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DATABASE OF CASES OF PRODUCTS AND SOFTWARES DEVELOPMENT IN THE HEALTHCARE AREA

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ABSTRACT

In the development of products it is important to know the best practices and techniques employed as a way to be able to adapt them to better results. The healthcare area benefits from such knowledge, since there are many challenges in identifying users and engaging them in the project in order to meet their needs. This study presents a database of cases of products and softwares development in the healthcare area. A systematic bibliographic review was carried out on the Scopus and Web of Science databases and articles that contained cases of product and/or software development in the healthcare area and presented details of the users' involvement throughout the development process were selected. The database is made up of 203 articles, 160 of which relate to software development, 26 are product development cases (hardware) and 18 describe product development with software. This database serves as a reference for researchers and practitioners who want to seek evidence of best practice and ways to engage users in the development of healthcare products/softwares.

Key-words: *user involvement*; *participatory design; health*; *systematic review, bibliometric analysis.*

1. INTRODUCTION

Several norms are imposed in the medical area to avoid problems in the use of products and services and among them the need to involve users in the development process (MONEY et al., 2011; SHAH; ROBINSON, 2006). Money et al. (2011) have found that, even so, many product and service development processes still face difficulties. The authors emphasize the way to involve the user, which method to use and who are the users to be involved.

Shah and Robinson (2006) highlight the importance of involving the user in different stages of the product life cycle to capture different perspectives. Despite the large number of methods available, developers choose to use a limited range, according to an interview conducted by Shah and Robinson (2006). The authors identified that focus group methods and questionnaires are the most used when engaging users.

During a product/service development process, all user groups should be considered and participate in the engagement process (VON HIPPEL, 2005). However, in the medical field, identifying which users involve may be a problem. Money et al. (2011) they found that often only physicians are involved in the project. There are others that can be considered as users of healthcare products: general healthcare professionals, such as nurses and physiotherapists (MARTIN et al., 2010); patients with disabilities or with special needs (SHAH; ROBINSON; ALSHAWI, 2009); elderly patients (SHAH; ROBINSON; ALSHAWI, 2009); general patients (MARTIN et al., 2010); technician (PIETZSCH et al., 2009); and anyone who has contact with the product, such as product maintenance, cleaning, transportation and training (MARTIN et al., 2010), patients relatives and caregivers responsible for the surgery department (MARTIN et al., 2010), and researchers, students and trainees (SHAH; ROBINSON; ALSHAWI, 2009). Some user groups may be overlooked in development and this can lead to usability issues (CARRUTHERS; PHILIP, 2006).

Data from the studies of Shah, Robinson and Alshawi (2009) and Money (2011) on methods used and who are the users involved in product development were identified through interviews with medical product manufacturers and no literature research was done on a sample of able to discuss the state of the art. In order to explain a phenomenon and discuss a theory, Tranfield et. al. (2003) indicate the use of the systematic review. This study presents a literature database with information on product development processes (hardware) or software in the medical area where there were application of methods to involve the user. Data on quantity and incidence of

methods used in user engagement, the types of users involved and the number of products and software were identified. The bibliometric analysis detected an increase number of publications on this topic, which countries are involved in the research, and also the journals.

2. METHODOLOGY

The combination of a systematic review and bibliometric analysis was used as methodology, proposed by Conforto, Amaral and Silva (2011). The objective of the SR is to generalize knowledge through theoretical synthesis in fields and subfields of research. This type of methodology has been frequent in the medical field in management research, probably because it can explain a phenomenon and at the same time ensure consistency in the analyzes of the theory (TRANFIELD; DENYER; SMART, 2003).

Conforto, Amaral & Silva (2011) recommend a 3-step-roadmap to develop SR researches in the area of operations management, focusing on product development and project management. This research is organized into 3 phases: entry, processing and exit (Figure 1).

On the first phase, the research objective, sources (Scopus and Web of Science), search string and inclusion/exclusion criteria were defined.

On processing phase, the quantity of articles identified before and after the inclusion/exclusion criteria is presented. In total, 538 articles were retrieved in the search string, 63 were duplicates, so 475 articles were considered for the first filter in the processing phase. After reading the abstract of these articles, 332 were considered for the second filter and the entire article was read. On the last phase, bibliometric analysis from 203 papers were shown and discussed as a result.

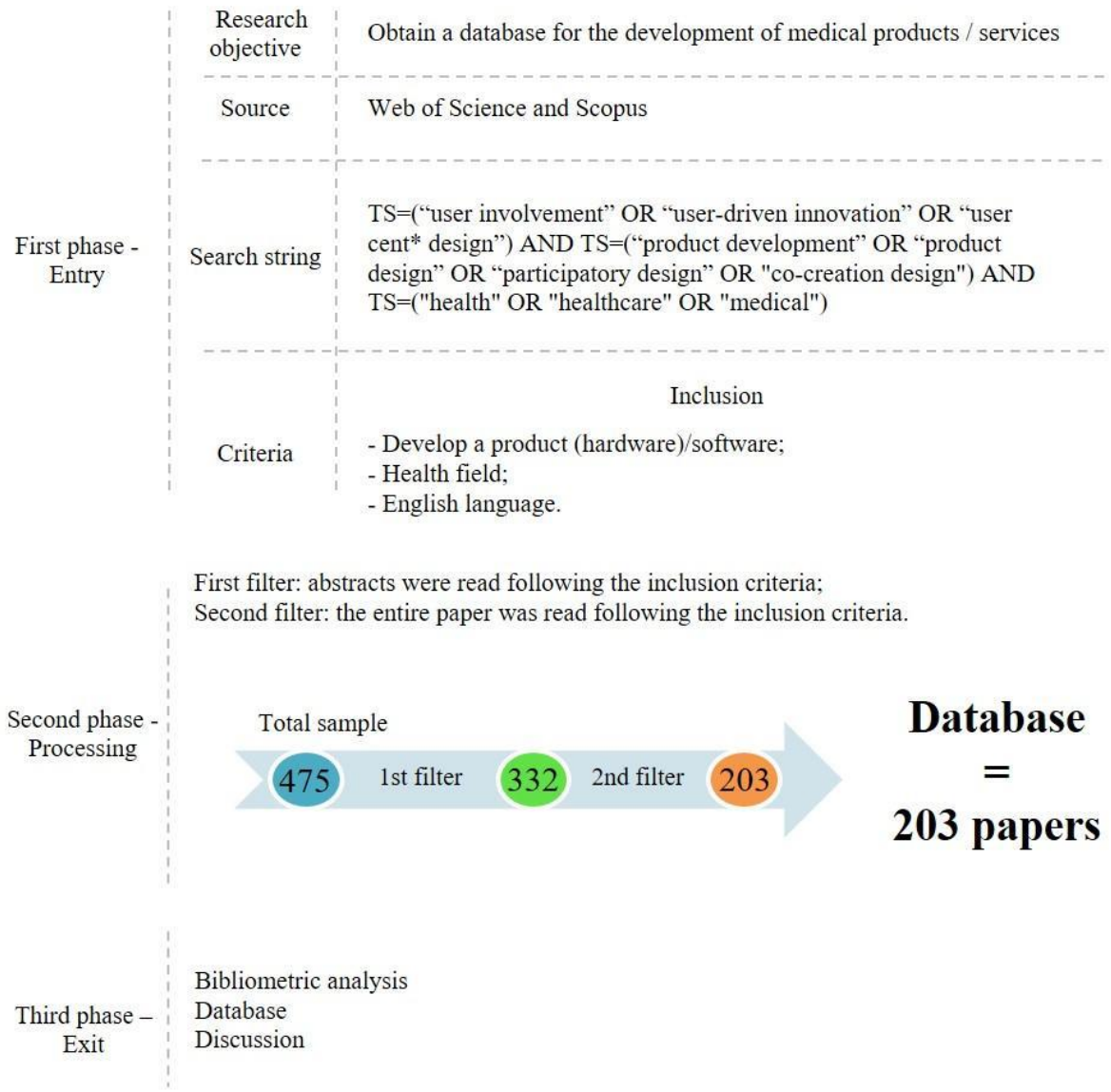

FIGURE 1 - Methodology process. Source: authors

3. RESULTS AND DISCUSSION

After the processing phase, 203 articles were cataloged (Appendix A). These studies present product (hardware) and/or software development in the medical field, all of them involve users throughout development.

3.1 PRODUCT AND SOFTWARE

Among the 203 papers, there is a great focus for the development of software (160 papers, ID 45 - 203). Programs are developed in 102 articles (ID 45 - 145); mobile application in 47 (ID 146 - 192); and websites in 11 papers (ID 193 - 203).

The product development corresponds to approximately 12% of the analyzed articles (26 papers, ID 1 - 26), while the combination of software and product development in articles was the least identified. Only 18 articles (ID 27 - 44) products are developed related to a program or application.

3.2 METHODS USED FOR USER INVOLVEMENT

In the database were identified 24 different methods used to involve users in different stages of development, such as concept, design, testing and trials (SHAH; ROBINSON, 2006).

The most used method is "prototyping" (190 articles; ~ 94%). Only 10 of the software articles (159) do not use prototypes to test the generated concepts. However, in article ID 133 a usability test and a heuristic evaluation are applied, in this way, it is believed that a prototype of the developed software has been made, even if it is a low fidelity one. Otherwise, these tests could not be applied. Among product articles (with or without a combination with software - total of 44), only 3 of them do not use prototypes for testing. It should be noted that a minority of the articles develops more than one prototype throughout the development, being one of low fidelity (CHIOU et al., 2014) and at least one of high fidelity (RUDD; STERN; ISENSEE, 1996). This practice indicates that the interactivity of the development phases was performed (AITCHISON et al., 2009), a good development practice focused on the user.

The second most applied method is "interview" (149 articles, ~ 73%). Among these articles, only one (ID 92) makes exclusive use of this method, being a development for software. A good practice in health products / services development is the application of more than one method, having a combination of them, better extracting the usability aspects (SHAH; ROBINSON, 2006).

"Questionnaire" is the third most applied method (65 articles, ~ 32%). It is noted that the articles ID 6 (product development) and ID 39 (product development + software) only apply this method. This practice is also in agreement with the combination of methods by Shah and Robinson (2006).

Still with a significant percentage, the following methods are applied: observation (~ 29%) and focus group (~ 28%). The methods that obtained a lower index of application were: user cases

(3 articles), contextual inquiry (3 articles) and storytelling (1 article). The latter 7 methods cited were applied for software development.

All the methods have greater application in the software area and none of them has a significant number of applications in the product developments in the articles analyzed. For example: 190 articles applying prototyping, only 24 are product development; of the 58 that apply focus group, only 5 are for product; of the 14 that apply personas, only 1 is for product.

Although some methods are quite common in the areas of product and software, they are still poorly applied in health care. For example, "heuristic assessment" is a method initially developed for software analysis (NIELSEN, 1993); however, it is poorly applied in healthcare technologies (5% of articles with software or product development + software). The same happens with the "personas" method, common in information technology projects / softwares (GRUDIN; PRUITT, 2002; HJALMARSSON; GUSTAFSSON; CRONHOLM, 2015; RAMOS, 2013) and Web development (GARRETH, 2011), but only 8% of analyzed articles that develop software apply persona.

Figure 2 gives an overview of how many times the identified methods have been applied, and the relation of which methods are applied by which articles analyzed is in Appendix B.

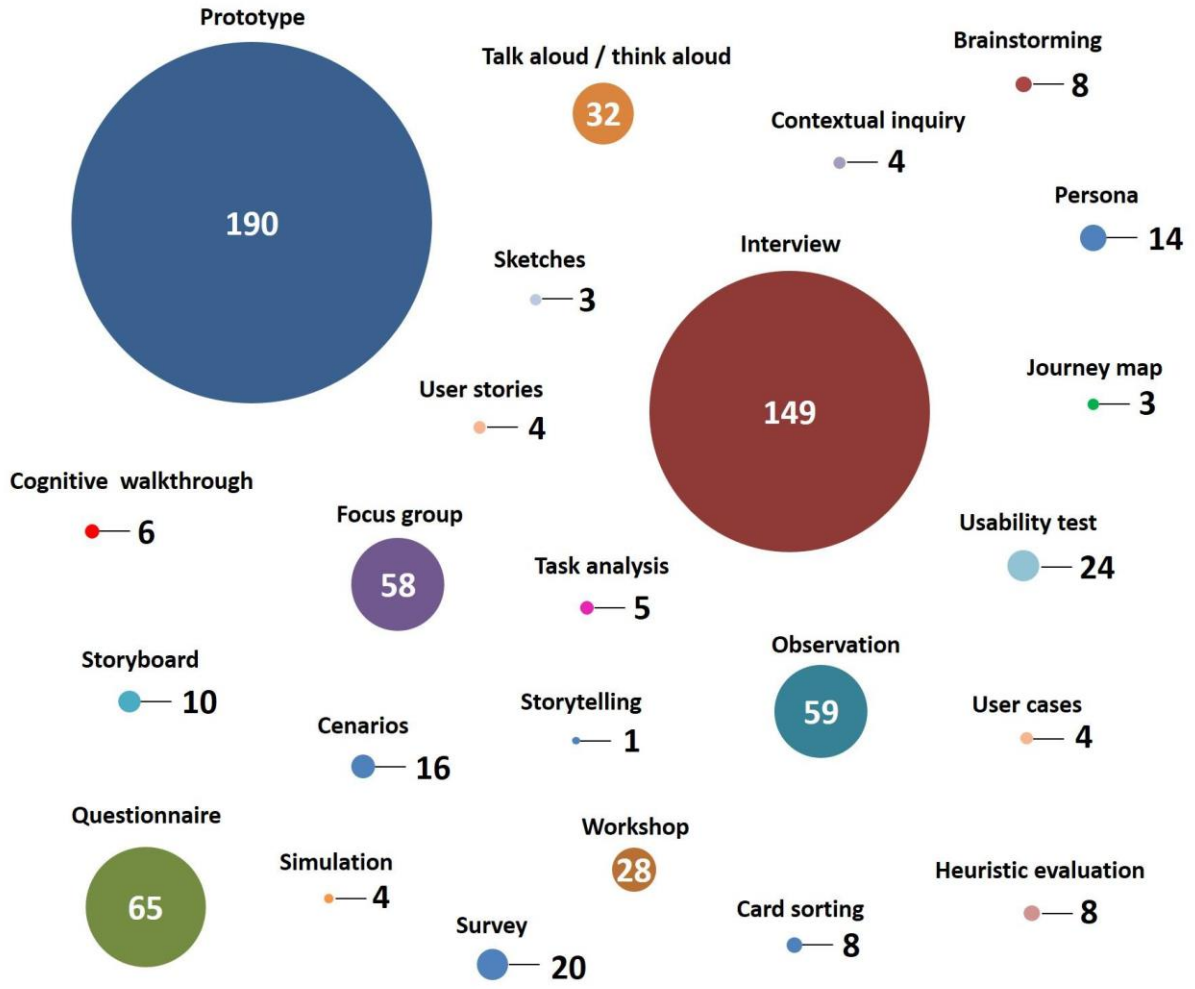

FIGURE 2 - Number of times a method was applied. Source: authors

3.3 Users

In the articles collected in the database, it was evident the importance of product development to be user focused and all types of users being considered (STACCINI et al., 2001). Most cases involved more than one type of user, such as patients (children, elderly and adults), family members, physicians, nurses, psychologists, and caregivers. In 48 articles (~ 24%), only one type of user was involved (ID 1, 5, 14, 17, 29, 30, 32, 44, 45, 49, 53, 54, 60, 64-66, 68, 69, 71, 75-77, 81, 86, 91, 102, 104, 125, 135, 139, 148, 149, 156, 157, 168, 171, 175, 183, 185, 194-200 and 204). Nine cases (~ 4%) did not involve the users that the developers considered as end-users (ID 20, 27, 53, 65, 84, 86, 92, 102 and 191), while 4 cases (IDs 20, 27, 84 and 191)

focused on patients but only involved health professionals. On the other hand, cases 53, 65, 86, 92 and 102 aimed to assist health professionals but only involved patients.

Among the analyzed articles, most focus on the involvement of patients and their families and/or caregivers, physicians and nurses (MARTIN et al., 2010; SHAH; ROBINSON; ALSHAWI, 2009). However, those database articles that develop products, none of them involves or mentions users who have indirect contact with the products, as responsible for maintenance, cleaning, transportation and training (MARTIN et al., 2010).

3.4 Bibliometric analysis

The case database is composed of articles published in journals (60% - total of 122) and articles published in conferences (40% - total of 81) (Figure 3). There is a greater number of publications concentrated in 7 journals, only one of which is not focused on healthcare, but rather has a scope of ergonomics and usability (Applied Ergonomics). These main journals are presented in Table 1.

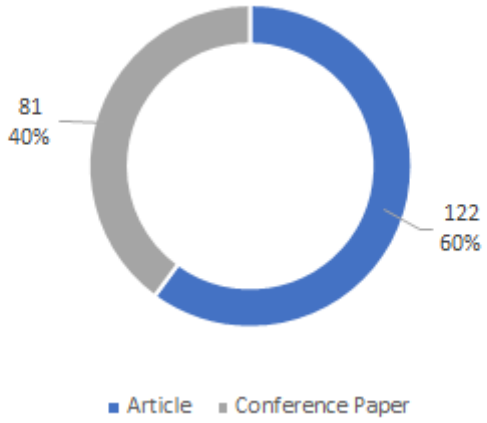

FIGURE 3 - Document type distribution. Source: authors

TABLE 1 - Main journals

Journals
Journal Of Biomedical Informatics
Journal of Medical Internet Research
International Journal of Medical Informatics
Applied Ergonomics
BMC Health Services Research
BMC Medical Informatics And Decision Making
Health Informatics Journal

Source: authors

The articles in the database come from 27 countries/territories (accounting carried out according to the country of the corresponding author of each article) (Figure 4). The highest number of cases was reported by authors from the USA (66), UK (25) and Canada (12). After them comes a great majority of European countries (Norway, Denmark, Sweden, the Netherlands and Germany). In Latin America, only 3 countries were identified (Brazil, Colombia and Argentina), Brazil being the largest number of cases (4).

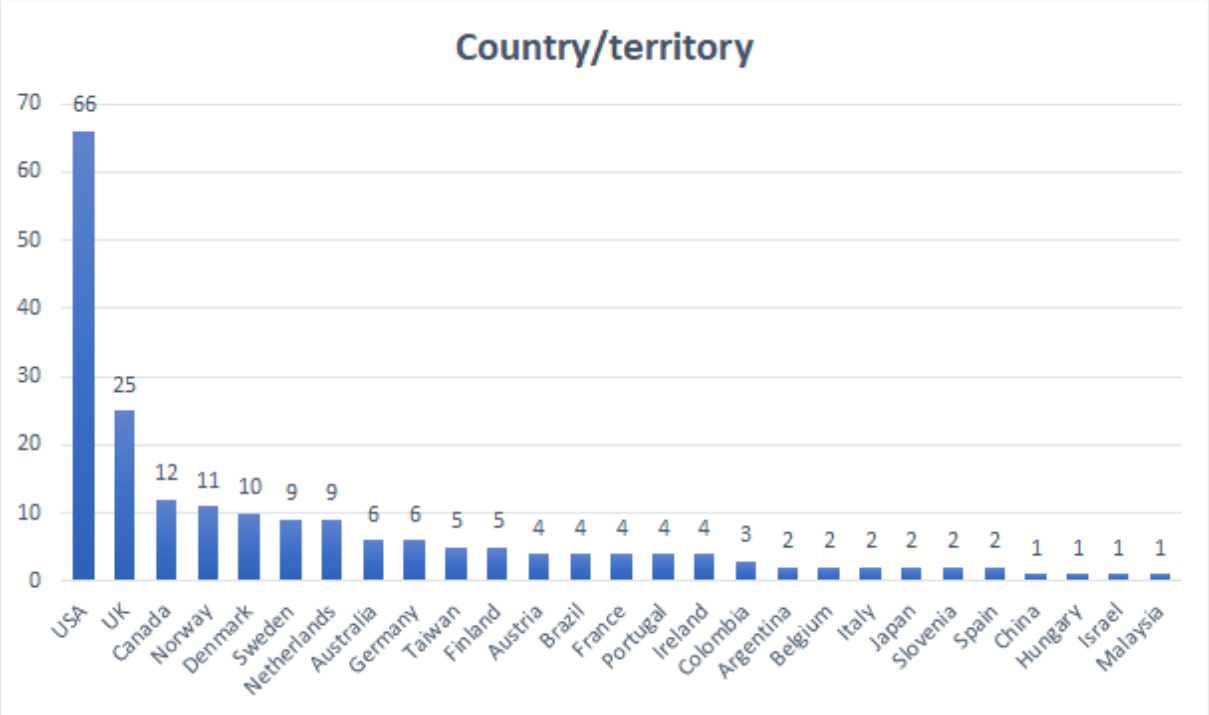

FIGURE 4 - Publication origin. Source: authors

The database comprises a period from 1986 to 2019, as can be seen in figure 5. Until 2004, there was a consistency of one article per year. Since then, there has been a growth in the publications of cases of products and/or software development in the healthcare area, such

growth was accentuated from 2009. The peak of articles presented in the case database was in 2018 with 32 cases cataloged. The database has cases published in the year 2019, accounting for 15 cases so far.

The publication of the usability standards ISO 62366 in 2007 and ISO 60601-1-6 in 2010 may have influenced the increase of user involvement in the development of healthcare products and/or software. These standards guide that development must be done with the active participation of users. They have an international application, but they were published in the USA, which may be related to the large number of published cases in the country.

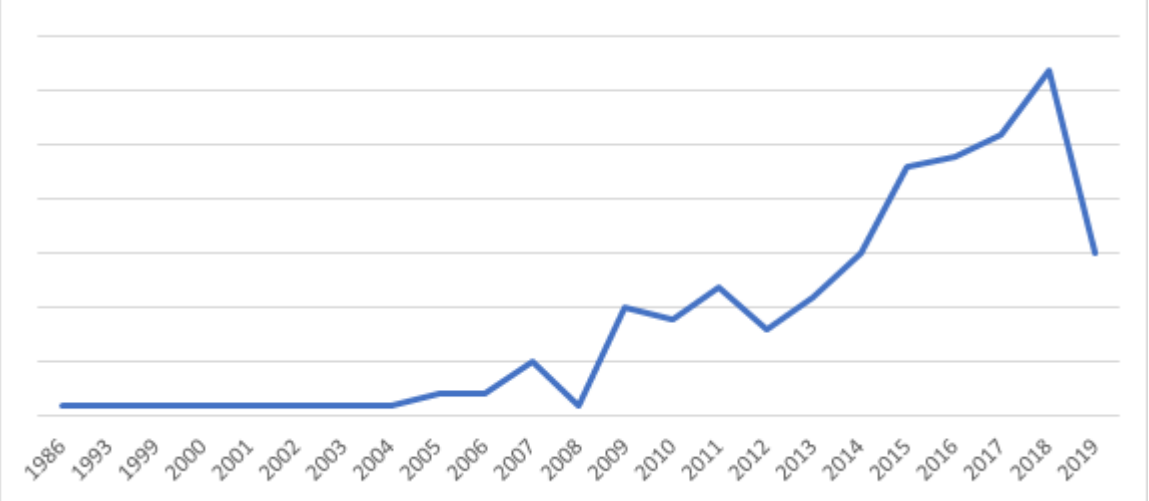

FIGURE 5 - Year of publication of the database articles. Source: authors

4. CONCLUSION

The database presents 203 cases of development of health products and softwares that have involved users throughout development, 160 articles developed software (software, websites and mobile applications), 26 developed products (hardware) and 18 developed products combination and software. Health product development faces the difficulty of managing the needs of different types of users, but despite this, most articles involve more than one type of user in their development cases.

All the cases from our database describe the user involvement through methods. In total 24 methods were applied as a form of user involvement, in which the use of prototypes for the

development of products and softwares in the health area is highlighted. Interviews and questionnaires are also very applied.

Our database presents an extensive review period, articles from several countries and serves as a reference for developers and researchers wishing to rely on cases described in the healthcare product development literature.

5. ACKNOWLEDGMENT

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6. REFERENCES

AITCHISON, G. . et al. A Review of the Design Process for Implantable Orthopedic Medical Devices. **The Open Biomedical Engineering Journal**, v. 3, n. 1, p. 21–27, 2009.

CARRUTHERS, I.; PHILIP, P. **Safety First: A report for patients, clinicians and healthcare managersDepartment of Health**. [s.l: s.n.]. Disponível em: <http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_064159.pdf>.

CHIOU, E. et al. Contextual Design: Designing a device for motivated medication management. **Ergonomics in Design: The Quarterly of Human Factors Applications**, v. 22, n. 1, p. 8–15, 2014.

CONFORTO, E. C.; AMARAL, D. C.; SILVA, S. L. DA. Roteiro para revisão bibliográfica sistemática: aplicação no desenvolvimento de produtos e gerenciamento de projetos. **8º Congresso Brasileiro de Gestão de Desenvolvimento de Produto - CBGDP 2011**, v. 8, n. 12, 13 E 14 DE SETEMBRO DE 2011, p. 1–12, 2011.

GARRETH, J. J. **The Elements of User Experience: User-Centered Design for the Web and Beyond**. Second Edi ed. Berkeley.

GRUDIN, J.; PRUITT, J. **Personas. Participatory Design and Product Development: An Infrastructure for Engagement**. (T.Binder, J.Gregory, I.Wagner, Eds.) PDC 02 Proceedings of the Participatory Design Conference. **Anais**...Malmo, Sweden: 2002

HJALMARSSON, A.; GUSTAFSSON, E.; CRONHOLM, S. **Exploring the Use of Personas in User-Centered Design of Web-based e-services**. iConference 2015 Proceedings.2015

MARTIN, J. L. et al. **Design for patient safety. User testing in the development of medical devices.** London National Patient Safety Agency, 2010.

MONEY, A. G. et al. The role of the user within the medical device design and development process: medical device manufacturers' perspectives. **BMC Medical Informatics and Decision Making**, v. 11, n. 1, p. 15, 2011.

NIELSEN, J. **Usability Engineering**. Elsevier, 1993.

PIETZSCH, J. B. et al. Stage-Gate Process for the Development of Medical Devices. **Journal of Medical Devices**, v. 3, n. 2, p. 021004, 2009.

RAMOS, E. DE S. **Elaboração de uma Persona para o profissional de Análise de Requisitos que pratica UX/UCD/IHC baseado em dados estatísticos provenientes de pesquisas no contexto brasileiro**. Encontro Anual de Tecnologia da Informação e Semana Acadêmica de Tecnologia da Informação. Frederico Westphalen: 2013. Disponível em: <http://www.eati.info/eati/2013/assets/anais/artigo288.pdf>

RUDD, J.; STERN, K.; ISENSEE, S. Low vs. high-fidelity prototyping debate. **interactions**, v. 3, n. 1, p. 76–85, 1996.

SHAH, S. G. S.; ROBINSON, I. User involvement in healthcare technology development and assessment: Structured literature review. **International Journal of Health Care Quality Assurance**, v. 19, n. 6, p. 500–515, 2006.

SHAH, S. G. S.; ROBINSON, I.; ALSHAWI, S. Developing medical device technologies from users' perspectives: A theoretical framework for involving users in the development process. **International Journal of Technology Assessment in Health Care**, v. 25, n. 4, p. 514–521, 2009.

STACCINI, P. et al. Modelling health care processes for eliciting user requirements: A way to link a quality paradigm and clinical information system. **International Journal of Medical Informatics**, v. 64, n. 2–3, p. 129–142, 2001.

TRANFIELD, D.; DENYER, D.; SMART, P. Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. **British Journal of Management**, v. 14, n. 3, p. 207–222, 2003.

VON HIPPEL, E. Democratizing innovation: The evolving phenomenon of user innovation. **Journal fur Betriebswirtschaft**, v. 55, n. 1, p. 63–78, 2005.

APPENDIX A

ID	Product Reference
1	AHRENS, M.; HEHENBERGER, P. **Empathic-Design Assisted By the Kano Method – a Human-Centered Design Method for Medical Devices Considering Patients**. In DS 80-9 20th International Conference on Engineering Design (ICED 15) Vol 9: User-Centred Design, Design of Socio-Technical system. Milan, Italy: 2015
2	BRUTON, A. et al. The Design and Development of a New Light-Weight Portable Oxygen System. **Journal of Medical Devices**, v. 6, n. 3, p. 031007, 2012.
3	CAIRNS, N. et al. Rethinking the foam cosmesis for people with lower limb absence. **Prosthetics and Orthotics International**, v. 42, n. 2, p. 223–227, 2017.
4	CRESPIN, O. M. et al. Feasibility of adapting the fundamentals of laparoscopic surgery trainer box to endoscopic skills training tool. **Surgical Endoscopy**, v. 32, n. 6, p. 2968–2983, 2018.
5	DONG, H.; VANNS, N. Designing an innovative pill dispenser: An undergraduate level case study of inclusive design. **Design Journal**, v. 12, n. 1, p. 95–116, 2009.
6	GREEN, S. **Westfocus designplus: Learnings from a major cross-disciplinary design, industry and academic network**. DS 43: Proceedings of E and PDE 2007, the 9th International Conference on Engineering and Product Design Education.University of Northumbria, Newcastle, UK: 2007 Disponível em: <http://www.scopus.com/inward/record.url?eid=2-s2.0-84859258601&partnerID=40&md5=91af36c0b10e32897886e6864e2fde94>
7	HAGEDORN, T. J.; KRISHNAMURTY, S.; GROSSE, I. R. An information model to support user-centered design of medical devices. **Journal of Biomedical Informatics**, v. 62, p. 181–194, 2016.
8	HAN, F.; SHIN, K.; CHOW, D. User-centred design approach for hydrotherapy wetsuit. **International Journal of Fashion Design, Technology and Education**, v. 9, n. 1, p. 16–22, 2016.
9	HANSON, L. et al. **Digital Human Modeling in Health Care Industry**. (V.G. Duffy, Ed.)International Conference on Digital Human Modeling.Berlin Heidelberg: Springer-Verlag, 2009
10	HARIH, G.; ČRETNIK, A. Interdisciplinary Approach to Tool-Handle Design Based on Medical Imaging. **BioMed Research International**, v. 2013, p. 1–8, 2013.
11	JUDGE, S.; NASR, N.; HAWLEY, M. A User-Centred Approach Exploring the Potential of a Novel EMG Switch for Control of Assistive Technology. **Studies in Health Technology and Informatics**, v. 242, p. 381–384, 2017.
12	KARLSSON, I. C. M. et al. Use-centred design of medical and healthcare technology: a pilot study of field tests as a development tool. **International Journal of Biomedical Engineering and Technology**, v. 5, n. 1, p. 11, 2011.
13	LANGELL, A. et al. Thermal Coagulation Device for Treating Cervical Dysplasia. **Surgical Innovation**, v. 26, n. 2, p. 149–152, 2019.
14	LIEN, C.; LIU, P. Systematic Innovation by User-centered Design : Case Study in Ampoule Opener Design. **International Journal of Systematic Innovation**, v. 5, n. 2, p. 45–52, 2018.
15	LORENZINI, G. C.; OLSSON, A.; LARSSON, A. **User Involvement in Pharmaceutical Packaging Design - a Case Study**. Ds87-8 Proceedings of the 21St International Conference on Engineering Design (Iced 17), Vol 8: Human Behaviour in Design. VANCOUVER, CANADA: 2017
16	MERLO, C. et al. **Proposal of a user-centred approach for CPS design: pillbox case study**. Proceedings of 2nd IFAC Conference on Cyber-Physical Human-Systems. **Anais**...Elsevier B.V., 2019Disponível em: <https://doi.org/10.1016/j.ifacol.2019.01.065>
17	MORRIS, K.; PARK, J.; SARKAR, A. Development of a Nursing Sports Bra for Physically Active Breastfeeding Women Through User-Centered Design. **Clothing and Textiles Research Journal**, v. 35, n. 4, p. 290–306, 2017.
18	NÄGELE, L. V.; RYÖPPY, M.; WILDE, D. **PDFi : Participatory Design Fiction with Vulnerable Users**. Proceedings of the 10th Nordic Conference on Human-Computer Interaction.2018
19	NAIK, A. D. et al. User-centered design of discharge warnings tool for colorectal surgery patients. **Journal of the American Medical Informatics Association**, v. 24, n. 5, p. 975–980, 2017.
20	PAZART, L. et al. **Consideration of the Human Factor in the Design and Development of a New Medical Device: Example of a Device to Assist Manual Ventilation**. BIODEVICES.2017
21	POWER, E. J.; LEAPER, D. J.; HARRIS, J. M. Designing functional medical products for children with cancer. **International Journal of Fashion Design, Technology and Education**, v. 10, n. 3, p. 381–386, 2017.
22	REISER, S. et al. Making Together: An Interdisciplinary, Inter-institutional Assistive-Technology Project. **IEEE computer graphics and applications**, v. 37, n. 5, p. 9–14, 2017.
23	ROBINSON, L. et al. Keeping in Touch Everyday (KITE) project: Developing assistive technologies with people with dementia and their carers to promote independence. **International Psychogeriatrics**, v. 21, n. 3, p. 494–502, 2009.
24	TSAI, C. C. et al. Usability and feasibility of PmEB: A mobile phone application for monitoring real time caloric balance. **Mobile Networks and Applications**, v. 12, n. 2–3, p. 173–184, 2007.
25	TSVYATKOVA, D.; STORNI, C. **Adapting design probes to explore health management practices in pediatric type 1 diabetes**. Proceedings of the 2014 conference on Interaction design and children.2014
26	YIN, S. et al. Functional Redesign of the Hospital Trolley-Bed Tray Table. **Ergonomics in Design**, v. 24, n. 4, p. 20–26, 2016.

Product and Software	
ID	**Reference**
27	AMIRIBESHELI, M.; BOUCHACHIA, H. A tailored smart home for dementia care. **Journal of Ambient Intelligence and Humanized Computing**, v. 9, n. 6, p. 1755–1782, 2018.
28	BATSIS, J. A. et al. Usability evaluation for the Amulet Wearable Device in rural older adults with obesity. **Gerontechnology**, v. 17, n. 3, p. 151–159, 2018.
29	BEECO, R. F. W. et al. **Creation of User-Centered Reports for Patients and Medical Professionals**. Proceedings of the Human Factors and Ergonomics Society 54th Annual Meeting. **Anais**...2010
30	BELARDO, S.; KARWAN, K. R. The development of a disaster management support system through prototyping. **Information and Management**, v. 10, n. 2, p. 93–102, 1986.
31	BELDEN, T. et al. **Developing an advanced "tool" for the clinician; using industrial design and interface design together to bring technology into the hand of the user**. Sixth Annual IEEE Symposium on Computer-Based Medical Systems Benefits.1993
32	BOYINGTON, A. R. et al. Development of a computer-based system for continence health promotion. **Nursing Outlook**, v. 52, n. 5, p. 241–247, 2004.
33	FABRICANT, R. **Incorporating guidance and rewards into a handheld-device user experience**. Proceedings of the 2005 conference on Designing for User eXperience. 2005. Disponível em: <http://dl.acm.org/citation.cfm?id=1138235.1138271>
34	GEORGIOU, T. et al. **A blended user centred design study for wearable haptic gait rehabilitation following hemiparetic stroke**. 2015 9th International Conference on Pervasive Computing Technologies for Healthcare (PervasiveHealth). IEEE. **Anais**...2015
35	HALL, M. L.; LOBO, M. A. Design and development of the first exoskeletal garment to enhance arm mobility for children with movement impairments. **Assistive Technology**, v. 30, n. 5, p. 251–258, 2018.
36	MADSEN, M. et al. **Challenges in Applying Standard Telemedicine Solutions in the Home of Type 2 Diabetics**. Proceedings of the 8th International Conference on Pervasive Computing Technologies for Healthcare. ICST (Institute for Computer Sciences, Social-Informatics and Telecommunications Engineerin. **Anais**...2014
37	MAIER, A. M. et al. **Remember to remember: A feasibility study adapting wearable technology to the needs of people aged 65 and older with mild cognitive impairment (MCI) and Alzheimer's dementia**. Proceedings of International Conference on Engineering Design (ICED 2015) Publication. 2015 Disponível em: <https://www.scopus.com/inward/record.uri?eid=2-s2.0-84979784061&partnerID=40&md5=df523ef92687f9cca36bf116689c972b>
38	MARQUIS-FAULKES, F. et al. Gathering the requirements for a fall monitor using drama and video with older people. **Technology and Disability**, v. 17, n. 4, p. 227–236, 2005.
39	NI, T.; KARLSON, A. K.; WIGDOR, D. **AnatOnMe : Facilitating Doctor-Patient Communication Using a Projection-Based Handheld Device**. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.2011 Disponível em: <http://dl.acm.org/citation.cfm?id=1979437>
40	PERUZZINI, M.; GERMANI, M. **A Service-oriented Architecture for Ambient-assisted Living**. 22nd ISPE Inc. International Conference on Concurrent Engineering. **Anais**...2015
41	PILLALAMARRI, S. S.; HUYETT, L. M.; ABDEL-MALEK, A. Novel Bluetooth-Enabled Tubeless Insulin Pump: A User Experience Design Approach for a Connected Digital Diabetes Management Platform. **Journal of Diabetes Science and Technology**, v. 12, n. 6, p. 1132–1142, 2018.
42	WEIGHTMAN, A. P. H. et al. Engaging children in healthcare technology design: Developing rehabilitation technology for children with cerebral palsy. **Journal of Engineering Design**, v. 21, n. 5, p. 579–600, 2010.
43	WIGGERMANN, N. et al. Human-Centered Design Process for a Hospital Bed: Promoting Patient Safety and Ease of Use. **Ergonomics in Design**, v. 27, n. 2, p. 4–12, 2019.
44	XIAO, D. et al. A newly designed portable ergonomic laparoscopic skills Ergo-Lap simulator. **Minimally Invasive Therapy and Allied Technologies**, v. 22, n. 6, p. 337–345, 2013.

Software - Programs	
ID	**Reference**
45	ABIB, J. C.; ANACLETO, J. C. **Interaction Design Process for Healthcare Professionals: formalizing user's contexts observations**. Proceedings of the 14th Brazilian Symposium on Human Factors in Computing Systems. **Anais**...2015
46	BARANYI, R. et al. **NutritionRush-A serious game to support people with the awareness of their nutrition intake**. 2017 IEEE 5th International Conference on Serious Games and Applications for Health, SeGAH 2017. **Anais**...2017
47	BELDEN, J. L. et al. Designing a medication timeline for patients and physicians. **Journal of the American Medical Informatics Association : JAMIA**, v. 26, n. 2, p. 95–105, 2018.
48	BJERKAN, J.; HEDLUND, M.; HELLESO, R. Patients' contribution to the development of a web-based plan for integrated care-A participatory design study. **Informatics for Health and Social Care**, v. 40, n. 2, p. 167–184, 2015.
49	BOEHMER, K. R. et al. Meaningful conversations in living with and treating chronic conditions: Development of the ICAN discussion aid. **BMC Health Services Research**, v. 16, n. 1, p. 1–9, 2016.
50	BØRØSUND, E. et al. A stress management app intervention for cancer survivors: Design, development, and usability testing. **Journal of Medical Internet Research**, v. 20, n. 9, p. 1–16, 2018.
51	BØRSTING, J.; CULÉN, A. L.; EIKE, M. C. **Design of a reference handling system for clinical DNA sequencing analysis**, 2015.
52	BOSSEN, C. Accounting and co-constructing: The development of a standard for electronic health records. **Computer Supported Cooperative Work**, v. 20, n. 6, p. 473–495, 2011.
53	BRENNAN, P. F.; DOWNS, S.; CASPER, G. Project HealthDesign: Rethinking the power and potential of personal health records. **Journal of Biomedical Informatics**, v. 43, n. 5, p. S3–S5, 2010.
54	BROX, E.; KONSTANTINIDIS, S. T.; EVERTSEN, G. User-Centered Design of Serious Games for Older Adults Following 3 Years of Experience With Exergames for Seniors: A Study Design. **JMIR Serious Games**, v. 5, n. 1, p. e2, 2017.
55	CARR, E. C.; BABIONE, J. N.; MARSHALL, D. Translating research into practice through user-centered design: An application for osteoarthritis healthcare planning. **International Journal of Medical Informatics**, v. 104, n. April, p. 31–37, 2017.
56	CHIOU, E. et al. Contextual Design: Designing a device for motivated medication management. **Ergonomics in Design: The Quarterly of Human Factors Applications**, v. 22, n. 1, p. 8–15, 2014.
57	CUTTING, E. et al. User-centered design of multi-gene sequencing panel reports for clinicians. **Journal of Biomedical Informatics**, v. 63, p. 1–10, 2016.
58	DAHL, Y.; HANSSEN, G. K. "Do You See What I Hear?": Designing for Collocated Patient–Practitioner Collaboration in Audiological Consultations. **Human-Computer Interaction**, v. 33, n. 5–6, p. 372–421, 2018.
59	DAS, A.; SVANÆS, D. Human-centred methods in the design of an e-health solution for patients undergoing weight loss treatment. **International Journal of Medical Informatics**, v. 82, n. 11, p. 1075–1091, 2013.
60	DE CROON, R.; KLERKX, J.; DUVAL, E. **Design and evaluation of an interactive proof-of-concept dashboard for general practitioners**. Proceedings - 2015 IEEE International Conference on Healthcare Informatics, ICHI 2015. **Anais**...2015
61	DEVOGE, J. M. et al. Collaborating With Physicians to Redesign a Sign-Out Tool. **Ergonomics in Design**, v. 17, n. 1, p. 20–28, 2009.
62	DIMEFF, L. A. et al. A novel engagement of suicidality in the emergency department: Virtual Collaborative Assessment and Management of Suicidality. **General Hospital Psychiatry**, n. April, 2018.

63 DIRIN, M.; DIRIN, A.; LAINE, T. H. **User-centered design of a context-aware nurse assistant (CANA) at Finnish elderly houses**. Proceedings of the 9th International Conference on Ubiquitous Information Management and Communication. **Anais**...2015

64 DUONG, T. A.; FAREL, R.; STAL-LE-CARDINAL, J. **PSS for Healthcare Service Engineering, a User-Centered Approach Using Social Network**. ICoRD'15–Research into Design Across Boundaries. **Anais**...New Delhi: 2015Disponível em: <http://link.springer.com/10.1007/978-81-322-2232-3>

65 FARINANGO, C. D. et al. Human-centered design of a personal health record system for metabolic syndrome management based on the ISO 9241-210:2010 standard. **Journal of Multidisciplinary Healthcare**, v. 11, p. 21–37, 2018.

66 FLOHR, L. et al. Clinician-Driven Design of VitalPAD-An Intelligent Monitoring and Communication Device to Improve Patient Safety in the Intensive Care Unit. **IEEE Journal of Translational Engineering in Health and Medicine**, v. 6, n. March, p. 3000114, 2018.

67 GAO, T. et al. **Participatory user centered design techniques for a large scale ad-hoc health information system**. Proceedings of the 1st ACM SIGMOBILE international workshop on Systems and networking support for healthcare and assisted living environments. 2007

68 GARCIA, J. J. . et al. **Fine-tuning a context-aware system application by using user-centred design methods**. Proc. of the IADIS Int. Conf. Interfaces and Human Computer Interaction 2010, IHCI, Proc. of the IADIS Int. Conf. Game and Entertainment Technologies 2010, Part of the MCCSIS 2010.2010 Disponível em: <http://www.scopus.com/inward/record.url?eid=2-s2.0-79955400128&partnerID=40&md5=99f791e2bb56e5ca3a3b6cc083744af7>

69 GELEIJNSE, G. et al. **A personalized recipe advice system to promote healthful choices**. IUI 2011: International Conference on Intelligent User Interfaces.Palo Alto, CA, USA: 2011

70 GONG, Y.; CHANDRA, A.; WANG, J. Toward an integrated health data display for aging in place. **Studies in Health Technology and Informatics**, v. 201, n. June, p. 233–240, 2014.

71 GRIM, K. et al. Development and usability testing of a web-based decision support for users and health professionals in psychiatric services. **Psychiatric Rehabilitation Journal**, v. 40, n. 3, p. 293–302, 2017.

72 HARTE, R. et al. Human-Centered Design Study: Enhancing the Usability of a Mobile Phone App in an Integrated Falls Risk Detection System for Use by Older Adult Users. **JMIR mHealth and uHealth**, v. 5, n. 5, p. e71, 2017.

73 HARTSWOOD, M. et al. **Being there and doing IT in the workplace: A case study of a co-development approach in healthcare**. Proceedings of the CPSR/IFIP WG 9.1 participatory design conference. **Anais**...2000

74 HOGARTH, M. et al. The Communication and Care Plan: A novel approach to patient-centered clinical information systems. **Journal of Biomedical Informatics**, v. 43, n. 5, p. S6–S8, 2010.

75 HOLZINGER, A.; SAMMER, P.; HOFMANN-WELLENHOF, R. **Computers Helping People with Special Needs**. Lecture Notes in Computer Science. **Anais**...2006Disponível em: <http://link.springer.com/10.1007/978-3-642-31522-0>

76 HORSKY, J.; RAMELSON, H. Z. Development of a cognitive framework of patient record summary review in the formative phase of user-centered design. **Journal of Biomedical Informatics**, v. 64, p. 147–157, 2016.

77 HØYBYE, M. T. et al. Virtual environments in cancer care: Pilot-testing a three-dimensional web-based platform as a tool for support in young cancer patients. **Health Informatics Journal**, v. 24, n. 4, p. 419–431, 2018.

78 HUA, L.; GONG, Y. **Identifying and addressing effectiveness in a user-centered design of voluntary medical incident reporting system**. 2011 IEEE 13th International Conference on e-Health Networking, Applications and Services, HEALTHCOM 2011. **Anais**...IEEE, 2011

79 HWANG, A.; TRUONG, K.; MIHAILIDIS, A. **Using participatory design to determine the needs of informal caregivers for smart home user interfaces**. 2012 6th International Conference on Pervasive Computing Technologies for Healthcare (PervasiveHealth) and Workshops.IEEE, 2012

80 IZARD, J. et al. User-centered design of quality of life reports for clinical care of patients with prostate cancer. **Surgery (United States)**, v. 155, n. 5, p. 789–796, 2014.

81 JOHNSEN, H. M. et al. Teaching clinical reasoning and decision-making skills to nursing students: Design, development, and usability evaluation of a serious game. **International Journal of Medical Informatics**, v. 94, p. 39–48, 2016.

82 KALLEN, M. A.; YANG, D. S.; HAAS, N. A technical solution to improving palliative and hospice care. **Supportive Care in Cancer**, v. 20, n. 1, p. 167–174, 2012.

83 KAMAL, N. et al. **VivoSpace: Towards health behavior change using social gaming**. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics). **Anais**...2011

84 KANG, H.; GONG, Y. Design of a user-centered voluntary reporting system for patient safety events. **Studies in Health Technology and Informatics**, v. 245, n. January, p. 733–737, 2017.

85 KATO, C. et al. Development of online counseling system and usability evaluation. **Journal of Emerging Technologies in Web Intelligence**, v. 3, n. 2, p. 146–153, 2011.

86 KILSDONK, E. et al. From an expert-driven paper guideline to a user-centred decision support system: A usability comparison study. **Artificial Intelligence in Medicine**, v. 59, n. 1, p. 5–13, 2013.

87 KLEMETS, J.; DE MOOR, K. Patient responsibility reallocation: A user-centered approach to support nurses' handling of nurse calls. **Personal and Ubiquitous Computing**, v. 19, n. 3, p. 601–621, 2015.

88 KLOMPMAKER, F. et al. Designing a telemedical system for cardiac exercise rehabilitation. **Communications in Computer and Information Science**, p. 111–122, 2010.

89 KUNJAN, K.; DOEBBELING, B.; TOSCOS, T. Dashboards to Support Operational Decision Making in Health Centers: A Case for Role-Specific Design. **International Journal of Human-Computer Interaction**, v. 35, n. 9, p. 742–750, 2019.

90 KUSHNIRUK, A.; NØHR, C. Participatory Design, User Involvement and Health IT Evaluation. In: AMMENWERTH, E.; RIGBY, M. (Eds.). . **Evidence-Based Health Informatics Promoting Safety and Efficiency Through Scientific Methods and Ethical Policy Edited**. p. 389.

91 KWAHK, J.; SMITH-JACKSON, T. L.; WILLIGES, R. C. **FROM USER-CENTEREDDESIGNTO SENIOR-CENTEREDDESIGN: DESIGNING INTERNET HEALTH INFORMATION PORTALS**. PROCEEDINGS of theHUMANFACTORS AND ERGONOMICS SOCIETY 45th ANNUAL MEETING.2001

92 LEHOUX, P. et al. Clinicians as health technology designers: Two contrasting tales about user involvement in innovation development. **Health Policy and Technology**, v. 2, n. 3, p. 122–130, 2013.

93 LIN, C.-K. E.; WANG, T.-H.; YANG, J.-F. K. TOUCH Doctor — A Nutrition Control Service System Developed under Living Lab Methodology. **International Journal of Automation and Smart Technology**, v. 2, n. 3, p. 253–263, 2012.

94 LUNA, D. et al. Participatory design for drug-drug interaction alerts. **Studies in Health Technology and Informatics**, v. 210, n. May, p. 45–49, 2015.

95 LUNA, D. R. et al. User-centered design improves the usability of drug-drug interaction alerts: A validation study in the real scenario. **Studies in Health Technology and Informatics**, v. 245, n. January, p. 1085–1089, 2017.

96 MANN, D. M. et al. Rationale, design, and implementation protocol of an electronic health record integrated clinical prediction rule (iCPR) randomized trial in primary care. **Implementation Science**, v. 6, n. 1, p. 1–10, 2011.

97 MARSAC, M. L. et al. Systematic, theoretically grounded development and feasibility testing of an innovative, preventive web-based game for children exposed to acute trauma. **Clinical Practice in Pediatric Psychology**, v. 3, n. 1, p. 12–24, 2015.

98 MARTIN-HAMMOND, A. M.; ABEGAZ, T.; GILBERT, J. E. Designing an over-the-counter consumer decision-making tool for older adults. **Journal of Biomedical Informatics**, v. 57, p. 113–123, 2015.

99 MARTIN, J. L.; BARNETT, J. Integrating the results of user research into medical device development: Insights from a case study. **BMC Medical Informatics and Decision Making**, v. 12, n. 1, p. 1–10, 2012.

100 MASSOUDI, B. L. et al. A web-based intervention to support increased physical activity among at-risk adults. **Journal of Biomedical Informatics**, v. 43, p. 541–545, 2010.

101 MATEO, K. F. et al. Development of a 5As-based technology-assisted weight management intervention for veterans in primary care. **BMC Health Services Research**, v. 18, n. 1, p. 1–14, 2018.

102 MOODY, L. et al. Design of a Handheld Computer Application for Clinical Critical Incident Reporting. **Contemporary Ergonomics**, p. 499–504, 2007.

103 MULVENNA, M. et al. Realistic expectations with brain computer interfaces. **Journal of Assistive Technologies**, v. 6, n. 4, p. 233–244, 2012.

104 NEBE, K.; GRÖTZBACH, L. **Aligning user centered design activities with established software development practices**. Proceedings of the 4th Nordic conference on Human-computer interaction: changing roles.2006

105 NELSON, S. D. . et al. A case report of refining user requirements for a health information exchange dashboard. **Applied Clinical Informatics**, v. 7, n. 1, p. 22–32, 2016.

106 NEUBECK, L. et al. Development of an integrated e-health tool for people with, or at high risk of, cardiovascular disease: The Consumer Navigation of Electronic Cardiovascular Tools (CONNECT) web application. **International Journal of Medical Informatics**, v. 96, p. 24–37, 2016.

107 NOERGAARD, B. et al. Development of a Web-Based Health Care Intervention for Patients With Heart Disease: Lessons Learned From a Participatory Design Study. **JMIR research protocols**, v. 6, n. 5, p. 1–8, 2017.

108 NOTA, I. et al. Development of a web-based patient decision aid for initiating disease modifying anti-rheumatic drugs using user-centred design methods. **BMC Medical Informatics and Decision Making**, v. 17, n. 1, p. 1–14, 2017.

109 PARK, T. et al. Living Profiles: an example of user-centered design in developing a teen-oriented personal health record. **Personal and Ubiquitous Computing**, v. 19, n. 1, p. 69–77, 2015.

110 PELEG, M. et al. Using multi-perspective methodologies to study users' interactions with the prototype front end of a guideline-based decision support system for diabetic foot care. **International Journal of Medical Informatics**, v. 78, n. 7, p. 482–493, 2009.

111 PIRES, M. R. G. M. et al. Sistema de Informação para a Gestão do Cuidado na Rede de Atenção Domiciliar (SI GESCAD): subsídio à coordenação e à continuidade assistencial no SUS. **Ciência & Saúde Coletiva**, v. 20, n. 6, p. 1805–1814, 2015.

112 PLAISANCE, A. et al. Development of a decision aid for cardiopulmonary resuscitation and invasive mechanical ventilation in the intensive care unit employing user-centered design and a wiki platform for rapid prototyping. **PLoS ONE**, v. 13, n. 2, p. e0191844, 2018.

113 POUKE, M.; HÄKKILÄ, J. Elderly healthcare monitoring using an avatar-based 3D virtual environment. **International Journal of Environmental Research and Public Health**, v. 10, n. 12, p. 7283–7298, 2013.

114 PRINCE, R. M. et al. User-Centered Design of a Web-Based Tool to Support Management of Chemotherapy-Related Toxicities in Cancer Patients. **Journal of medical Internet research**, v. 21, n. 3, p. e9958, 2019.

115 PRINZ, A. et al. **inSERT - An NFC-based self reporting questionnaire for patients with impaired fine motor skills**. Proceedings - 3rd International Workshop on Near Field Communication, NFC 2011. **Anais**...IEEE, 2011

116 PURI, S. K.; SAHAY, S.; LEWIS, J. Building participatory HIS networks: A case study from Kerala, India. **Information and Organization**, v. 19, n. 2, p. 63–83, 2009.

117 REIS, C. I. et al. Patient centered design: Challenges and lessons learned from working with health professionals and schizophrenic patients in e-therapy contexts. **Communications in Computer and Information Science**, v. 221 CCIS, n. PART 3, p. 1–10, 2011.

118 REYNOLDS, L. M. et al. StreetWise: developing a serious game to support forensic mental health service users' preparation for discharge: a feasibility study. **Journal of Psychiatric and Mental Health Nursing**, v. 24, n. 4, p. 185–193, 2017.

119 ROSS, S. E. et al. Two complementary personal medication management applications developed on a common platform: Case report. **Journal of Medical Internet Research**, v. 13, n. 3, p. 1–13, 2011.

120 SAVAZZI, F. et al. Engaged in learning neurorehabilitation: Development and validation of a serious game with user-centered design. **Computers and Education**, v. 125, n. June, p. 53–61, 2018.

121 SIRIARAYA, P. et al. **Learnings and challenges in designing gamifications for mental healthcare: The case study of the readysetgoals application**. 2018 10th International Conference on Virtual Worlds and Games for Serious Applications, VS-Games 2018 - Proceedings.IEEE, 2018

122 SLAGLE, J. M. et al. MyMediHealth – Designing a next generation system for child-centered medication management. **Journal of Biomedical Informatics**, v. 43, n. 5, p. S27–S31, 2010.

123 SMARADOTTIR, B. et al. User-centred Design of the User Interface of a Collaborative Information System for Inter-municipal Dementia Team. **HEALTHINF**, p. 446–453, 2015.

124 SOLVOLL, T.; SCHOLL, J.; HARTVIGSEN, G. Physicians interrupted by mobile devices in hospitals: Understanding the interaction between devices, roles, and duties. **Journal of Medical Internet Research**, v. 15, n. 3, p. 1–12, 2013.

125 SRINIVAS, P.; CORNET, V.; HOLDEN, R. Human Factors Analysis, Design, and Evaluation of Engage, a Consumer Health IT Application for Geriatric Heart Failure Self-Care. **International Journal of Human-Computer Interaction**, v. 33, n. 4, p. 298–312, 2017.

126 SUTCLIFFE, A. et al. Developing visualization-based decision support tools for epidemiology. **Information Visualization**, v. 13, n. 1, p. 3–17, 2014.

127 TANG, T. et al. Clinician user involvement in the real world: Designing an electronic tool to improve interprofessional communication and collaboration in a hospital setting. **International Journal of Medical Informatics**, v. 110, p. 90–97, 2018.

128 TAYLOR, D. P. et al. **User-centered development of a Web-based preschool vision screening tool**. Annual Symposium Proceedings .2003 Disponível em: <http://www.ncbi.nlm.nih.gov/pubmed/14728254>

129 TEIXEIRA, L.; FERREIRA, C.; SANTOS, B. S. User-centered requirements engineering in health information systems: A study in the hemophilia field. **Computer Methods and Programs in Biomedicine**, v. 106, n. 3, p. 160–174, 2012.

130 TENDEDEZ, H. et al. **Scoping the Design Space for Data Supported Decision-Making Tools in Respiratory Care**. Proceedings of the 12th EAI International Conference on Pervasive Computing Technologies for Healthcare.2018

131 TORRES, S. et al. The Development of a Communication Tool to Facilitate the Cancer Trial Recruitment Process and Increase Research Literacy among Underrepresented Populations. **Journal of Cancer Education**, v. 30, n. 4, p. 792–798, 2016.

132 TÓVÖLGYI, S. User involvement in the ergonomic development of a medical instrument: a longitudinal case study. **International Journal of Occupational Safety and Ergonomics**, v. 22, n. 2, p. 207–217, 2016.

133 VAN DER WEEGEN, S. et al. The development of a mobile monitoring and feedback tool to stimulate physical activity of people with a chronic disease in primary care: A user-centered design. **Journal of Medical Internet Research**, v. 15, n. 7, p. 1–13, 2013.

134 VENTURA, F. et al. Exploring the Person-Centeredness of an Innovative E-Supportive System Aimed at Person-Centered Care. **CIN: Computers, Informatics, Nursing**, v. 34, n. 5, p. 231–239, 2016.

135 VERHOEVEN, F.; VAN GEMERT-PIJNEN, J. **Discount user-centered e-health design: a quick-but-not-dirty method**. In *Symposium of the Austrian HCI and Usability Engineering Grou*, November, p. 101-123. Springer, Berlin, Heidelberg, 2010

136 VERHOEVEN, F.; VAN GEMERT-PIJNEN, L.; HENDRIX, R. **The Development of a web-based tool for compliance with safe work practices; A case study about methicillin-resistant staphylococcus aureus**. Proceedings - International Conference on eHealth, Telemedicine, and Social Medicine, eTELEMED 2009. **Anais**...2009

137 VINK, P.; KONINGSVELD, E. A.; MOLENBROEK, J. F. Positive outcomes of participatory ergonomics in terms of greater comfort and higher productivity. **Applied ergonomics** v. 7, n. 4, p. 537-546, 2006.

138 VIMARLUND, V. et al. Organizational effects of information and communication technology (ICT) in elderly homecare: A case study. **Health Informatics Journal**, v. 14, n. 3, p. 195–210, 2008.

139 WÄRNESTÅL, P.; SVEDBERG, P.; NYGREN, J. **Co-constructing child personas for health-promoting services with vulnerable children**. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems. **Anais**...2014

140 WASTELL, D.; WHITE, S. Making sense of complex electronic records: Socio-technical design in social care. **Applied Ergonomics**, v. 45, n. 2 Part A, p. 143–149, 2014.

141 WEIGHTMAN, A. P. H. et al. Engaging children in healthcare technology design: Developing rehabilitation technology for children with cerebral palsy. **Journal of Engineering Design**, v. 21, n. 5, p. 579–600, 2010.

142 WENT, K. **Safer prescribing in intensive care: designing a system to reduce errors**. Proceedings of the HCI'07 Conference on People and Computers XXI. **Anais**...2007Disponível em: <http://www.bcs.org/upload/pdf/ewic_hc07_dcpaper9.pdf%5Cnhttp://www.bcs.org/server.php?show=ConWebDoc.13996>

143 WILLARD, S. et al. Development and testing of an online community care platform for frail older adults in the Netherlands: A user-centred design. **BMC Geriatrics**, v. 18, n. 1, p. 1–9, 2018.

144 WILLIAMSON, S. S.; GORMAN, P. N.; JIMISON, H. B. **A mobile/web app for long distance caregivers of older adults: functional requirements and design implications from a user centered design process.** Annual Symposium proceedings. AMIA Symposium. **Anais**...2014Disponível em: <http://www.ncbi.nlm.nih.gov/pubmed/25954469%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC4419890>

145 WOODS, L. et al. Conceptual Design and Iterative Development of a mHealth App by Clinicians, Patients and heir Families...Health Informatics Conference, Sydney Australia, 2018. **Studies in Health Technology & Informatics**, v. 252, p. 170–175, 2018.

	Software - Mobile Applications
ID	Reference
146	BARRY, M. et al. **mHealth for Maternal Mental Health: Everyday Wisdom in Ethical Design**. Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems.2017
147	BIEDIGER-FRIEDMAN, L. et al. A Focus Group Investigation. **Am J Health Behav.**, v. 40, n. 4, p. 461–471, 2016.
148	BURCHERT, S. et al. User-centered app adaptation of a low-intensity e-mental health intervention for Syrian refugees. **Frontiers in Psychiatry**, v. 10, n. JAN, p. 1–18, 2019.
149	CALVILLO-ARBIZU, J. et al. User-centred design for developing e-Health system for renal patients at home (AppNephro). **International Journal of Medical Informatics**, v. 125, n. February, p. 47–54, 2019.
150	DITHMER, M. et al. "The Heart Game": Using Gamification as Part of a Telerehabilitation Program for Heart Patients. **Games for Health Journal**, v. 5, n. 1, p. 27–33, 2016.
151	DOS SANTOS, M. M. T. et al. **Personalizing health-related ICT interface and application**. Proceedings of the 7th International Conference on Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion. 2017
152	DUVAL, J. S.; MÁRQUEZ SEGURA, E.; KURNIAWAN, S. **SpokeIt**. Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems - CHI '18. 2018. Disponível em: <http://dl.acm.org/citation.cfm?doid=3170427.3186494>
153	FERNANDES, F.; DUARTE, L.; CARRIÇO, L. **DETACH: Authoring Digital Therapeutic Artefacts**. 2013 7th International Conference on Pervasive Computing Technologies for Healthcare and Workshops. 2013
154	GARZO, A. et al. Design and development of a gait training system for Parkinson's disease. **PloS one**, v. 13, n. 11, p. e0207136, 2018.
155	HAKOBYAN, L. et al. **A longitudinal evaluation of the acceptability and impact of a diet diary app for older adults with age-related macular degeneration**. Proceedings of the 18th International Conference on Human-Computer Interaction with Mobile Devices and Services. **Anais**...2016
156	HARDY, A. et al. How Inclusive, User-Centered Design Research Can Improve Psychological Therapies for Psychosis: Development of SlowMo. **JMIR Mental Health**, v. 5, n. 4, p. e11222, 2018.
157	HAYNES, S. C.; KIM, K. K. **A mobile system for the improvement of heart failure management: Evaluation of a prototype.** Annual Symposium proceedings. AMIA Symposium. 2017 Disponível em: <http://www.ncbi.nlm.nih.gov/pubmed/29854150%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC5977691>
158	HERSCHMAN, J. et al. Development of a smartphone app for adolescents with lupus: a collaborative meeting-based methodology inclusive of a wide range of stakeholders. **Pan American journal of public health**, v. 35, n. 5–6, p. 471–6, 2014.
159	HOBSON, E. V. et al. The TiM system: developing a novel telehealth service to improve access to specialist care in motor neurone disease using user-centered design. **Amyotrophic Lateral Sclerosis and Frontotemporal Degeneration**, v. 19, n. 5–6, p. 351–361, 2018.
160	HOLM, K. G. et al. Participatory design methods for the development of a clinical telehealth service for neonatal homecare. **SAGE Open Medicine**, v. 5, p. 1–8, 2017.
161	HUBERTY, J. et al. Development and design of an intervention to improve physical activity in pregnant women using Text4baby. **Translational Behavioral Medicine**, v. 6, n. 2, p. 285–294, 2016.
162	JENSEN, C. M. et al. Bridging the gap: A user-driven study on new ways to support self-care and empowerment for patients with hip fracture. **SAGE Open Medicine**, v. 6, p. 1–13, 2018.
163	JURIC, S.; ZALIK, B. An innovative approach to near-infrared spectroscopy using a standard mobile device and its clinical application in the real-time visualization of peripheral veins. **BMC Medical Informatics and Decision Making**, v. 14, n. 1, p. 1–10, 2014.
164	KATUSIIME, J.; PINKWART, N. **Supporting Maternal Health Education in Developing Countries Using Mobile Phones-Results of a Pilot Study**. Proceedings of the First African Conference on Human Computer Interaction. 2016
165	KLAKEGG, S. et al. **Informing Caregivers Through an Assistive Tool: An Investigation of Elderly Care Metrics**. Proceedings of the 31st British Computer Society Human Computer Interaction Conference. 2017
166	LAZAR, J. et al. Co-Design Process of a Smart Phone App to Help People With Down Syndrome Manage Their Nutritional Habits. **Journal of Usability Studies**, v. 13, n. 2, p. 73–93, 2018.
167	LEE, D. et al. **Puzzle Walk: A Gamified Mobile App to Increase Physical Activity in Adults with Autism Spectrum Disorder**. 10th International Conference on Virtual Worlds and Games for Serious Applications (VS-Games).2018
168	LI, X. et al. **Serenity: A Low-Cost and Patient-Guided Mobile Virtual Reality Intervention for Cancer Coping**. Proceedings - 2016 IEEE International Conference on Healthcare Informatics, ICHI 2016. **Anais**...IEEE, 2016
169	LIN, F. S. et al. **Graphical Tools for Doctor-Patient Communication: An App Prototype Design in Children's Pain Management**. International Conference on Human-Computer Interaction. 2016
170	LIN, W-J.;CHIU,M-C. **Design a Personalized Brain-Computer Interface of LegoRobot Assisted by Data Analysis Method**. Transdisciplinary Engineering: A Paradigm Shift: Proceedings of the 24th ISPE Inc. International Conference on Transdisciplinary Engineering, July 10-14, 2017. Vol. 5. IOS Press, 2017.
171	LIU, Y.-C. et al. Evaluating Mobile Health Apps for Customized Dietary Recording for Young Adults and Seniors: Randomized Controlled Trial. **JMIR mHealth and uHealth**, v. 7, n. 2, p. 1–15, 2019.
172	LOPEZ, K. N. et al. Improving transitions of care for young adults with congenital heart disease: Mobile app development using formative research. **Journal of Medical Internet Research**, v. 20, n. 9, p. 1–12, 2018.
173	LÖW, C. et al. **ZENse - Supporting Everyday Emotional Reflection**. 15th Human-Computer Interaction (INTERACT). **Anais**...2015
174	MADRIGAL-CADAVID, J. et al. Design and development of a mobile app of drug information for people with visual impairment. **Research in Social and Administrative Pharmacy**, p. 2–6, 2019.
175	MAHER, M. et al. User-Centered Design Groups to Engage Patients and Caregivers with a Personalized Health Information Technology Tool. **Biology of Blood and Marrow Transplantation**, v. 22, n. 2, p. 349–358, 2016.
176	MARIEN, S. et al. A User-Centered design and usability testing of a web-based medication reconciliation application integrated in an eHealth network. **International Journal of Medical Informatics**, v. 126, p. 138–146, 2019.
177	MELNICK, E. R. et al. Patient-Centered Decision Support: Formative Usability Evaluation of Integrated Clinical Decision Support With a Patient Decision Aid for Minor Head Injury in the Emergency Department. **Journal of Medical Internet Research**, v. 19, n. 5, p. 1–12, 2017.
178	MINGE, M. et al. **Developing a Mobile System for Children and Teenagers with Scoliosis to Improve Therapy Adherence**. Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems.2018
179	MONTEIRO-GUERRA, F. et al. **The Design of a Mobile App for Promotion of Physical Activity and Self-Management in Prostate Cancer Survivors: Personas, Feature Ideation and Low-Fidelity Prototyping**. Proceedings - IEEE Symposium on Computer-Based Medical Systems. **Anais**...2017
180	MUMMAH, S. A. et al. Iterative development of Vegethon: A theory-based mobile app intervention to increase vegetable consumption. **International Journal of Behavioral Nutrition and Physical Activity**, v. 13, n. 1, p. 1–12, 2016.

181	NARVÁEZ, S. et al. Human-centered design of an mhealth app for the prevention of burnout syndrome. **Studies in Health Technology and Informatics**, v. 228, n. 4, p. 215–219, 2017.
182	NEUHAUSER, L. et al. Using design science and artificial intelligence to improve health communication: ChronologyMD case example. **Patient Education and Counseling**, v. 92, n. 2, p. 211–217, 2013.
183	PETERS, D. et al. Young people's preferences for an asthma self-management app highlight psychological needs: A participatory study. **Journal of Medical Internet Research**, v. 19, n. 4, p. 1–13, 2017.
184	SANAUL HAQUE, M.; JÄMSÄ, T.; KANGAS, M. **A theory-driven system model to promote physical activity in the working environment with a persuasive and gamified application**. CEUR Workshop Proceedings. **Anais**...2017
185	SCANDURRA, I.; HÄGGLUND, M.; KOCH, S. **Integrated Care Plan and Documentation on Handheld Devices in Mobile Home Care**. International Conference on Mobile Human-Computer Interaction. **Anais**...2010
186	SERRANO, J. A. et al. **Patients Initiated Timeline Marking of Events in Parkinson's Disease: Visualization of Time Correlation between Patients Marked Events and Acquired Data from Sensors**. International Conference on Augmented Cognition. 2014 Disponível em: <http://link.springer.com/10.1007/978-3-319-07527-3>
187	SHALAN, A. et al. YORwalK: Desiging a smartphone exercise application for people with intermittent claudication. **Studies in Health Technology and Informatics**, v. 247, p. 311–315, 2018.
188	SHELLMER, D. A. et al. Development and field testing of Teen Pocket PATH® , a mobile health application to improve medication adherence in adolescent solid organ recipients Diana. **Pediatric transplantation**, v. 20, n. 1, p. 130–140, 2016.
189	SOBRINHO, A. et al. Design and evaluation of a mobile application to assist the self-monitoring of the chronic kidney disease in developing countries. **BMC Medical Informatics and Decision Making**, v. 18, n. 1, p. 1–14, 2018.
190	SVARRE, T.; LUNN, T. B. K.; HELLE, T. Transforming paper-based assessment forms to a digital format: Exemplified by the Housing Enabler prototype app. **Scandinavian Journal of Occupational Therapy**, v. 24, n. 6, p. 438–447, 2017.
191	THOMSON, J. et al. **Aspira: Employing a serious game in an mHealth app to improve asthma outcomes BT - 5th IEEE International Conference on Serious Games and Applications for Health, SeGAH 2017, April 2, 2017 - April 4, 2017**. BT - 5th IEEE International Conference on Serious Games and Applications for Health.2017Disponível em: <http://dx.doi.org/10.1109/SeGAH.2017.7939268>
192	WOODS, L. et al. Conceptual Design and Iterative Development of a mHealth App by Clinicians, Patients and heir Families...Health Informatics Conference, Sydney Australia, 2018. **Studies in Health Technology & Informatics**, v. 252, p. 170–175, 2018.

Software - Websites	
ID	**Reference**
193	ATKINSON, N. L. et al. User-centered research on breast cancer patient needs and preferences of an internet-based clinical trial matching system. **Journal of Medical Internet Research**, v. 9, n. 2, p. 1–11, 2007.
194	ATKINSON, N. L. et al. Rural eHealth nutrition education for limited-income families: an iterative and user-centered design approach. **Journal of medical Internet research**, v. 11, n. 2, p. 1–13, 2009.
195	BRADFORD, D. et al. Interacting with genomic data: Clinician requirements and prototype structure. **Studies in Health Technology and Informatics**, v. 239, p. 1–7, 2017.
196	ELF, M. et al. Young carers as co-designers of a web-based support system - The views of two publics. **Informatics for Health and Social Care**, v. 37, n. 4, p. 203–216, 2012.
197	FISHER, A. M. et al. User-centered design and usability testing of RxMAGIC: a prescription management and general inventory control system for free clinic dispensaries. **BMC Health Services Research**, v. 18, n. 1, p. 1–12, 2018.
198	FONDA, S. J. et al. Combining iGoogle and personal health records to create a prototype personal health application for diabetes self-management. **Telemedicine and e-Health**, v. 16, n. 4, p. 480–489, 2010.
199	GONCALVES, S. et al. Integration of all information sources in a clinical environment. **Health Informatics Journal**, v. 5, n. 4, p. 193–199, 1999.
200	HE, X. et al. **Prototyping an Interactive Visualization of Dietary Supplement Knowledge Graph**. Proceedings - 2018 IEEE International Conference on Bioinformatics and Biomedicine, BIBM 2018. **Anais**...IEEE, 2019
201	JENKINSON, J. et al. Development and evaluation of sentinel node biopsy: a continuing professional development course. **Journal of Biocommunication**, v. 29, n. 4, p. 5–10, 2003.
202	JONES, R. B. et al. A web-based psychoeducational intervention for adolescent depression: design and development of MoodHwb. **Journal of Medical Internet Research**, v. 20, n. 2, p. 1–19, 2018.
203	KILLEEN, O. et al. User-Centered Design of the eyeGuide, a Tailored Glaucoma Behavior Change Program Olivia. **Journal of glaucoma**, v. 25, n. 10, p. 815–821, 2016.

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