos indivíduos e prejudicando sua independência e autonomia. A Tecnologia Assistiva (TA) visa promover ações que possibilitem às Pessoas com Deficiência ou Mobilidade Reduzida executar suas atividades diárias da forma mais normal e independente possível. No entanto, estudos mostram altas taxas de abandono de dispositivos de TA por motivos geralmente relacionados à eficácia do próprio produto. Assim, este estudo tem como objetivo realizar a coleta, organização e análise de dados, para compreender as expectativas das partes interessadas sobre o desenvolvimento de novos dispositivos de TA para indivíduos com AR. Para tanto, os procedimentos técnicos da pesquisa foram segmentados da seguinte forma: Fase 1 - Fundamentação Teórica; Fase 2 - Seleção do Público Alvo e Amostragem; Fase 3 - Levantamento de dados; e Fase 4 - Organização e Análise de Dados. Por meio dos procedimentos adotados, foi possível verificar que existem diferenças significativas entre as expectativas das partes interessadas quanto ao desenvolvimento de novos produtos de TA para pessoas com AR, o que pode implicar diretamente na satisfação do usuário, gerando consequentemente o abandono desses dispositivos caso não atendam às expectativas.

PALAVRAS-CHAVE

Tecnologia Assistiva;
Projeto de Produto;
Saúde.

CONTATO: Allisson J. F. de Andrade – *allisson502@gmail.com*

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1. INTRODUCTION

According to data from the last National Health Survey (PNS), carried out by the Brazilian Institute of Geography and Statistics – IBGE (2015), about 6.2% of the Brazilian population has some type of disability. Among the survey respondents, 1.3% declared having a physical disability, with the proportions of occurrence increasing in people over 30 years old, where: people aged 30 to 39 years old represented 1.0%; from 40 to 59 years, 1.9%; and 60 years or older constituted 3.3%. According to the study, in Brazil, about 0.3% of the population was born with a physical disability, while 1.0% acquired it during their lifetime due to an illness or accident (IBGE, 2015).

For Vasco and Franco (2017), the acquisition of a disability can has important impacts on the life of an adult, promoting significant changes in the individual's reality. When faced with a different body from what he had before, the individual finds himself in a new "vital situation" that will reverberate in his social, affective, and professional life (TEIXEIRA, 2006). The suddenly acquired disability can also impact the identity of the individual, triggering, for example, psychological disorders such as depression (MAIA, 2006).

Rheumatoid Arthritis (RA) is a systemic disease that causes consequences in all parts of the body, but it most frequently destroys synovial and bone joints (GRAVALLESE, 2002). This disease affects about 0.4% to 1.3% of the world population (SMOLEN; ALETAHA; MCINNES, 2016). The impairment of hand joints affects about 80% of individuals, causing functions reduction, weakness, and mobility restriction, which makes it difficult to hold and handle objects (O'BRIEN, 2006). The advancement of RA can cause edema, joint stiffness, deformities, and consequently, a decrease in physical and functional capacity (MAYOUX BENHAMOU, 2007).

According to Pichler (2019), the significant growth in the number of People with Disabilities (PWDS) promoted the emergence of global movements to guarantee the rights of these individuals through public policies, tax incentives, and other actions that seek to improve their participation and inclusion in society. Promoting the independence and autonomy of PWDS is one of the ways to insert these individuals into society. Therefore, Assistive Technology (AT) has a fundamental role in this context (FEDERICI; SCHERER, 2012; WHO, 2016).

Bersh (2017) explains that the purpose of AT is to provide PWDS with greater independence, quality of life, and social inclusion through actions that seek to expand their skills and interactions with society. AT contributes to increasing PWDS participation in tasks that could not be performed otherwise or that would be performed with difficulty (SHIPHAM et al., 2003). Meeting the needs of individuals must be one of the main goals of AT, in addition to meeting the demands of the environment in which the user is inserted, as well as ensuring the efficiency and safety of these devices (WHO, 2012).

Data from the World Health Organization - WHO state that about 75% of assistive devices purchased are abandoned by users due to reasons generally associated with performance, aesthetic and product monitoring services, in addition to changes in their needs (WHO, 2016). A study with 91 individuals, who had a total of 199 AT, found that 18% of them (n = 35) were abandoned and that, in addition, 37% (n = 13) of the individuals stated that the cause of the abandonment occurred because they did not like the device(s) (CEZAR DA CRUZ; GUILLAUMON EMMEL, 2015).

The user's emotional factors and personal needs can also influence the success of products/services, which may result in dissatisfaction if these products/services do not operate as expected or do not meet user expectations (ZEITHAML; BITNER, 2003). For Esperidião (2006), users have a pre-established "tolerance zone" between the desired services and those considered adequate. Therefore, satisfaction or dissatisfaction will be the result of how much the service performance was superior or inferior to the established zone. Eberle and Milan (2009) state that satisfying users' needs is knowing whether their expectations were met or not.

Given the above, it is possible to affirm that AT use is essential to improve the quality of life of individuals with RA who have a joint impairment. However, due to the high abandonment rates of these devices, it is necessary to promote actions that result in products that are more in line with what is expected by these potential users. That said, this study aims to carry out a survey involving collection, organization, and analysis of data related to the expectations of stakeholders concerning the development of new AT products for individuals with RA.

For this research, it is necessary to emphasize that stakeholders (or interested parties) are any group or individual that affect or can be affected by the achievement of the goals of an organization (FREEMAN, 2010). Therefore, these stakeholders can be consumers, employees, suppliers, shareholders, and the community where the organization is inserted (CAMPOS, 2010).

2. RHEUMATOID ARTHRITIS

Rheumatoid Arthritis (RA) is an inflammatory condition of unknown cause and systemic origin that predominantly affects peripheral joints, leading to progressive joint destruction by persistent inflammation (WOOLF; PFLEGER, 2003; LIN; ANZAGHE; SCHÜLKE, 2020). This progressive inflammation in the joints results in cartilage destruction, erosion, and bones deficiency (SMOLEN; ALETAHA; MCINNES, 2016). RA is a multisystemic and autoimmune disease that, in addition to compromising the joints, can trigger non-articular manifestations, namely: subcutaneous nodules, vasculitis, pulmonary nodules, intestinal fibrosis, among others (SANGHA, 2000).

RA is one of the most prevalent chronic inflammatory diseases worldwide (SMOLEN; ALETAHA; MCINNES, 2016). Among the risk factors for the development of the disease are smoking, obesity, exposure to ultraviolet light, sex hormones, medications, changes in the intestine, mouth, and lung microbiome, presence of periodontal disease (periodontitis), and infections (BRANDÃO et al., 2020).

The disease affects both sexes, but it is more frequent in individuals aged around 60 years and more common in urban than in rural areas (MYASOEDOVA et al., 2010; SMOLEN; ALETAHA; MCINNES, 2016). The disease prevalence rates in women tend to be significantly higher than among men (CARMONA et al., 2010), reaching a ratio of two to four women per affected man (VAN VOLLENHOVEN, 2009; QUINTERO et al., 2012).

In Brazil, Rheumatoid Arthritis affects about 0.2% to 1.0% of the population, representing 1.3 million people (COSTA et al., 2014). If the age group between 55 and 74 years is considered, the prevalence of the disease increases from 0.3% to 2.7% (SENNA et al., 2004). Studies with individuals diagnosed with RA under outpatient follow-up indicate that the prevalence of the disease in Brazil is established at six women for every man (LOUZADA JR et al., 2007).

According to Mota et al. (2013) in the initial phase of the disease, joint manifestations can be reversible. However, if the inflammation is not controlled, it can lead to the destruction of bones and cartilage, and irreversible injuries to tendons and ligaments. Goeldner et al. (2011) state that about 50% of patients affected by RA also suffer from extra-articular manifestations, with Sjögren's syndrome – immune system

syndrome characterized by dry eyes and mouth – being the most common. For Louzada Júnior et al. (2007), most patients have a fluctuating clinical course, with periods of improvement and worsening.

The gradual damage generated by RA can lead to impairment of the functional activities of individuals, such as in the performance of Daily Life Activities – DLAs and in professional activities (LAPSLEY et al., 2002; KHURANA; BERNEY, 2005). RA manifestations are common in the upper limbs, generating problems directly related to the person's capacity and independence, caused by complications in the joint (DE SOUZA SILVA; MASSA, 2015). To illustrate the differences between the hand of a person in "normal" conditions and that of a person with RA, Figure 1 presents a case of ulnar deviation, where the illustration of the hand that presents the disease highlights (in red and in the right) the impairment of the small joints.

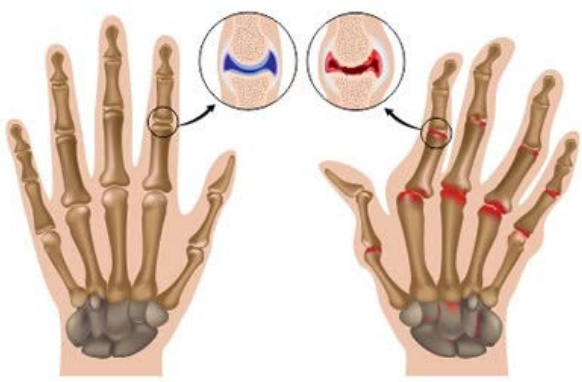


Figure 1 Comparison between the hand of a person with (right) and without (left) Rheumatoid Arthritis (ZERBINI; LOMONTE, 2015).

As for the severity of the disease, RA is divided into three categories: mild, moderate, and severe (LOUZADA JR. et al., 2007). According to Carmona et al. (2010), access to early diagnosis and the most modern treatments can influence the disability level and the mortality rate of RA. The diagnosis is based on the presence or absence of clinical, laboratory, and radiological alterations (SANGHA, 2000). As it does not present particular symptoms, there is some difficulty in diagnosing RA, as there is no specific way for the precise indication (SYMMONS, 2002).

2.1 Disease treatment

Once the individual is diagnosed, the main goal of health professionals is to achieve complete remission, or at least significantly reduce the evolution of the disease within approximately six months to prevent joint damage, disability, and systemic manifestations of the disease (BURMESTER; POPE, 2017; ALETAHA; SMOLEN, 2018). The immediate treatment is based on the fact that 80% of poorly treated individuals will have their joints damaged, and 40% of them will be unable to work within ten years from the disease onset (WOLFE, 1996; SOKKA et al., 1999; ALETAHA; SMOLEN, 2018).

According to Smolen, Aletaha, and McInnes (2016), RA treatment consists of preventing or interrupting the individual's structural changes, seeking to minimize or reverse the physical deficiencies caused by the disease. Knowing that the inflammation represents the apex of clinical events – clinical symptoms of conduction, joint damage, disability, and comorbidity – in RA (SMOLEN et al., 2007), the reversal of this aspect is the main objective of the treatment, since the reduction of inflammation results in damage regression, improving physical function and reducing sequelae (SMOLEN; ALETAHA; MCINNES, 2016). Thus, the treatment of RA requires a strategic approach, based on monitoring to adapt the treatment or change the medication according to the course of the disease (SMOLEN et al., 2015).

The treatment of Rheumatoid Arthritis in the Brazilian population has an estimated average cost of U$424, of which 59% is spent on medication (CHERMONT, 2008). The Unified Health System (SUS) provides free drugs that modify the progression of the disease and prevent injuries, intending to preserve joint integrity and functionality in the RA treatment (MOTA et al., 2012). However, the numbers are expressive, and the disease is already considered one of the five diseases that cause the most significant budgetary impact in the country, consuming around 10.4% of SUS resources (CARIAS et al., 2011). Through the studies mentioned, it is possible to conclude that RA can be considered a public health problem in Brazil.

3. ASSISTIVE TECHNOLOGY

Established by Decree No. 5.296/2004, within the scope of the Special Human Rights Secretariat of the Presidency of the Republic of Brazil, the Technical Assistance Committee – CAT aims to encourage the development of Assistive Technology (AT) in the country (CAT, 2009). Through the CAT, the concept of AT in Brazil was defined, being approved in the minutes of the VII meeting of December 2007 as a knowledge area, with an interdisciplinary character, which encompasses actions aimed at promoting functionality regarding the activity and participation of PWDS or reduced mobility, seeking to provide autonomy, independence, quality of life and social inclusion (CAT, 2007).

According to Galvão Filho (2009), the concept of AT differs from rehabilitation technology and is characterized by personal resources or procedures that seek to meet the individual's direct needs, aiming for his independence and autonomy. For Bersh (2017), AT is an aid that seeks to promote the performance of functions that are impaired due to factors such as disability and aging.

Cook and Hussey (1995) define AT as a wide range of equipment, services, strategies, and practices designed and applied to alleviate the functional problems encountered by individuals with disabilities. According to Tuntland et al. (2010), AT involves several products, from low-tech devices to technologically complex equipment. For the authors, these devices can be produced both for the general public and for people with functional limitations or disabilities.

According to Bersh (2017), for the development of AT products or services, different teams of professionals can be used, varying according to their characteristics and the place where individuals are inserted. Also, according to the author, AT brings together professionals from different backgrounds, such as educators, engineers, architects, designers, occupational therapists, speech therapists, physiotherapists, physicians, social workers, psychologists, among others, to help AT users (BERSH, 2017).

A classification of AT resources was written in 1998 by José Tonolli and Rita Bersch, in which AT resources are organized according to their functional objectives (BERSH, 2017). The classification is divided as follows:

- Daily assistance;
- Augmentative and Alternative Communication – AAC;
- Computer accessibility features;
- Environmental control systems;

- Architectural projects for accessibility;
- Orthotics and prostheses;
- Postural adequacy;
- Mobility aids;
- Assistance for the qualification of visual ability and resources that expand the information for people with low vision or blindness;
- Assistance for people with deafness or hearing impairment;
- Mobility in vehicles;
- Sports and leisure.

According to Garcia and Galvão Filho (2012), AT conceives far beyond mere devices, equipment, or tools, also encompassing the processes, strategies, and methodologies related to them in the concept. For the legislation of the United States of America (USA), AT is divided into resources and services, the first being any item, product, or system aiming to maintain or improve the functional capabilities of people with disabilities; and the second being equipment that helps people with disabilities to select, buy or use the previous resources (ADA, 1994).

Costa et al. (2006) conceptualize the Daily Life Activities (DLAs) as all the tasks that people need to perform to take care of themselves, namely: bathing, dressing, walking, eating, doing their physiological needs, among others. The functional capacity is related to the way people perform DLAs independently (MATSUDO, 2002). Therefore, Wagner (2010) states that PWDS have greater difficulty in performing DLAs and that existing limitations are caused by accessibility problems, with accessibility being the resources that promote the exercise of autonomy and participation.

4. A SYSTEMATIC REVIEW OF THE MAIN THEMES

It is understood that DLAs are activities whose execution requires some autonomy and independence. As RA tends to compromise these two aspects, the development of AT solutions contributes to improving the functional capacity of individuals with RA. That said, the following studies presented were found through a Systematic Review (SR) that addresses the use of Assistive Technology by people with Rheumatoid Arthritis.

In the study made by Van Der Esch, Heijmans, and Dekker (2003) involving 223 people affected with RA, with an average age of 63 years old and the majority being women, 49% (n = 110) used locomotion devices such as orthopedic shoes, canes, and crutches. Through multivariate analysis, it was found that the most common reasons for using the AT were disability, frequency of pain, and advanced age. Another aspect found was the relationship between the use of ATs and education (the higher the level of education, the greater the use of AT), which according to the authors, may be directly related to socioeconomic status.

Carried out with a sample of 42 women and 13 men, the study by Shipam et al. (2003) aimed to establish a list of useful ATs for people with RA. According to the research, the most reported activities were those that require strength, such as turning on a faucet, cutting, and opening unlocked doors. Tasks that required dexterity (writing, buttons, and handling money) were not identified as a problem. Among the devices used by respondents, 83% were designed to compensate for the loss of strength, 11% to compensate for the loss of dexterity, and 5.8% to compensate for both.

The research by Thyberg et al. (2004) was performed with 284 people with early stages of RA and applied the Daily Life Activity Assessment Questionnaire (EDAQ) tool 12 and 24 months after disease diagnosis to detect patients who needed assistive devices. According to the authors, the main difficulties reported involved activities related to eating and drinking (opening a glass bottle and using a frying panhandle) and outdoor mobility (taking long walks, carrying groceries, and shopping on a large scale). At the end of the study, the authors show that in all (except one) the activities studied, there were positive results in the use of AT, significantly reducing people's difficulty in carrying out their activities.

The multicentric study by De Boer et al. (2009) was developed in hospitals in the Netherlands and interviewed 240 people with RA, of which 213 (89%) used one or more ATs. However, the proportions of people who never used their devices ranged between 8% (orthopedic insoles) and 23% (handrails). According to the study, the common reasons for not using ATs were: impairment or incapacity, satisfaction with the device, or self-efficacy. In general, the authors highlight the importance of ATs to compensate for the limitations present in people with RA.

Comprised of 114 people with RA, the research by Dahmen et al. (2014) interviewed individuals who have been diagnosed with the disease for an average of ten years. Of these, 25% wore therapeutic shoes, which, according to the authors, had positive results, such as reduced pain related to activity and improved gait. These benefits – in addition to others not mentioned – show that the use of therapeutic shoes is a realistic and effective treatment option for foot problems associated with RA.

In general, through the results found, it was possible to identify a concern in the scientific community regarding the use of Assistive Technologies by individuals with Rheumatoid Arthritis. The selected studies indicate that in the last twenty years relevant researches were carried out to verify the effectiveness of these products, in order to optimize them based on the reports of the users themselves.

5. MATERIALS AND METHODS

This study has an applied nature, an exploratory objective, and a quali-quantitative approach. Regarding technical procedures, the research was segmented as follows: Phase 1 – Theoretical Foundation; Phase 2 – Selection of Target Audience and Sampling; Phase 3 – Data Survey; and Phase 4 – Data Organization and Analysis. The structure of the study can be seen in Figure 2.

5.1 Phase 1: Theoretical Foundation

The first phase of this study consisted of developing a theoretical basis through bibliographic surveys and a Systematic Review (SR). The sources used in the research included: books, journal articles, theses, dissertations, conference proceedings, among others. As for the SR, articles that addressed the development of Assistive Technology for People with Rheumatoid Arthritis were selected, without restrictions regarding the period of the publications.

5.2 Phase 2: Selection of Target Audience and Sampling

To execute this phase, a non-probabilistic convenience sample was adopted. The non-probabilistic sample is applied when there is no knowledge of the size of the universe, and individuals are selected by criteria established by the researcher (ARIBONI; PERITO, 2004). The convenience sample, on the other hand, is defined by a sample group that has specific characteristics (COZBY, 2003).

Thus, the universe of the research was divided into three groups, according to the following inclusion criteria:

- Group 1 – People with Rheumatoid Arthritis: individuals diagnosed with RA by a health professional and who have a smartphone, computer, notebook, or similar devices with internet access;
- Group 2 – Designers: Designers or Engineers, who also have a device with internet access;
- Group 3 – Rehabilitation Professionals: Physiotherapists or Occupational Therapists, who also have a device with internet access.

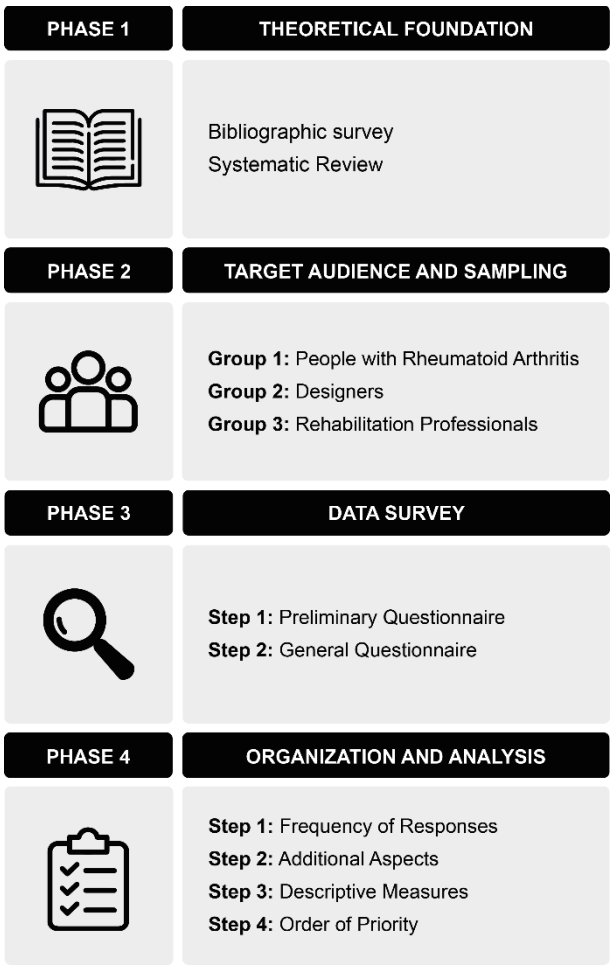


Figure 2 Research structure.

Regarding the sampling, this research presented different characteristics regarding the groups. In the Preliminary Questionnaire (described in Phase 3, Step 1), the following sampling was obtained: Group 1 (n=390), Group 2 (n=52), and Group 3 (n=54). In the General Questionnaire (described in Phase 3, Step 2), the sampling was as follows: Group 1 (n=189), Group 2 (n=41), and Group 3 (n=46).

Since the procedures adopted involve human beings, this study was previously submitted and approved by the Ethics Committee for Research with Human Beings (CEPSH) of the Federal University of Santa Catarina (UFSC), upon a substantiated assessment issued on June 9, 2020, No. 4,079,702.

5.3 Phase 3: Data Survey

In this phase, structured questionnaires were used, applied remotely through the free Google Forms tool. Therefore, individuals were recruited through social media and participated in the survey voluntarily. This phase took place in two stages, as follows:

- Step 1 – Preliminary Questionnaire: first, eight satisfaction items were selected from the Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST 2.0) tool (DEMERS; WEISS-LAMBROU; SKA, 2002), whose structure has twelve items in total, eight of which of them related to the use of AT. The selected items were: dimensions, weight, adjustments, safety, durability, ease of use, comfort, and effectiveness. In the second moment, individuals were asked to check the item they considered relevant in AT devices for individuals with RA. Finally, the individuals were asked if they missed any aspect that was not listed, and were free to include as many as they wished.
- Step 2 – General Questionnaire: the aspects mentioned in the previous questionnaire were presented again, adding those that were not among the main ones, but that were mentioned more frequently by respondents (they were: affordable price and product presentation). Given the presented aspects, individuals were asked to classify them according to their degree of importance (LIKERT, 1932), being (1) not important and (5) very important.

5.4 Phase 4: Data Organization and Analysis

After the Data Survey, the responses were exported to Microsoft Excel, and the analyzes were performed in the following order:

- Step 1 – Frequency of Responses: it contains data related to the Preliminary Questionnaire, indicating which aspects were most frequently chosen by the individuals;
- Step 2 – Additional Aspects: it represents the aspects that were not listed in the Preliminary Questionnaire but mentioned by at least 5% of the individuals in the groups;
- Step 3 – Descriptive Measures: it shows the variables obtained through mathematical calculations, regarding the General Questionnaire and the classification of the degree of importance of each aspect of the study, according to the groups;
- Step 4 – Order of Priority: it presents the comparison between the order of classification of the aspects, according to the evaluation of each group.

6. RESULTS AND DISCUSSIONS

The results of this study are presented in this topic following the order of Phase 4 (Data Organization and Analysis), as follows: Frequency of Responses, Additional Aspects (results of the preliminary questionnaire), Descriptive Measures, and Priority Order (results of the general questionnaire).

6.1 Frequency of Responses

The data in Table 1 shows that the aspects with the highest frequency of choice among the three research groups were: “efficacy” and “comfort”, both with percentages above 80% in all groups. In addition, the following aspects also stood out in Group 2 (Designers): “ease of use” with 96.1% (n=50); “adjustments” with 92.3% (n=48); and “security” with 86.5%

(n=45). In Group 3, the aspect “ease of use” reached the maximum percentage of choice, with 100% (n=52). Finally, the aspects “adjustments” with 94.2% (n=49) and “durability” with 82.6% (n=43) also stand out.

Table 1 Frequency of responses per group.

Items	Frequency of response		
	Group 1	Group 2	Group 3
Dimensions	50.0% (n=195)	78.8% (n=41)	75.0% (n=39)
Weight	60.5% (n=236)	**80.7%** (n=42)	78.8% (n=41)
Adjustments	69.4% (n=271)	**92.3%** (n=48)	**94.2%** (n=49)
Safety	62.5% (n=244)	**86.5%** (n=45)	78.8% (n=41)
Durability	61.0% (n=238)	67.3% (n=35)	**82.6%** (n=43)
Ease of use	75.3% (n=294)	**96.1%** (n=50)	**100%** (n=52)
Comfort	**80.2%** (n=313)	**96.1%** (n=50)	**94.2%** (n=49)
Effectiveness	**82.3%** (n=321)	**92.3%** (n=48)	**94.2%** (n=49)

Through these data, it is possible to observe that Group 1 (People with Rheumatoid Arthritis) was the one that presented the lowest frequency of choice in general (that is, the group that least chose the available research aspects presented as being important), with only two aspects having a frequency above 80%. Besides, the aspects with the lowest recurrence of choice among the three groups were also from Group 1, namely (from the smallest to the largest): “dimensions” with 50.0% (n=195); “weight” with 60.5% (n=236); and “durability” with 61.0% (n=238).

6.2 Additional Aspects

For this research, the aspects mentioned as additional were grouped according to their degree of similarity since individuals were free to express their opinions in any way they wished (through an open question). It is also worth noting that the aspects that were mentioned by less than 5% of the individuals were grouped in the preliminary questionnaire inside the “other(s)” category.

Figure 3 presents the data obtained through three graphs, one for each research group, as can be seen. According to the graphs, it is possible to notice that the item “I wouldn’t add more aspects” is highlighted, that is, for the absolute majority of individuals (Group 1: 70.2%; Group 2: 41.5%; and Group 3: 52.9%) the aspects listed in the research are sufficient to describe those that are important in developing an Assistive Technology product.

The graphs also show that individuals would add the “affordable price” aspect, observed in group’s responses: Group 1 (16.1% (n=62)); Group 2 (15.1% (n=8)); and Group 3 (17.6% (n=9)). In addition, the “product presentation” aspect was expressively mentioned, but by only two groups: Group 2 (15.1% (n=8)); and Group 3 (13.7% (n=7)). The “material” aspect was mentioned only by individuals in Group 2 (5.7% (n=3)). And finally, some individuals indicated other(s) aspect(s), but when their responses were added together, they did not reach 5%.

Through the data obtained, it was concluded that the aspects "affordable price" and "product presentation", as they presented considerable percentages in at least two of the three research groups, should be included with the other aspects to the assessment of the degree of importance in the General Questionnaire.

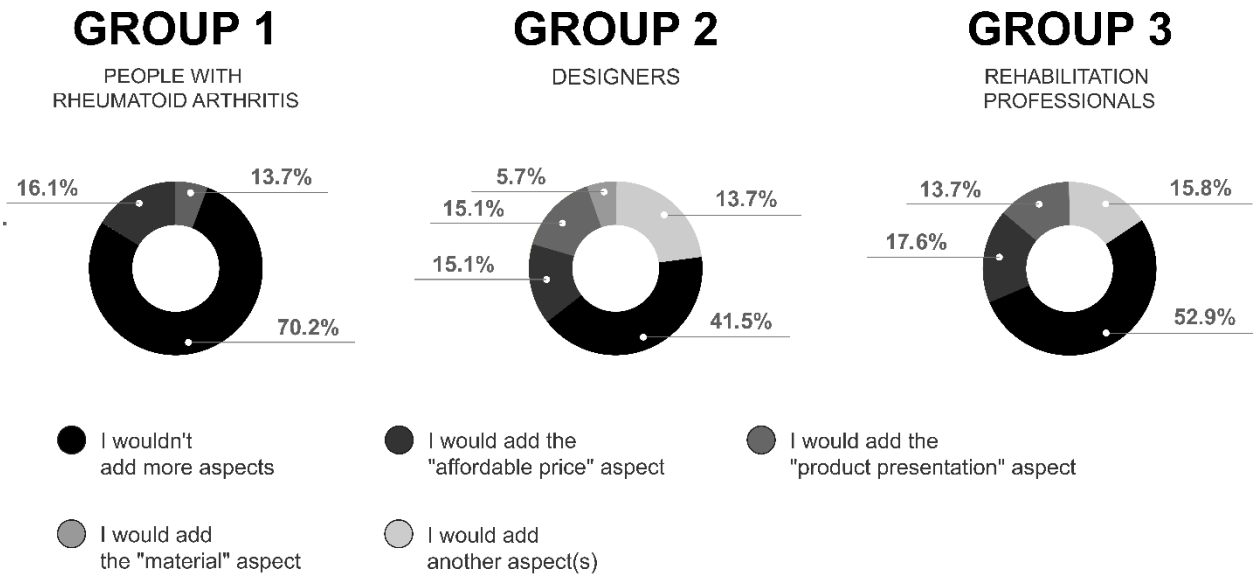


Figure 3 Graphics: choice of additional aspects for each group.

6.3 Descriptive Measures

The data obtained are presented below in the format of tables and are in the following order: the variables correspond to the ten aspects of the research (Items); the minimum value assigned by the research subjects/respondents to the variable (Min.); the maximum value assigned to the variable (Max.); the average values attributed to the answers by the individuals (Avg.); the standard deviation of the attributed values (S.D.); and finally, the variance of the values (the squared deviation) (Variance).

Table 2 presents the descriptive measures of Group 1 – People with Rheumatoid Arthritis, in which it is possible to highlight that, unlike the others, the "safety" aspect was the only one that received a score of 3 (three) as the lowest value attributed. The highest averages (in bold) were perceived in the "comfort" (4.89), "effectiveness" (4.87), and "safety" (4.86) aspects, in that order. The lowest averages (from lowest to highest) were for the aspects "product presentation" (3.93), "dimensions" (4.52), and "durability" (4.67).

Table 2 Descriptive Measures: Group 1.

Items	Min.	Max.	Avg.	S.D.	Variance
Dimensions	1	5	4.52	.828	.687
Weight	2	5	4.79	.581	.338
Adjustments	1	5	4.72	.667	.445
Safety	3	5	**4.86**	.440	.194
Durability	1	5	4.67	.644	.415
Ease of use	2	5	4.85	.498	.248
Comfort	2	5	**4.89**	.404	.163
Effectiveness	2	5	**4.87**	.406	.165
Affordable price	2	5	4.79	.524	.274
Product presentation	1	5	3.93	1.087	1.181

Regarding the standard deviation, the responses of individuals in Group 1 showed fewer variations among the evaluations of the "comfort" (.404), "effectiveness" (.406), and "safety" (.440) aspects, in that order. The aspects in which the answers varied the most were: "product presentation" (1.087), "dimensions" (.828), and "adjustments" (.667).

Table 3 shows the data referring to Group 2 – Designers, and just as in Group 1, the "safety" aspect received the best evaluation from individuals, where the lowest score attributed was 4 (four). In relation to the averages, the best evaluations are observed (in bold) in the aspects (from the biggest to the smallest): "ease of use" (4.91); "safety" and "effectiveness", both with (4.87). The lowest ratings were perceived in the aspects "affordable price" (3.93), "durability" (4.11), and "product presentation" (4.16), from lowest to highest.

Table 3 Descriptive Measures: Group 2.

Items	Min.	Max.	Avg.	S.D.	Variance
Dimensions	3	5	4.62	.614	.377
Weight	3	5	4.56	.725	.525
Adjustments	3	5	4.64	.645	.416
Safety	4	5	**4.87**	.344	.118
Durability	3	5	4.11	.714	.510
Ease of use	3	5	**4.91**	.358	.128
Comfort	3	5	4.71	.661	.437
Effectiveness	3	5	**4.87**	.405	.164
Affordable price	2	5	3.93	.780	.609
Product presentation	2	5	4.16	.824	.680

As for the standard deviation, individuals in Group 2 showed less variation between the responses in the "safety" (.344), "ease of use" (.358), and "effectiveness" (.405) aspects. Regarding the aspects in which the individuals' answers varied the most, those: "product presentation" (.824), "affordable price" (.780), and "weight" (.725).

Table 4 presents data for Group 3 – Rehabilitation Professionals, where, unlike the previous groups, the variable that received the best evaluation was the "comfort" aspect. Regarding the average of the assigned values, the most highly rated (in bold) were the aspects "comfort" (5.00) - which received the highest score from all individuals in the group - in addition to "effectiveness" (4.98) and " safety" (4.96). The aspects with the lowest evaluation were (from lowest to highest): "product presentation" (4.24), "affordable price" (4.63), and "adjustments" (4.64).

Table 4 Descriptive Measures: Group 3.

Items	Min.	Max.	Avg.	S.D.	Variance
Dimensions	3	5	4.67	.560	.314
Weight	4	5	4.76	.431	.186
Adjustments	4	5	4.83	.383	.147
Safety	4	5	**4.96**	.206	.043
Durability	3	5	4.65	.604	.365
Ease of use	4	5	4.93	.250	.062
Comfort	5	5	**5.00**	0.000	0.000
Effectiveness	4	5	**4.98**	.147	.022
Affordable price	3	5	4.63	.532	.283
Product presentation	2	5	4.24	.822	.675

Regarding the standard deviation, Group 3 showed less variation between the responses of its individuals in the aspect "comfort" (0.000) – where all research participants gave maximum marks to this aspect – in addition to "effectiveness" (.147) and "security" (.206). The aspects with the most variation between the answers were (from the largest to the smallest): "product presentation" (.822), "durability" (.604), and "dimensions" (.560).

Finally, Table 5 summarizes the overall average of the groups, the average per aspect, in addition to the summary of the individual average of the groups in each aspect (Average per Variable – AV). Through this table, it is possible to compare the evaluations attributed by each group to each of the listed aspects, enabling a better understanding of the variation in responses from each group. In bold, the aspects that received the best evaluation among the three research groups are highlighted.

According to the table, it is possible to observe that the most highly rated aspect, in general, was "effectiveness" (4.91) (in bold) with averages by groups: 4.87 (Group 1); 4.87 (Group 2); and 4.98 (Group 3). In contrast, the aspect "product presentation" (4.11) received the lowest overall rating among the groups, with averages: 3.93 (Group 1); 4.16 (Group 2); and 4.24 (Group 3). About the total average by groups, Group 3 (Rehabilitation Professionals) attributed the best marks to the research aspects (4.77); followed by Group 1 (People with RA) (4.69); and finally Group 2 (Designers) (4.54).

Table 5 Overall average of the groups.

Items	Average			A.V.
	Group 1	Group 2	Group 3	
Dimensions	4.52	4.62	**4.67**	4.60
Weight	**4.79**	4.56	4.76	4.70
Adjustments	4.72	4.64	**4.83**	4.73
Safety	4.86	4.87	**4.96**	4.90
Durability	**4.67**	4.11	4.65	4.48
Ease of use	4.85	4.91	**4.93**	4.90
Comfort	4.89	4.71	**5.00**	4.87
Effectiveness	4.87	4.87	**4.98**	**4.91**
Affordable price	**4.79**	3.93	4.63	4.45
Product presentation	3.93	4.16	**4.24**	4.11
Total average per group	4.69	4.54	4.77	-

6.4 Priority order

Assuming that all aspects presented in this research – extracted from QUEST 2.0 (DEMERS; WEISS-LAMBROU; SKA, 2002) – are relevant in an Assistive Technology, the Frequency of Responses shows that not all groups think this way. It is worth highlighting the main research group (Group 1), whose data show that only two aspects had a percentage of choice above 80% by individuals (Comfort and Efficacy) (see Table 1). On the other hand, when asked about additional aspects, only a reduced portion of individuals suggested adding them, and most stated that the aspects mentioned in the research were sufficient in an AT product (Group 1 - 70.2 %; Group 2 - 41.5%; and Group 3 - 52.9%).

The Descriptive Measures were related to the assessments applied to individuals to measure the degree of importance of each aspect of the research, in which the Likert scale (1932) was used by previous studies observed in the literature (DAYKIN; MOFFATT, 2002; CLASON; DORMODY, 1994). Taking into account the form of assessment used, in which (1) represents that the "X" aspect is not important in an AT product for individuals with RA and that (5) indicates that it is a very important aspect, it was possible to draw some conclusions about the opinions of each research group, as to what was expected by them in new AT products.

When observing the averages of the aspects regarding the evaluation of each group (Table 6), it is evident that there are differences between the individuals' expectations regarding the order of importance of the aspects. Overall, the order of importance of the aspects according to Group 1 (People with Rheumatoid Arthritis) and Group 3 (Rehabilitation Professionals) are similar. However, when compared to Group 2 (Designers), it was possible to notice distinct differences regarding the order of importance. These said differences could also be evidenced through applied mathematical calculations, which can be observed in previous studies with applications in Design (MOREIRA; SCHEMES, 2008; FERREIRA et al., 2010; DE SOUZA MOTTA; FERNANDES; CORTEZ, 2012; SPERHACKE, 2015; VASCONCELOS et al., 2016; MAHSHID, 2019).

Taking the data in Table 6 as a reference, and the noticeable difference between the order of importance of the aspects in Group 1 and Group 2, it is evident that there are divergences in the expectations of users (potential) and designers. This observed disparity may be related to the way designers are used to thinking and developing their projects. According to Norman (2004), Designers and Engineers are commonly self-centered and believe they have the domain for all answers and usage problems. Tonetto and Xavier da Costa (2011) state that – generally – Designers are not the end-users of their projects, and that is why they develop products based on their beliefs and experiences, which can often be distinguished from the characteristics of the users. Thus, the insertion of the user in the design process becomes essential, as designers are not always able to understand the reality of these individuals (BAEK, et al., 2008; LADNER, 2015).

Table 6 Order of Importance of aspects per group.

	Group 1	Group 2	Group 3
1º	Comfort (4.89)	Ease of use (4.91)	Comfort (5.00)
2º	Effectiveness (4.87)	Safety (4.87)	Effectiveness (4.98)
3º	Safety (4.86)	Effectiveness (4.87)	Safety (4.96)
4º	Ease of use (4.85)	Comfort (4.71)	Ease of use (4.93)
5º	Affordable price (4.79)	Adjustments (4.64)	Adjustments (4.83)
6º	Weight (4.79)	Dimensions (4.62)	Weight (4.76)
7º	Adjustments (4.72)	Weight (4.56)	Dimensions (4.67)
8º	Durability (4.67)	Product presentation (4.16)	Durability (4.65)
9º	Dimensions (4.52)	Durability (4.11)	Affordable price (4.63)
10º	Product presentation (4.69)	Affordable price (3.93)	Product presentation (4.24)

It is necessary to accept the contributions of users throughout the product development process to generate solutions suited to their needs and desires, and not solutions that users need to adapt to a determined product (DOROFTEI et al., 2017). A fundamental principle in product development is user interaction (BAEK et al., 2008), where the designer plays the role of establishing connections with it, through testing throughout the product development (PAGNAN; SIMPLÍCIO; SANTOS, 2019). On the other hand, for users' contributions to be effective, it is essential to use methods, tools, and approaches that facilitate their understanding and participation in projects (SZABLUK et al., 2019). Another indispensable factor is the relationship that the designer needs to establish with other stakeholders. Taking this study as an example, it was observed that Rehabilitation Professionals demonstrate expectations that are more in line with what is expected by users, so it would be crucial to listen to them. Thus, the success of an organization also depends on the full integration between designers and other stakeholders in the product development process (VAN DER LINDEN; LACERDA, 2009).

7. FINAL CONSIDERATIONS

The number of people with some disability is expressive all over the world. Regarding physical disability, the limitations directly imply the impairment of independence and autonomy of individuals. Therefore, the person with Rheumatoid Arthritis in the moderate or severe phase, besides the specific symptoms of the disease, suffers from the consequences of physical limitations. The development of Assistive Technologies for individuals with RA arises intending to give back to these

individuals their independence and autonomy, compromised by the disease.

As for the objective of this research, it is correct to state that it was fully met, since the survey and data analysis through questionnaires provided results related to the expectations of stakeholders (People with RA, Designers and Rehabilitation Professionals), through the degree of importance according to the Likert scale. Thus, it was possible to obtain an overview that shows how similar and divergent the expectations of the three research groups were, as well as to identify the order of importance of each aspect according to the groups, regarding the development of AT products for individuals with RA.

Regarding the methodological procedures adopted, phases 3 and 4 stand out. In Phase 3, the use of the QUEST 2.0 tool provided a "starting point" for listing all aspects considered important in an AT, as well as the Likert scale was essential to establish the order of importance of the aspects. Regarding Phase 4, the use of mathematical calculations enabled a better understanding of the data through the details obtained, in addition to detecting the similarities and differences between them.

This study enabled a better understanding of what individuals with RA expect from new AT products. But, far beyond that, it provided data showing the disparity in the expectations among the users and the professionals responsible for developing these devices (Designers). On the other hand, it was observed that there is a significant similarity between the expectations of users and Rehabilitation Professionals. Therefore, the need to include the user throughout the design process is evident, as well as making use of multidisciplinary teams, so that different opinions are heard and considered, all in favor of the success and effectiveness of the products developed.

Among the boundaries of this study, there is the outbreak of Covid-19 (SARS-CoV-2), declared on March 11, 2020, as a global pandemic by the World Health Organization (WHO). Because of the pandemic, the questionnaires applied in this research – which would initially be in person – had to be answered remotely. In addition, the distance between researchers and participating individuals resulted in pronounced default in filling out the questionnaires. Thus, there was a need for better monitoring of individuals and some demand from the researchers' side.

Finally, the contributions of this study allow for a reflection on how ATs are currently developed and how this affects the low performance and expressive numbers of abandonment of these devices. In addition, it is expected that the study will contribute to the promotion of new projects aimed at People with Disabilities and better performances in the development of ATs, as well as products in general.

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