Innovation and digital transformation to support clinical care and prevent osteoporosis related fractures

Ana Maria Rodrigues[1,2,3], Helena Canhão[1,2,4]

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Medicine in general and rheumatology in particular, are in continuum innovation and transformation. New and more accurate methods for early diagnosis and disease monitoring, new therapies and new ways of care delivery are revolutionizing rheumatology field.
Over decades, the development and delivery of new drugs and therapies have been representing the cutting edge of innovation.

But currently, innovation is far beyond the development of new drugs. Digital transformation is invading our practices and healthcare systems. It is transforming the health records, interprofessional communication and communication between professionals and patients, large registries with real world data, medical devices, support to clinical decisions and personalized health programs. It is also democratizing health and facilitates health access. Patients and caregivers can be more actively involved in this process, managing their disease and integrating the innovation pathway[1]. Of course, there is the other side of the coin. Confidentiality, security, safety, ethics and legal responsibility are all issues that must be carefully attended.

Our team is working on an information and communication technology (ICT) program: "The Healthy Bone TV" application which is a multimodule, interactive, customizable app that delivers a home-based program including physical exercise, nutritional plan, osteoporosis (OP) and fragility fractures patient education, and treatment reminders to assist high-risk fragility fractures long-term self-management. Because ICT literacy in elderly is low, this solution is user friendly and blended with human contact.

Worldwide, osteoporosis causes more than 8.9 million fractures annually, resulting in an osteoporotic fracture every 3 seconds, and it is estimated to affect 200 million 50+ older adults worldwide in the next 50 years[2]. In Portugal, osteoporosis related fractures are a significant public health problem[3, 4]. In fact, one in five Portuguese women older than 65 years-old reported to already had suffered at least one low impact fracture[5]. This reality can be changed if we provide the proper long-term care to this high-risk population. Fracture liaison services are growing fast and high-risk of fracture patients are now being better identified. As far as treatment is concerned, medication, healthy diet and weight-bearing exercises can help prevent bone loss or strengthen already weak bones. However, a significant drop-out rates in exercise interventions (>40%) and low to moderate adherence (40-70%) to drug therapies[6, 7] by osteoporosis patients are reported, placing the need for their sustained motivation via motivational and education tools. There is an imperative need to develop new interventions that improve OP treatment adherence and lifestyle adjustments. Thus, implementation of the Healthy Bone TV program will allow patients to gain a better understanding of the importance of treatment and increasing OP treatment adherence rates.

Recently, the development of new computer based interactive technologies and the widespread of the Internet and mobile phones/tv apps lead to the "e-health and m-health" concept, which is an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. Theoretically, computer-based interactive technologies can help monitoring subjects at distance, support daily activities such as recalling drug intake times, taught about individual habits and behavior patterns, thus allowing the customization of interventions[8,9]. Based on that, several companies and academic institutions are developing devices (wearable, etc.) for collecting health-related data. Others are investing in cloud-based data analysis and machine learning techniques to deal with terabytes of new informa-

1. EpiDoC Unit, CEDOC, NOVA Medical School, UNL
2. Comprehensive Health Research Center (CHRC)
3. Unidade de Reumatologia, HSEIT, Terceira, Acores
4. Unidade de Reumatologia, CHLC-Hospital Curry Cabral, Lisboa

tion coming from multiple sources. However, few are focused in validating these tools and in answering to our research questions – are those ICTs useful and cost-effective? Can we support osteoporosis patients at home? Are they usable by the elderly? What are the ethical concerns and the added value of monitoring health variables? We consider that the "e-health and m-health concept" can be used to develop tools to assist osteoporosis patient long-term self-management, increasing treatment adherence and health literacy.

In the last years, our research team has been dedicated to understand the practical use of ICTs among rheumatic diseases patients and testing its use to improve clinical outcomes. The Healthy Bone TV app was based on our previous project that has already shown results: a TV program (available on all Portuguese TV operators) aimed at improving elderly life styles that was developed in a co-creation approach. Seniors, physiotherapists, nutritionist, physicians, psychologists and engineers, contributed to this tv program development. Every day senior individuals were given tasks and tips to improve their physical condition, diet and lifestyles[10]. The new challenge now is to validate and release to the market a unique multimodule TV platform, specifically designed as a home-based intervention program to improve treatment adherence, lifestyles and health literacy in high-risk fracture patients.

In the Healthy Bone TV project we will conduct a pragmatic, unblinded, two-arm, parallel, randomized, controlled pilot study to assess the effectiveness and safety of a 52-week home-based program containing a combination of patient education, treatment reminders and lifestyles tips delivered through a TV app on OP treatment adherence, among post-fragility fracture community dwelling seniors. Recruitment will start in march 2020 and the project will be finished in 2022.

In conclusion, ICTs are delivery in a fast pace. But sometimes the clinical validation and cost-effectiveness analysis of ICTs is forgotten. Clinical validation through randomized controlled studies are warranted to assess the effectiveness and safety of ICTs and home-based programs. There is an imperative need to prevent and proper treat high risk fragility fractures patients and ICTs can be useful tools to support multidisciplinary teams to provide excellent patient care. In our project, we will hopefully reveal that the Healthy Bone program is an effective strategy to optimize OP care and improve overall outcomes, minimizing the consequences of the disease to patients and society.

CORRESPONDENCE TO
Ana Maria Rodrigues
NOVA Medical School | Faculdade de Ciências Médicas
Universidade Nova de Lisboa
CEDOC - Campus Sant'Ana.
Pólo de Investigação, NMS, UNL. Edifício Amarelo.
Rua do Instituto Bacteriológico, nº5 | 1150-082 Lisboa, Portugal
E-mail: anamfrodrigues@gmail.com

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