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EMERGING TRENDS IN DESIGN FOR MUSCULOSKELETAL MEDICINE (S GOLDCHMIT AND M QUEIROZ, SECTION EDITORS)

Patient Education in Orthopedics: the Role of Information Design and User Experience

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Abstract

Purpose of Review This narrative review will focus on concepts and methods of Information Design and User Experience for patient education in orthopedics, with osteoarthritis as an application example.

Recent Findings Information design can make complex health information clear according to the needs of the patients. Digital health presents new opportunities to design scalable educational interventions and may be improved with User Experience Design. Human-centered design methods such as user research, co-design, and prototype testing are being applied in orthopedics to achieve patient-centered care. Current international guidelines on osteoarthritis put patient education as one of the key care strategies. Educational interventions target preoperative education and osteoarthritis self-management, but current models could be enhanced.

Summary Patient education and health literacy are fundamental to face the burden of musculoskeletal pain. The collaboration between design and health is essential to deal with the demand for education, behavioral, and social change.

Keywords Patient education · Information design · User experience · Design for health · Osteoarthritis · Orthopedics

Introduction

Healthcare systems around the world are facing the challenges posed by the burden of chronic diseases arising from population aging and unhealthy lifestyles. The World Health Organization (WHO) recent global strategy points to a paradigm shift in health services, favoring a people-centered approach. People-centered health services embrace individuals, families, and communities as partners in shared healthcare decisions and outcomes assessment, in order to provide better services and financial sustainability [1].

The ongoing shift from paternalistic model to patient-centered care is committed with patients' health literacy and overall patient education improvement. Health literacy emerged

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in the last decade as an important health component [2]. It is defined as "the degree to which individuals can obtain, process, understand, and communicate about health-related information needed to make informed health decisions" [3]. The role of patient education is to guide patients to understand their condition and treatment options and, ultimately, empower patients to enhance their autonomy to achieve therapeutic goals [4].

Patient education materials (PEMs) are important channels where health literacy can be attained. PEMs can be delivered as printed booklets, websites, videos, classes, demonstrations [5], or other kinds of media. Health information is an essential part of medical care. There is a growing demand for information by patients, who can now have easy and instantaneous access to health information through websites, social media, and mobile apps.

Nonetheless, health knowledge transfer has a series of difficulties. Technical terms may not be understood by patients, who are already worried with symptoms and stressed [6]. Reading patient education materials is a challenge, concerning two reading aspects: legibility (which is the facility to recognize letters) and readability (which is the competence to understand) [7]. A study aimed at evaluating the readability of American Academy of Orthopedic Surgeons (AAOS) online patient education materials found out that its readability levels were beyond patients' comprehension [8].

Providing information is not enough, and there is a need for better understanding patients' information needs and capabilities through evidence-based design tools [9]. Information Design (ID) and User Experience Design (UX) are human-centered design approaches that start from knowing users' needs, as well as listening to other stakeholders involved, and rely on their feedback to improve prototypes. Both may be used to enhance patient education and engagement.

This narrative review will focus on concepts and methods of ID and UX for patient education in orthopedics, with osteoarthritis as an application example.

Design Concepts

Information Design

ID as a disciplinary field with its own methods was established in the 1970s, but rooted on the pioneer work of researchers and practitioners from previous decades who enlightened the need for clarity and efficiency on communication design [7, 10, 11]. The Information Design Journal was founded in 1979 followed by seminal studies on instructional texts [12], document design [13–15], signs, and printed materials [16]. A renewed interest in the theme emerged through recent comprehensive publications that return to historical perspectives, theories, and principles while also addressing methods and case studies [7, 17•, 18].

ID involves reasoning, planning, display, and comprehension of messages in regard to its content and form, to suit the information needs of recipients [19]. The International Institute for Information Design (IIID) prescribe "Good information design makes information accessible (easily available), appropriate (to its contents and users), attractive (inviting), concise (clear and without embellishments), relevant (connected to the purpose of the user), timely (available when the user needs it), understandable (without doubts or ambiguities), appreciated (for its utility)" [20].

According to Frascara [7], ID "aims at the creation of effective communications through the facilitation of the processes of perception, reading, comprehension, memorization and use of the information presented." Therefore, information design is necessarily human-centered and action-oriented, aimed at making complex information clear according to the needs of the users [17•]. ID methods involve engagement with information providers and end-users, extensive field research, and iterative testing of prototypes [18]. The professional designer working within a human-centered approach is somewhat a transparent figure that does not impose his own choices but rather triggers and translates the will of those involved [21].

ID is an intrinsically multidisciplinary area, gathering expertises from graphic design, interface design, human-computer interaction (HCI), marketing, cognitive psychology, journalism, information science, management, and linguistics, among others [22].

As an umbrella paradigm for different kinds of data organization today, ID encompasses digital interfaces, infographics, maps, diagrams, forms, tables, warnings, wayfinding systems, technical and scientific illustration, instructional materials, and medicine package leaflets, among others. Information design gains relevance nowadays as the web and digital technologies enable the production and access to public data in unprecedented volumes. As we experience a serious loss of information authority, ID can help to formulate, qualify, and prioritize the excess of data available on the internet [23], helping to ease information anxiety and navigate through the maze of information.

Designer's technical skills on typography [24], information layout [23, 24], pictures [6], and graphic elements [25] are crucial to improve legibility, readability, attention, comprehension, and memory. ID methods applied to the health sector can help to enhance both research and practice for better communication.

User Experience Design

UX can be defined by the experience one product provides for the people who use it. [26]. As reported by Tosi [27], "user experience is the sum of the emotions, perceptions and reactions that a person experiences when interacting with a

product or service. In other words, it is equivalent to the level of subjective adherence between expectations and satisfaction when interacting with the system, be it physical (e.g. a ticket machine) or digital (e.g. online shopping)."

Designers artificially fabricate products by combining features such as content, presentation, functionality, and interaction in order to convey an intended character. But there is no guarantee that the individual will acknowledge and enjoy the product in the way designers planned, because the experience is subjective, as is the perception of the product and its emotional responses in various contexts [28•]. UX is the aspect of design that concerns the user on the act of use, overcoming the pragmatic aspects of usability. Designing the experience is vital to development of any new product or service, beyond the aesthetic and functional features [26].

UX has been disseminated across many fields recently. Although it can be applied to any designed product or service, the concept originated in the junction between interaction design and ergonomics, when a closer exam of a user's perspective was needed [27].

Historically, research and practice on HCI emerged in the early 1980s from various concerns about human aspects when working with computers [29]. HCI was traditionally concerned to determine a system's behavior to suit a user's task efficiently, according to the engineering usability paradigm [30]. The International Organization for Standardization ISO 9241-11:2018 defines usability as "extent to which a system, product or service can be used by specified users to achieve specific goals with effectiveness, efficiency and satisfaction in a specified context of use" [31]. This recent definition incorporates the term "satisfaction" to the standard, a revision that includes current user experience approach [32].

Early research on human factors in computing systems had already warned of the possibility of adapting the system to the users' behavior and not the other way around. Interactive design could benefit from the analysis of the behavior of new computer users, incorporating their feedback [33]. As stated by Nielsen [34], the personal computer revolution of the 1980s and the web revolution of the 1990s had put pressure on the computer industry and companies to enhance the usability and quality of their interaction design, arguing that the user experience has a straight impact on purchase decisions.

Donald Norman, a pioneer in the design field, enlightened the need of evolving HCI from practical towards more subjective concerns. Norman describes emotional aspects of design encounter in three levels: visceral (initial reaction to appearance), behavioral (function, understandability, usability, and physical feel), and reflective (meaning) levels [27, 35]. Hassenzahl, in its turn, proposes an evolution from pragmatic to hedonistic goals when using a product, expanding the concept of satisfaction [27, 28•].

Technology can make life much easier and more pleasant, but its complexity is frequently difficult to overcome, leading to frustration [36]. The technological advances we face, especially the mobile revolution, undeniably surface tremendous design challenges to make its use as simple, understandable, and enjoyable as it could be.

Patient Education on Osteoarthritis

Osteoarthritis (OA) is a chronic prevalent joint disorder and a major public health challenge with an increasing burden worldwide. It is characterized by pain and functional limitation, with currently no pharmacological cure. Palliative treatments can temporarily improve pain and function. However, when the quality of life is acutely compromised, joint replacement surgery is the treatment for end-stage OA. Recent guidelines indicate patient education as a priority for OA management [37–39].

Current evidence to rehabilitation for chronic pain affirms that education, exercise, and weight loss are considered the pillars of non-pharmacological treatments for OA. The education, in special, can potentiate compliance to exercise and weight loss programs, thereby improving their benefits [40]. However, beliefs that physical activity is ineffective, harmful, or can further deteriorate your condition occur in patients with OA and can prevent people from being active or engaging in an exercise program, thus compromising the good progress or results of conservative treatment for this condition. On the other hand, accurate knowledge about the importance of exercises in OA, acquired through health interventions, is an important facilitator for adherence to the practice of physical activities [41].

OA is a progressive disease treated with surgical and non-surgical approaches according to the stage and the degree of symptoms. Patient education in OA will be divided in this article as preoperative education and OA self-management.

Preoperative Patient Education

Preoperative education aims to improve people's knowledge, health behaviors, and health outcomes by educational interventions made before surgery. The content frequently encompasses presurgical and surgical procedures, postoperative care (pain management and movements to avoid post-surgery), discussion of scenarios, and potential complications [42]. Education is usually provided by multidisciplinary teams such as physiotherapists, nurses, and psychologists in the format of one-to-one verbal communication, group sessions, videos, or brochures. Through education about the operation, pre- and postoperative procedures, physical, self-management, and mental well-being, it is supposed that patients will be less anxious, shorten the hospital stay, have early functional improvement, less pain and postoperative complications.

Total hip replacement (THR) or total knee replacement (TKR) are major interventions, generally associated with good clinical outcomes, resolving pain and function. Nonetheless, some patients report suboptimal results. Studies indicate that higher self-efficacy is linked to better recovery after THR [43]. It is also known that motivation, expectancy, and beliefs shape the pain experience and the behaviors that could contribute to either chronic pain or disability. This can be critically linked with the concept of self-management [40]. Moreover, patient reported outcomes can differ from surgeons' opinion, so it is recommended that patients' expectations are calibrated with proper preoperative information that is not only received but properly understood.

The information booklet is a traditional artifact easily available that has been widely adopted in preoperative patient education interventions. However, these written materials are still very much focused on purely structural and technical information or restrictive information that might fail on presenting current evidence-based information and having its content validated by both patients and healthcare professionals [44]. Butler et al. [45] reported on a study where patients received preadmission educational booklets by mail, 4 to 6 weeks prior to hospital admission for THR surgery. The booklet was developed by a multidisciplinary team from nursing, physiotherapy, occupational therapy, and social work and tested with patients before dispatch. The readability of the booklet was assessed to achieve the 6th grade recommended level. Compared to 48 no-booklet patients, the 32 patients who received the booklet presented better outcomes regarding anxiety, availability for doing exercises that promote recovery, and required less postoperative intervention from physiotherapy [45]. Multidisciplinary teamwork, readability tests, co-creation with patients, and adaptation of content according to target audience are all typical information design methods and may have helped the results.

Mc Donald et al. [42] published a Cochrane systematic review on preoperative education for hip or knee replacement in relation to postoperative outcomes such as pain, function, quality of life, anxiety, length of hospital stay, and the rate of adverse events. Authors analyzed 18 randomized or quasi-randomized trials (1.463 participants) of preoperative education delivered as verbal, written, or audiovisual information. The study is unsure if current patient education form offers benefits over usual care and affirms that patient education should be improved and stratified for patients' physical, psychological, and social needs.

Groeneveld et al. [46•] used a "research through design" approach to develop tailored communication in orthopedics. The study focused on information provision to patients undergoing THR. Patients were divided into three subgroups, according to surveys on quality of life, pain, anxiety, coping style, communication skills and preferences, and self-efficacy, among others. Patient segmentation followed by content customization was intended to promote better engagement. User-centered design methods were applied to identify users' needs and to have them evaluating paper-based prototypes for a digital application. This study provides insights for crafting THR information for digital health interventions that is adapted to patients' subgroup-specific needs.

Understanding patients' beliefs and perspectives along the surgical journey is vital to developing education strategies. Kennedy [47] reports on a Canadian qualitative study that collects patients' feedback in using educational materials in each stage. Focus groups and semi-structured interviews were conducted with 32 patients during follow-up visits post-joint replacement. Findings corroborate the need for tailored communication for specific patient groups and bring out a gap in pain management information following hospital discharge.

The rapid growth of electronic health technologies (eHealth) presents many opportunities to engage patients through digital platforms. Mobile Health (mHealth) is defined as "the intersection between eHealth and smartphone technology. The coverage of mHealth includes the acquisition, manipulation, classification, and transmission of health-related information." [48]. Campbell et al. [49••] report on the benefits of patient engagement platforms (PEP) to automate communication, achieve better outcomes, and reduce cost of care with improved workflows. There are many orthopedic PEPs with an array of features and user-friendly designs that can help in monitoring and informing patients through the journey of their care, including pre- and post-surgery specific details. Chatbots that employ artificial intelligence are also attractive to deliver timely and instant answers to simple questions during the perioperative period. Nevertheless, authors advise that the target patient population should be considered before implementation of PEPs to examine if it would be adequate for them.

Osteoarthritis Self-Management

Current international evidence-based guidelines for conservative nonpharmacological treatment of OA recommend education and exercise therapy as main elements of OA management [37, 38]. However, most OA patients are not physically active due to the fear of pain during physical activity and a general assumption that exercise could harm their joints even more [41, 50]. Dubious or nocebo-causing information and a passive coping style make people inhibited or accommodated and prevent them taking an active role in self-managing their pain and function. This has been related to poorer outcomes across chronic pain disorders as OA [40].

Self-management interventions means any program that aims to teach individuals to take a more active role in managing their condition, through any combination of education, behavioral change, and psychosocial coping skills [51].

Patient education targeted to chronic conditions such as OA usually demands behavior change interventions, designed to support people in managing their own condition and symptoms, not replacing medical care [52]. Recent evidence has called on clinicians to change their understanding of chronic musculoskeletal health conditions, expand the focus of the educational approach beyond structural damage, encompass multidimensional concepts such as psychosocial factors, and insert the patient at the center of decision-making [53•].

A Cochrane systematic review on self-management education programs for osteoarthritis [52] analyzed 29 studies (6.753 participants) comparing self-management education programs to attention control, usual care, information alone, or another intervention (exercise, physiotherapy, social support, etc.). The meta-analysis suggests that these programs may only slightly improve outcomes such as self-management skills, pain, function, and symptoms compared to usual care. Nonetheless, the study reminds that programs developed with different strategies for delivery, type of audience, sessions' frequency and duration, and teaching staff might enhance OA self-management skills. Furthermore, the modest outcomes improvement may be the result of the difficulty of patients' behavior changes.

Behavioral interventions have been traditionally delivered amid face-to-face encounters between health provider and patient. Today, digital health presents new opportunities to design scalable interventions [54]. Besides educational content, mobile health apps also allow remote patient monitoring by clinicians through frequent and richer self-reported data collection [55].

A Swedish study investigating the long-term effects of a digital self-management program for hip or knee OA patients observed improvements in pain and function by 70% of the participants. The mHealth program encompasses instructions for neuromuscular exercises tailored to each patient, support by physical therapists and tools for progress self-tracking [56]. A previous pilot study was carried out to test the platform by a smaller group of patients that reported they would highly recommend the program [57]. Although these studies do not address the design features of the app, it is implied that a sleek interface with easy interactions probably contributed to enhancing the experience of use.

In spite of the accelerated expansion of mobile health, implementation, long-term adherence, and eHealth literacy are challenges to overcome. Knitza et al. [58] reported on digital preferences and barriers in mobile health usage by patients with chronic rheumatic diseases. Results show that the internet is the preferred source to retrieve medical information for 75%. While almost 70% of the participants believed that using medical apps could benefit their own health, only 4% were currently using health apps. Authors conclude the current usage of mHealth apps by rheumatic patients is still limited, but their needs were identified and could be addressed by including safe and effective mHealth tools into routine.

Despite the recent advancements in the eHealth and mHealth industry, Information Design and User Experience Design are not always taken for granted as a prerequisite for new developments. Mobile health apps are expected to be aligned with the current industry standards, with the same level of design quality as any other app users may have in their phones [55].

Conclusion

The collaboration between design and health is seen as essential to face the contemporary global health challenges regarding aging, chronic diseases, and the demand for behavioral and social change. Patient education and health literacy have strongly emerged as key strategies to improve adherence to exercise, lifestyle modification, and face the burden of osteoarthritis and chronic musculoskeletal pain.

Current evidence regarding preoperative education for hip or knee replacement and self-management programs for osteoarthritis are still made under heterogeneous methods and show modest benefits with current models, which indicates that there is room for improvement. Recent literature testifies that human-centered design methods such as co-design, prototyping, and user's stratification are being applied in orthopedics and seem to be well suited to achieve patient-centered solutions. Interdisciplinary collaboration between design experts, orthopedic surgeons, physiotherapists, and health team providers is paramount.

The mHealth advancements potentially expand and democratize access to care, but it is necessary to identify the barriers that prevent reach and adherence by the intended audience. Such challenges can be overcome through competent design-driven research followed by the craft of information, interfaces, and experiences that are suitable, relevant, and meaningful to its users.

Compliance with Ethical Standards

Conflict of Interest Sara Miriam Goldchmit, Marcelo Cavalheiro de Queiroz, Nayra Deise dos Anjos Rabelo, Walter Ricioli Junior, and Giancarlo Cavalli Polesello declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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- •• Of major importance

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