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P5 Medical Centre, a platform to improve health and promote behavioural change in a Digital Era

Liliana Amorim
Association P5 Digital Medical Centre (ACMP5), Portugal
Fábio Borges
Association P5 Digital Medical Centre (ACMP5), Portugal
Inês Fernandes
Association P5 Digital Medical Centre (ACMP5), Portugal
Marina Gonçalves
Association P5 Digital Medical Centre (ACMP5), Portugal
Nuno Santos
Association P5 Digital Medical Centre (ACMP5), Portugal
Pedro Morgado
Association P5 Digital Medical Centre (ACMP5), Portugal
Nuno Sousa
Association P5 Digital Medical Centre (ACMP5), Portugal

Abstract

Digital technologies have changed the way we manage our health. In fact, they not only contributed to health transformation by delivering care in people's homes, but also by addressing weaknesses in health systems and improving the training and performance of the health workforce. Taking advantage of the ubiquitous use of mobile phones and computers/ tablets, the P5 Digital Medical Center (ACMP5) at the School of Medicine of University of Minho (EM-UMinho) aims at strengthening the Portuguese health care system through a platform that enables a sustained environment for behaviour change and for health monitoring and promotion. This pilot project combines the use of mobile apps and platforms with personalized feedback and guidelines from different health professionals, to empower individuals with non-controlled hypertension and type II diabetes in the appropriate monitoring of their health status, so that they can properly manage their health. To do so, P5 has a multidisciplinary team composed by psychologists, family doctors (GP's), nurses, nutritionists and computer scientists working together and with the digital technology to improve individuals' health.

The use of digital platforms for health improvement and behaviour change

Preventable and treatable conditions continue to be at the top of mortality and morbidity rates worldwide (World Health Organization, 2019), increasing the need for effective programs guiding people towards healthier choices and lifestyles, helping them in maintaining it and allowing for a long-term assessment of the programs' effectiveness (Pellmar, Brandt, & Baird, 2002). With digital technologies, new avenues are observed with the possibility of a universal health care coverage, as well as the acquisition of day-to-day data that not only can aid in monitoring individual's progress, but also in obtaining a reliable mean to assess interventions efficacy (Rathbone & Prescott, 2017; Redfern, 2019). Thus, with P5 project, we take advantage of these aspects and use different platforms and mobile apps (Haas, Hayoz, & Maurer-Wiesner, 2019; Jamaladin et al., 2018; Rohde, Lorkowski, & Dawczynski, 2017; Cianflone et al., 2016) to monitor users' health status and provide them personalized feedback that will help them adjusting behaviours and maintaining it for a longer period of time. The use of digital platforms and mobile apps to promote

behaviour change has increased (Groarke et al., 2019; Morrissey, Glynn, Casey, Walsh, & Molloy, 2018; Walsh & Groarke, 2019). Results from these studies show an improvement not only on its' individual health status and well-being (Avery et al., 2012; Lean et al., 2018), but also in decreasing the economic burden related to disease (OECD/EU, 2016). However, it is also important to recognize that there is still limited evidence in what concerns to these programs efficacy and sustainability across time (Grist, Porter, & Stallard, 2017; Marshall, Dunstan, & Bartik, 2019; Walsh & Groarke, 2019; Wang, Varma, & Prosperi, 2018). Indeed, despite many individuals having smartphones and being able to use health apps, there is still the possibility that *they* do not engage in these type of interventions given their lack of motivation to change behaviour or their different needs (Ernsting et al., 2017).

P5: project description, aims and future steps

The P5 Digital Medical Centre (ACMP5) was created at the School of Medicine of University of Minho (EM-UMinho) and aims at improving the health of citizens by providing digital platforms combined with the action of a multidisciplinary team to empower the individual to achieve a healthier lifestyle. The central idea of the P5 Digital Medical Centre is to promote better health care at the following levels: prevention, interconnection between primary health care and hospitals, and chronic disease monitoring (starting with hypertension and type 2 diabetes). There are two ways to register in ACMP5: individuals can register by themselves through a specific link in ACMP5 webpage or they can be recommended by their GP to be followed in one of our platforms - hypertension (Cianflone et al., 2016; Jamaladin et al., 2018) or type 2 diabetes (Haas et al., 2019; Rohde et al., 2017) (the later also being used by the NHS England; https://www.england.nhs.uk/2019/05/online-diabetes-support/). According to the Medical Research Council's evaluation framework, at this point, we are assessing the feasibility of our interventions (Craig et al., 2008; Dowding, Lichtner, & Closs, 2017). A description of the hypertension and type 2 diabetes programs, using the TIDieR guidelines (Campbell et al., 2018; Hoffmann et al., 2014) is provided in Table 1.

P5's strategy is focused on providing personalized attention and care to its users. For this, psychologists will act as "health coaches", guiding and motivating the user to keep on track for a healthier lifestyle and follow their doctor indications. Importantly, the role of psychologists as "health coaches" is to be highlighted. In the literature there is still heterogeneity regarding the importance of health coaches in the success of the interventions (Canadian Agency for Drugs and Technologies in Health, 2016). Since there has been positive results when combining digital health and coaching in behavioural change (Castro Sweet et al., 2018), we are interested in determining the impact that a psychologist as a health coach has in the success of implementing and maintaining behaviour change (Dixon & Johnston, 2010). Specifically, the health coaches will work alongside with nutritionist and nurses to actively promote healthier lifestyles in service users. Particularly for chronic conditions like hypertension and type 2 diabetes, personalized approaches will be adopted to increase the number of individuals with the control of the disease and that adhere to the treatment. By specifically addressing these two conditions, with a program aimed to increase the adherence to treatments and healthier life choices, we aim to help the primary care providers with their work on these patients.

As stated above, it is vital to find a reliable and effective way to enable people to make health-enhancing choices that promote behaviours with a long-term positive impact on their health and well-

Table 1. TIDieR checklist for the hypertension and type 2 diabetes programs.

Item	Item description
1. Brief Name	P5: a digital platform to monitor, intervene and support patients' health management.
2. Why	A combination between a digital platform and the action of a multidisciplinary team composed by GP's, nurses, psychologists and nutritionists is considered to increase the potential of the intervention and promote long term effects in behaviour change.
3. Materials	Materials that support the intervention will be provided to the participants through the platform and/or by email. The materials include: an educational package about hypertension and/or diabetes; cards that are shown throughout the program (in the app) highlighting the most important aspects of a healthier lifestyle; and a personalized program that is sent every month with the detailed information for the 8 days or 30 days ahead (for example, with the nutritional plan or the scheduled calls with the psychologist or nutritionist).
4. What and how	The program duration can vary between 60 and 90 days (hypertension and the type 2 diabetes programs respectively).In the hypertension program, there is an initial call by a nurse that collects the clinical history and then another call from a psychologist for an initial psychological assessment. Then, all the monitoring and implementation of the program in made automatically by the app. At specific times (defined with each patient throughout the program), there will be a call from the health psychologist to promote the adherence to the program and therapeutics. In the beginning of each month, the user receives a detailed program for that 30 days. Regarding the type 2 diabetes program, the use of the platform will be mainly to facilitate the communication between health psychologists and the nutritionist and to provide the materials relevant for the program. There is also a notification service that will allow the user to be notified every time there is a session scheduled or that he/she has a new aim to fulfil that week. Through the platform, they have also the opportunity to message the professional that is following him/her. Contrary to the hypertension program, in the type 2 diabetes program, there will be set aims every 8 days.
5. Who provided	A multidisciplinary team provides the services. At this moment our time is composed by experienced GP's, nurses, health psychologists and nutritionists, all registered in professional boards. Health psychologists are responsible for the implementation of the programs and for promoting the compliance to it; nurses have the responsibility to collect the clinical data and nutritionists are responsible for elaborating the nutritional plan. GP's supervise the therapeutic plan.
6. Where	All the interventions are performed with the use of a platform or mobile app. Video chat, calling and messaging is also applied.
7. When and how often	Interventions are designed for a period of 90 days or 60 days and the interaction with the health professionals is determined by each user when they initiate the program.
8.1. Planned variation	Not applicable.
8.2. Unplanned variation	Not applicable.
9.1. How well	The intervention activities delivered for each program will be recorded within the P5 platform. An audit will also be implemented periodically (quarterly) to monitor the notes about intervention delivery for each program.

NOTE: we are still working on the programs and changes are possible to be performed after the pilot.

being. A healthcare shift from a disease reactive mode of action, to a predictive, preventive, personalized and participatory care (P4 medical concept) was already observed (Hood & Friend, 2011; Vogt, Hofmann, & Getz, 2016). Adding to the mobile applications and behaviour change platforms, P5 counts with a multidisciplinary that will individualize the intervention to the specific needs of the user and provide the proximity between the individual and his/her health care providers (i.e. the reason why we call the project P5). Importantly, this proactive mode of action in healthcare enables more effective and sustainable actions by focusing on the preventive and personalized dimension; furthermore, in this approach, causes rather than symptoms, are the focus of intervention. By working together in healthcare networks of different levels of complexity (from primary care to the highest hospital differentiation) and with the appropriate digital support, we can reduce the incidence of chronic diseases, which are currently responsible for 75% of global healthcare costs.

We are currently conducting focus groups with different stakeholders, including with patients, caregivers and health professionals in order to obtain information about the real needs of each of these groups, as well as the best strategies to tackle them with our interventions. We will use specific platforms and apps that set specific aims for each week of the intervention, and that will be complemented by the action of the health coaches at the level of health literacy and motivation.

When working with digital technology, data safety is a crucial topic to address. Within P5 project, we assured that sensitive data is protected. For this, we have a data protection office (DPO) that helps us in understanding and implementing the best strategies to ensure data safety. Ethic committees were also considered in this process. There is also a policy to ensure transparent data governance and security, responsibility, time and place of storage, traceability, property and market value of such data. Another aspect that makes our pilot very valuable is the fact that we will evaluate each platform used, in order to contribute to the real understanding of the value and long-term sustainability of such interventions.

In conclusion, the P5 initiative aims to bridge the benefits of digital technology to healthcare in a humanized context, assured by a multidisciplinary team that is critical for the success of behavioural and therapeutic interventions.

References

Avery, L., Flynn, D., Wersch, A. van, Sniehotta, F. F., & Trenell, M. I. (2012). Changing Physical Activity Behavior in Type 2 Diabetes: A systematic review and meta-analysis of behavioral interventions. *Diabetes Care, 35*(12), 2681–2689. https://doi.org/10.2337/dc11-2452

Campbell, M., Katikireddi, S. V., Hoffmann, T., Armstrong, R., Waters, E., & Craig, P. (2018). TIDieR-PHP: A reporting guideline for population health and policy interventions. *BMJ, 361*, k1079. https://doi.org/10.1136/bmj.k1079

Canadian Agency for Drugs and Technologies in Health. (2016). Trained Health Coaches for Chronic Disease Prevention or Management: A Review of Clinical and Cost-Effectiveness and Guidelines. Obtido de http://www.ncbi.nlm.nih.gov/books/NBK343957/

Castro Sweet, C. M., Chiguluri, V., Gumpina, R., Abbott, P., Madero, E. N., Payne, M., … Prewitt, T. (2018). Outcomes of a Digital Health Program With Human Coaching for Diabetes Risk Reduction in a Medicare Population. *Journal of Aging and Health, 30*(5), 692–710. https://doi.org/10.1177/0898264316688791

Cianflone, D., Del Mauro, G., Colombo, E., Bordignon, T., Costeri, S., Fabi, M., & Viscone, I. (2016). Prevalence of optimal blood pressure

values in digital-savvy hypertensives. *Journal of the American Society of Hypertension, 10*(4), e23. https://doi.org/10.1016/j.jash.2016.03.052

Craig, P., Dieppe, P., Macintyre, S., Michie, S., Nazareth, I., & Petticrew, M. (2008). Developing and evaluating complex interventions: The new Medical Research Council guidance. *The BMJ, 337*. https://doi.org/10.1136/bmj.a1655

Dowding, D., Lichtner, V., & Closs, S. J. (2017). Using the MRC Framework for Complex Interventions to Develop Clinical Decision Support: A Case Study. *Studies in Health Technology and Informatics, 235,* 544–548.

Ernsting, C., Dombrowski, S. U., Oedekoven, M., O Sullivan, J. L., Kanzler, M., Kuhlmey, A., & Gellert, P. (2017). Using Smartphones and Health Apps to Change and Manage Health Behaviors: A Population-Based Survey. *Journal of Medical Internet Research, 19*(4), e101. https://doi.org/10.2196/jmir.6838

Grist, R., Porter, J., & Stallard, P. (2017). Mental Health Mobile Apps for Preadolescents and Adolescents: A Systematic Review. *Journal of Medical Internet Research, 19*(5), e176. https://doi.org/10.2196/jmir.7332

Groarke, J. M., Richmond, J., Kelly, M. G., McSharry, J., Groarke, A., Kerr, T., … Walsh, J. (2019). Examining the Impact of a Personalized Self-Management Lifestyle Program Using Mobile Technology on the Health and Well-Being of Cancer Survivors: Protocol and Rationale for a Randomized Controlled Trial (The Moving On Study). *JMIR Research Protocols, 8*(8), e13214. https://doi.org/10.2196/13214

Haas, K., Hayoz, S., & Maurer-Wiesner, S. (2019). Effectiveness and Feasibility of a Remote Lifestyle Intervention by Dietitians for Overweight and Obese Adults: Pilot Study. *JMIR MHealth and UHealth, 7(*4), e12289. https://doi.org/10.2196/12289

Hoffmann, T. C., Glasziou, P. P., Boutron, I., Milne, R., Perera, R., Moher, D., … Michie, S. (2014). Better reporting of interventions: Template for intervention description and replication (TIDieR) checklist and guide. *BMJ, 348*, g1687. https://doi.org/10.1136/bmj.g1687

Hood, L., & Friend, S. H. (2011). Predictive, personalized, preventive, participatory (P4) cancer medicine. *Nature Reviews Clinical Oncology, 8*(3), 184–187. https://doi.org/10.1038/nrclinonc.2010.227

Jamaladin, H., van de Belt, T. H., Luijpers, L. C., de Graaff, F. R., Bredie, S. J., Roeleveld, N., & van Gelder, M. M. (2018). Mobile Apps for Blood Pressure Monitoring: Systematic Search in App Stores and Content Analysis. *JMIR MHealth and UHealth, 6*(11), e187. https://doi.org/10.2196/mhealth.9888

Lean, M. E., Leslie, W. S., Barnes, A. C., Brosnahan, N., Thom, G., McCombie, L., … Taylor, R. (2018). Primary care-led weight management for remission of type 2 diabetes (DiRECT): An open-label, cluster-randomised trial. *The Lancet, 391*(10120), 541–551. https://doi.org/10.1016/S0140-6736(17)33102-1

Marshall, J. M., Dunstan, D. A., & Bartik, W. (2019). Clinical or gimmickal: The use and effectiveness of mobile mental health apps for treating anxiety and depression. *The Australian and New Zealand Journal of Psychiatry*, 4867419876700. https://doi.org/10.1177/0004867419876700

Morrissey, E. C., Glynn, L. G., Casey, M., Walsh, J. C., & Molloy, G. J. (2018). New self-management technologies for the treatment of hypertension: General practitioners' perspectives. *Family Practice, 35*(3), 318–322. https://doi.org/10.1093/fampra/cmx100

Pellmar, T. C., Brandt, E. N., & Baird, M. A. (2002). Health and Behavior: The Interplay of Biological, Behavioral, and Social Influences: Summary of an Institute of Medicine Report. *American Journal of Health Promotion, 16*(4), 206–219. https://doi.org/10.4278/0890-1171-16.4.206

Piko, B. F. (2004). Interplay between self and community: A role for health psychology in

Eastern Europe's public health. *Journal of Health Psychology, 9*(1), 111–120. https://doi.org/10.1177/1359105304036105

Rathbone, A. L., & Prescott, J. (2017). The Use of Mobile Apps and SMS Messaging as Physical and Mental Health Interventions: Systematic Review. *Journal of Medical Internet Research, 19*(8), e295. https://doi.org/10.2196/jmir.7740

Redfern, J. (2019). Can Older Adults Benefit from Smart Devices, Wearables, and Other Digital Health Options to Enhance Cardiac Rehabilitation? *Clinics in Geriatric Medicine, 35*(4), 489–497. https://doi.org/10.1016/j.cger.2019.07.004

Rohde, A., Lorkowski, S., & Dawczynski, C. (2017). Dietary mobile apps: Acceptance among young adults. A qualitative study. *Ernahrungs Umschau, (64*(2)), 36–43. https://doi.org/10.4455/eu.2017.007

Vogt, H., Hofmann, B., & Getz, L. (2016). The new holism: P4 systems medicine and the medicalization of health and life itself. *Medicine, Health Care and Philosophy, 19*(2), 307–323. https://doi.org/10.1007/s11019-016-9683-8

Walsh, J. C., & Groarke, J. M. (2019). Integrating Behavioral Science With Mobile (mHealth) Technology to Optimize Health Behavior Change Interventions. *European Psychologist*. Obtido de https://econtent.hogrefe.com/doi/abs/10.1027/1016-9040/a000351

Wang, K., Varma, D. S., & Prosperi, M. (2018). A systematic review of the effectiveness of mobile apps for monitoring and management of mental health symptoms or disorders. *Journal of Psychiatric Research, 107*, 73–78. https://doi.org/10.1016/j.jpsychires.2018.10.006

OECD/EU. (2016). *Health at a Glance: Europe 2016*. Paris, France: OECD Publishing.

World Health Organization. *World Health Statistics Overview 2019. Monitoring health for the sustainable development goals (SDGs)*. https://apps.who.int/iris/bitstream/handle/10665/311696/WHO-DAD-2019.1-eng.pdf assessed at 30/08/2019.

World Health Organization 2018. *Digital technologies: shaping the future of primary health care. Technical Series on Primary Health Care*. https://www.who.int/docs/default-source/primary-health-care-conference/digital-technologies.pdf?sfvrsn=3efc47e0_2.

Liliana Amorim
Life and Health Sciences Research Institute (ICVS), School of Medicine, University of Minho, Campus Gualtar, Braga, Portugal
ICVS/3B's - PT Government Associate Laboratory, Braga/Guimarães, Portugal.
Association P5 Digital Medical Centre (ACMP5), Braga, Portugal.
liliana@p5.pt

Fábio Borges
Life and Health Sciences Research Institute (ICVS), School of Medicine, University of Minho, Campus Gualtar, Braga, Portugal
Association P5 Digital Medical Centre (ACMP5), Braga, Portugal.
fabioborges@med.uminho.pt

Inês Fernandes
Association P5 Digital Medical Centre (ACMP5), Braga, Portugal.
ines@p5.pt

Marina Gonçalves
Life and Health Sciences Research Institute (ICVS), School of Medicine, University of Minho, Campus Gualtar, Braga, Portugal
Association P5 Digital Medical Centre (ACMP5), Braga, Portugal
marinagoncalves@med.uminho.pt

Nuno Santos
Association P5 Digital Medical Centre (ACMP5), Braga, Portugal.
nsantos@icognitus.com

Pedro Morgado
Life and Health Sciences Research Institute (ICVS), School of Medicine, University of Minho, Campus Gualtar, Braga, Portugal
ICVS/3B's - PT Government Associate Laboratory, Braga/Guimarães, Portugal
Association P5 Digital Medical Centre (ACMP5), Braga, Portugal
pedromorgado@med.uminho.pt

Nuno Sousa
Life and Health Sciences Research Institute (ICVS), School of Medicine, University of Minho, Campus Gualtar, Braga, Portugal
ICVS/3B's - PT Government Associate Laboratory, Braga/Guimarães, Portugal
Association P5 Digital Medical Centre (ACMP5), Braga, Portugal
njcsousa@med.uminho.pt