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Designing digital health for hip osteoarthritis self-care in Brazil: A study on patients' socioeconomic profile and media preferences

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Abstract: Digital health has a great potential to promote predictive, personalised, preventive, and participatory care while also reducing in-person visits to medical services. Osteoarthritis (OA) is a prevalent joint disorder and a leading cause of disabilities worldwide. Health literacy is crucial to cope with pain and mobility limitations. However, in the Brazilian context, trustworthy information about OA is scarce, inadequate, or non-existent in the Brazilian Unified National Health System (SUS). Knowing the audience is decisive in designing digital health solutions. This study aimed to collect data on SUS patients' socioeconomic status and media preferences. The results of 52 participants show the preponderance of C and D classes with basic educational levels, for whom video format and WhatsApp messaging application may be favourable to disseminate health information. This study is part of a multidisciplinary research project that employs a human-centred design approach to create products and services for hip OA SUS patients.

Keywords: Digital health; Osteoarthritis; User research; Media preferences

1. Introduction

Health systems around the world are undergoing a profound paradigm shift. The cost escalation, which results in part from population ageing and the increase in chronic diseases, is unsustainable. At the same time, the use of digital technologies has promoted unprecedented changes in the way information and services are managed and made available. Digital health technologies are reshaping the way users of health services obtain information about their condition and how they can take care of their wellbeing (Meskó et al., 2017; Rivas & Wac, 2018; Shaffer & Preziosi, 2019; Topol, 2012; Yock et al., 2015).



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Digital health (eHealth) is defined as "the delivery of healthcare services and useful information to patients, family members, and healthcare providers using electronic devices and communication". In contrast, mobile health (mHealth) is "the practice of eHealth assisted by smartphones, which are used to capture, analyse, process and transmit health-based information" (Adibi, 2015; Morita, 2020). Therefore, digital health has a great potential to promote the so-called P4 medicine: a more predictive, personalised, preventive, and participatory care (Alonso et al., 2019).

Osteoarthritis (OA) is the most prevalent joint disorder and a leading cause of disabilities in older adults. It affects 7% of the global population, more than 500 million people (Hunter et al., 2020). It is estimated to affect 4% of the people in Brazil – more than 8 million people (Ferreira et al., 2018). It is a chronic condition that causes pain and progressive functional limitation, compromising several aspects of quality of life, with no pharmacological cure. Joint replacement surgery is the treatment for end-stage hip OA. With the trends of an ageing population and increasing obesity, OA is a significant health challenge, often aggravated by social determinants of health.

In line with other non-communicable diseases, OA results, in addition to genetics, from lifestyle and behaviour patterns that are linked to community and planetary health – poor diet, environmental exposure, neighbourhood and built environments, among other factors. (Lung et al., 2012). Despite its individual and societal burden worldwide, global strategies for non-communicable diseases often ignore OA (Hunter et al., 2020). The patient's journey – from prevention, symptom onset and diagnosis to surgery and rehabilitation – involves different needs, behaviours and treatments that change over time as the disease worsens (Allen et al., 2016; Brembo et al., 2016).

The current and future trend of OA care is to promote public health interventions focused on preventive, personalised and participatory care that encourage behaviour change in favour of self-care to cope with pain and mobility limitations. (Bannuru et al., 2019). The first step is to provide reliable, accessible, comprehensive, and persuasive information for such a challenge. Unfortunately, in the Brazilian context, trustworthy information about osteoarthritis is still scarce, inadequate, or non-existent in many care services digital channels provided by the Brazilian Unified National Health System (Sistema Único de Saúde – SUS). The lack of public health information is an alarming gap considering that SUS provides care for nearly 80% of the Brazilian population (Duarte et al., 2018). Nevertheless, the use of technology for information transfer has great potential to influence people's lifestyles (Arigo et al., 2019) and expand access to care at a lower cost – and in the case of OA management, it is no different (Einhorn et al., 2018).

On the other hand, patients' reach and adherence to such information on websites and apps are often limited. Studies indicate that educational materials on hip and knee OA produced by leading healthcare organisations worldwide have text comprehension rates above recommended levels (Doinn et al., 2020; Eltorai et al., 2015). Problems with readability, usability,

identification, comprehension and content retention lead to frustration and giving up, indicating flaws or absence of design strategies leading to greater engagement and behaviour change (Ludden et al., 2015). Additionally, today, the public over 60 years of age is more connected to the Internet than ever. Still, it has lower rates of technology adoption than the general public. Cognitive, physical, perceptual, and motivational factors are barriers to technological adherence by the elderly (Li et al., 2021).

Digital self-care for hip OA patients is a complex problem with a massive potential for transformation, with no simplistic solution. Therefore, a human-centred design approach is decisive to explore its multifactorial aspects, highlighting the users' profiles, needs, preferences and capabilities. This paper presents a study on SUS-dependent patients' socioeconomic profiles and media preferences. The data obtained in this stage will help the research team to understand the target audience. Furthermore, these results will inform the development of new communication strategies and digital products for hip OA self-care suited to the target audience.

2. Research context

This study is part of a multidisciplinary research project — design, orthopaedics, and physiotherapy. The research context is the Hip Surgery outpatient clinic of the Department of Orthopedics and Traumatology (DOT) of Santa Casa de São Paulo Hospital. That is a SUS clinic where more than 1.000 patients are awaiting hip replacement surgery, with a prolonged waiting time, usually longer than five years. Besides the follow-up appointments scheduled twice a year, there are no structured non-surgical care protocols for this waiting patient, who faces the progression of symptoms in a situation of vulnerability.

3. Methods

In this transversal study, researchers collected data on patients' socioeconomic status and media preference from a convenience sample of 52 patients seen at the Santa Casa outpatient clinic contacted from appointment scheduling lists from December 2020 to February 2021 provided by the medical staff. Respondents got contacted in person at the clinic or through phone calls. The study was approved by the Research Ethics Board (Number 4.185.253). Informed written consent was obtained from all participants. The socioeconomic status of the patients was identified through the survey Brazil Economic Classification Criteria of the Brazilian Association of Research Companies (ABEP, 2019), which generates an estimate of the economic class of the respondent according to the sum of the scores of a series of variables based on educational level and possessions (Figure 1).

Personal information

1) Name	4) Education level	5) Literacy level
2) Age	<input type="radio"/> Illiterate/ Complete Elementary school	<input type="radio"/> Read
3) Gender	<input type="radio"/> Complete Elementary school/ Incomplete Middle school	<input type="radio"/> Write
<input type="radio"/> Female	<input type="radio"/> Complete Middle school/ Incomplete High school	6) Document number
<input type="radio"/> Male	<input type="radio"/> Complete High school/ Incomplete Higher education	(optional)
	<input type="radio"/> Complete higher education	7) Email (optional)
		8) Telephone number

Socio-economic status

1) Mark the quantity that you have of each of the following items:	2) Your residence's water is from:
<p><input type="radio"/> Do not have <input type="radio"/> 1 <input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 or more</p> <p>- Number of cars used for private use.</p> <p>- Number of monthly employees that work at 5 days a week.</p> <p>- Number of washing machines, not including portable washing machines.</p> <p>- Number of bathrooms.</p> <p>- DVD, including any equipment that reads DVD and not including car DVDs.</p> <p>- Number of refrigerators.</p> <p>- Number of independent freezers or part of a duplex fridge.</p>	<p><input type="radio"/> Sewage system</p> <p><input type="radio"/> Pit or spring</p> <p><input type="radio"/> Other</p>
<p>- Number of microcomputers, including table computers, laptops and notebook, not including tablets, palms or smartphones</p> <p>- Number of dish washing machines</p> <p>- Number of microwave ovens</p> <p>- Number of motorcycles, not including the ones used exclusively for professional purposes</p> <p>- Number of clothes dryer machines, including washer-dryer machines</p>	<p>3) Considering your residence's street, would you say it is:</p> <p><input type="radio"/> Paved road</p> <p><input type="radio"/> Dirt road</p>
	<p>4) What is your head of the family's education level? Consider the head of the family as the person who contributes the most with your family's income.</p> <p><input type="radio"/> Illiterate/ Elementary school incomplete</p> <p><input type="radio"/> Complete Elementary school/ Incomplete Middle school</p> <p><input type="radio"/> Complete Middle school/ Incomplete High school</p> <p><input type="radio"/> Complete High school/ Incomplete Higher education</p> <p><input type="radio"/> Complete higher education</p>

Figure 1. Survey Brazil Economic Classification Criteria of the Brazilian Association of Research Companies (ABEP, 2019).

The team developed the media preferences questionnaire, divided into queries about preferred media usage 1) in free time, 2) for information searching, 3) to find the OA information currently presented in a booklet, and 4) for learning (Figure 2).

Media preferences

1) Which media do you use during your spare time?

- Television Instagram
 Newspaper Youtube
 Magazines Radio
 Books Whatsapp
 Facebook Others
 Twitter

2) Which media do you use to search for information?

- Websites Twitter
 Googles Instagram
 Television Youtube
 Newspaper Radio
 Magazines Whatsapp
 Books Others
 Facebook

3) In which media would you like to find the content of the booklet?

- Websites Twitter
 Googles Instagram
 Television Youtube
 Newspaper Radio
 Magazines Whatsapp
 Books Others
 Facebook

4) How do you prefer to learn subjects of your interest? Mark 0 to 5 considering that "0" means that you do not like and "5" that you like very much.

Video (Ex: Youtube)

- 0 1 2 3 4 5

Reading pamphlets, magazines and books

- 0 1 2 3 4 5

Face to face classes

- 0 1 2 3 4 5

Reading websites

- 0 1 2 3 4 5

Audio

- 0 1 2 3 4 5

Video call online classes

- 0 1 2 3 4 5

Figure 2. Survey Media preferences developed by the authors.

Study data were collected and managed using REDCap electronic data capture tools hosted at Faculdade de Ciências Médicas da Santa Casa de São Paulo (Harris et al., 2009, 2019). REDCap (Research Electronic Data Capture) is a secure, web-based software platform designed to support data capture for research studies, providing 1) an intuitive interface for validated data capture; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to standard statistical packages, and 4) procedures for data integration and interoperability with external sources.

4. Results

4.1 Users' socioeconomic profile

Between December 2020 and February 2021, researchers collected 52 responses from patients seen at the Hip Clinic of Santa Casa de São Paulo Hospital. As for the gender of respondents, 31 were female (59.6%), while 21 were male (40.4%). The average age was 53.4 years (25-78).

All respondents declared themselves literate; however, they had different levels of education. Most of the participants had completed Elementary school or high school, followed by completed Middle school. Using the ABEP classification, 75% of participants belong to C and D classes. The most predominant economic classes were C2 (30,8%) and C1 (26,9%), with an average household income of R\$1.748,59 (€276,57) and R\$ 3.085,48 (€488,03), respectively (Table 1).

Table 1 Socioeconomic profile of the patients with hip OA from Santa Casa de São Paulo Hospital.

Age		
Mean age	53.4	
Median	54	
Youngest age	25	
Oldest age	78	
Gender		
Male	21 (40.4%)	
Female	31 (59.6%)	
Education level		
Illiterate/ Elementary school incomplete	2 (3,8%)	
Elementary school complete/ Middle school incomplete	19 (36,5%)	
Middle school complete/ High school incomplete	7 (13,5%)	
High school complete/ College incomplete	19 (36,5%)	
College complete	5 (9,6%)	
ABEP Economic class		
Class	Average household income	Number of interviewees
D-E	R\$719,81 / €113,85	9 (17,3%)
C2	R\$1.748,59 / €276,57	16 (30,8%)
C1	R\$3.085,48 / €488,03	14 (26,9%)
B2	R\$5.641,64 / €892,35	11 (21,2%)
B1	R\$11.279,14 / €1.784,05	2 (3,8%)
A	R\$25.554,33 / €4.041,99	0

4.2 Media preferences

On the query about "Medias used in the free time", the messaging application "WhatsApp" and "Television" received over 50% acceptance rate. A relevant number of patients chose "Radio" and internet platforms such as "YouTube" and "Facebook". On the query about "Media preferences for information seeking", "Google" was the primary choice, followed by "Television" and "WhatsApp". When asked where participants would like to find information on OA currently presented in a booklet provided by Santa Casa, "WhatsApp" and "Websites" were the two main options, followed by "Television" and "Facebook" (Table 2).

Table 2 Media preferences of the patients with hip OA from Santa Casa de São Paulo Hospital.

Media preferences			
Media type	Media used in the free time	Media for information seeking	Media to find the OA booklet's content
Television	44 (84,6%)	34 (65,4%)	37 (71,2%)
Newspaper	14 (26,9%)	17 (32,7%)	21 (40,4%)
Magazine	12 (23,1%)	12 (23,1%)	27 (51,9%)
Books	23 (44,2%)	16 (30,8%)	28 (53,8%)
Facebook	36 (69,2%)	26 (50%)	35 (67,3%)
Twitter	3 (5,8%)	2 (3,8%)	12 (23,1%)
Instagram	14 (26,9%)	7 (13,5%)	18 (34,6%)
YouTube	29 (55,8%)	27 (51,9%)	33 (63,5%)
Radio	27 (51,9%)	21 (40,4%)	23 (44,2%)
WhatsApp	43 (82,7%)	30 (57,7%)	41 (78,8%)
Websites	-	27 (51,9%)	40 (76,9%)
Google	-	40 (76,9%)	-
Others	0	1 (1,9%)	4 (7,7%)

To investigate which media they prefer for learning, the participants assigned grades from 0 to 5 to the categories "Videos", "Websites", "Booklets, magazines and books", "Audio", "Face-to-face classes", and "Online classes". The one with the highest acceptance rate was the option "Videos", as 73,1% chose the highest score and 17,3% attributed 3 or 4 as the rating grade. The least popular media were "Booklets, magazines and books" followed by

"Online classes" with 19,3% and 15,4% respectively, assigning the grades 0 to 2. Even though the "Booklets, magazines and books" received lower scores in comparison to "Online classes", 59,6% of the interviewees chose the 5 for such media, indicating that printed material also has good acceptance among the participants (Table 3).

Table 3 Learning media preferences of the patients with hip OA from Santa Casa de São Paulo Hospital.

Media preferences for learning						
	0	1	2	3	4	5
Videos	2 (3,8%)	1 (1,9%)	2 (3,8%)	4 (7,7%)	5 (9,6%)	38 (73,1%)
Audio recordings	2 (3,8%)	0	4 (7,7%)	10 (19,2%)	9 (17,3%)	27 (51,9%)
Booklets, magazines and books	4 (7,7%)	3 (5,8%)	3 (5,8%)	5 (9,6%)	6 (11,5%)	31 (59,6%)
Website	7 (13,5%)	1 (1,9%)	4 (7,7%)	9 (17,3%)	10 (19,2%)	21 (40,4%)
Face-to-face classes	2 (3,8%)	2 (3,8%)	1 (1,9%)	7 (13,5%)	8 (15,4%)	32 (61,5%)
Remote classes	4 (7,7%)	1 (1,9%)	3 (5,8%)	7 (13,5%)	9 (17,3%)	28 (53,8%)

5. Discussion

Improvement of access to health, inequality reduction and cost containment are desirable to the Brazilian Unified Public Health System and digital health can help achieve them (Guido Cerri, 2021). Mobile health has a great potential to improve self-care, contain the burden of OA on the healthcare system and convey a more predictive, preventive, personalised and participatory approach.

Health literacy is paramount to achieving patient-centred care, mainly through patient education materials. These materials must be adequate for their audience to enhance comprehension and increase patients' chances of taking beneficial actions for their health and well-being (Abraham, 2011). Furthermore, favourable health outcomes provided by technology depend on recognising intertwined cultural challenges and meeting patients' needs (Meskó et al., 2017). Thus, it is imperative to acquire knowledge about the audience when developing human-centred design solutions.

This study found relevant information about Santa Casa patients' socioeconomic profiles and media preferences. The survey revealed that 75% of participants belong to C and D classes,

whose average monthly income does not exceed € 488. Chronic conditions are associated with social determinants of health, defined by the World Health Organization (WHO) as the "societal conditions in which people are born, grow, live, work and age" (World Health Organization, 2011). OA is no exception, as living in poverty areas is associated with a higher prevalence of knee and hip OA (Luong et al., 2012; Vennu et al., 2020).

Regarding educational status, all participants stated they could read and write, along with the elementary school or high school completion, whereas there is a shallow rate for higher education. Poor educational levels and low health literacy skills may hinder people's motivation and competence to access, comprehend and implement health information (Wittink & Oosterhaven, 2018).

The media preferences survey results point out that this group of users own a cell phone, are connected to the Internet, and are well acquainted with social media in their daily lives, regardless of age or income. Brazil has a population of 211 million inhabitants, with an internet penetration of 71% (Newman et al., 2020). Although the access to information and communication technologies (ICT) has grown intensely in the 21st century, persistent economic inequalities and recession affected household access to the Internet in Brazil, resulting in cell phone internet connection as the most frequent choice of access (Silva et al., 2020).

Not surprisingly, "WhatsApp" and "Facebook" were the preferred choices for free time usage, behind only open channel television, a traditional media valued by seniors in Brazil. As the second-largest western country in terms of internet users, Brazil represents one of the leading markets for WhatsApp and Facebook (Rossini et al., 2021). Moreover, in 2020 social media surpassed TV as the primary source of news in Brazil (Newman et al., 2020).

The same choices were highlighted as positive to present OA informational content currently disseminated through a booklet and "Websites". These results follow a cross-sectional survey of 968 patients diagnosed with asthma and chronic obstructive pulmonary disease (COPD) living in Latin American countries (Ecuador, Argentina, Mexico, Venezuela, Peru). The survey assessed the frequency and preferences of using information and communication technologies (ICTs). The study reported that SMS, followed by WhatsApp, represented the preferred technologies for receiving information about the disease. Also, the web-based Internet remains the leading choice when searching for health-related information across all generational cohorts (Cherrez-Ojeda et al., 2020).

Whatsapp is already in use as a communication technology in health. A survey carried out in 2015 showed that Brazilian doctors use WhatsApp to communicate with patients more often than in other countries such as the United Kingdom, France, Germany, Italy, Spain, the United States, and China. (Conteúdo, 2015)

Internet and social media familiarity can pave the way for an avenue for exploration in digital health initiatives for OA self-care. On the downside, despite the considerable potential for democratisation of access, digital health transformation for the Brazilian public health

system faces the risk of deepening the digital divide, defined as "the gap between individuals, households, businesses, and geographic areas at different socioeconomic levels with regard both to their opportunities to access ICTs and to their use of the internet for a wide variety of activities" (Nishijima et al., 2017).

A study on the digital divide in selected Latin American countries showed that the continent is highly diversified in internet access. Low income and low education are its main determinants, with other overlapping factors that prevent people from participating in the information society (Tomczyk et al., 2019). In Brazil, 86,7% of households in the urban area had access to the Internet in 2019, while 55,6% in rural areas. The cell phone is the most used device to access the Internet, at 99,5% of households. However, only 45% of Brazilian people over 60 have internet access (do Brasil, 2021).

Recent studies discuss the need to plan the digital transformation in healthcare in an intelligent, efficient, sustainable, and ethical way, prioritising reliability and safety. Above all, that technological insertion in health offers solutions that meet the needs of all users involved: whether they are citizens, patients, doctors, nurses, and managers. (Ito, 2021; Meskó et al., 2017).

Regarding the learning preferences, "Videos" were very well rated as a learning medium, corroborating the idea that a multimedia design approach that combines visual, auditory, linguistic, and gestural modes can better address elderly limitations while offering accessible and engaging content (Eliseo et al., 2020). Educational videos are increasingly popular and may perform better on patients to retain information and improve outcomes than verbal or written communication. However, the downside is the high cost and time-consuming development of professional videos, including the drawbacks of updating scientific evidence when needed (Ganguli et al., 2017).

"Face-to-face classes" were also a highly rated option for learning. The public might appreciate spending time with health providers beyond consultation, in-person, and with other hip OA patients, learning to cope with their condition. Their availability for in-person classes is even more poignant considering mobility difficulties, distance from the hospital, and the accompanying caregiver's time. In-person training for patients might particularly benefit those with low health literacy levels, providing an inviting environment where they can debate their ideas and increase their chances of engagement in self-care (Hoving et al., 2010).

"Booklets, magazines and books" appeared as the third most rated option for learning, reminding us that printed media persists and is also recommended to complement online information. A multi-modal approach employing print-based materials like pamphlets that might be available in hospitals, doctors' offices and community centres coordinated with online information is desirable to provide a more equitable health information transmission that outstrips the digital divide (Sium et al., 2017).

Costs, distance, and availability of professionals make access to health services difficult. Considering that the healthcare sector is responsible for approximately 5% of global greenhouse

gas emissions, it has a critical role in mitigation efforts. Digital redesign of clinical practice focusing on health promotion and disease prevention can reduce the frequency of in-person visits to medical services, thus resulting in less impact on transport, which also benefits those with reduced mobility (Tennison et al., 2021).

Limitations of the study include a small sample size, selected by convenience sampling.

In summary, mHealth projects employing video format and WhatsApp messaging applications may be favourable approaches to broadcast health information on hip OA self-care to Santa Casa Hip Clinic patients. This mHealth product could be a good tool for increasing global patient access, especially in LMICs. However, further research is needed to develop and test pilot digital products employing these recommendations on a larger scale.

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