The Back-UP Project: Towards predictive diagnosis and personalised medicine for NLBP underpinned by the VPH technologies and vision

M. Hoz de Vila, A.F. Frangi

Department of Electrical & Electronic Engineering, The University of Sheffield, United Kingdom

* Correspondence: *m.hoz@sheffield.ac.uk, CISTIB, Pam Liversidge Building, Mappin St., Sheffield S1 3JD, UK*

1. Introduction
The EU funded Back-Up research project will develop, integrate, and validate, patient-specific multifactorial prognostic models to support an effective and efficient management of non-specific Neck and Low Back Pain (NLBP), a complex health problem with major impact on healthcare and worker disability. This paper introduces the concept, components and benefits of this novel predictive modeling platform.

2. Materials and Methods
NLBP is a dynamic process where biological, psychological, social and economic factors change over time following complex patterns [1]. Information and statistical models from those multidisciplinary dimensions will be integrated into a comprehensive unified system, able to deliver a reliable prognostic model based on the digital representation of multidimensional data, ranging from the molecular level (glycomics) to musculoskeletal structures, integrating as well, the wider psychological, socioeconomic and lifestyle context. Additionally, an integration with the Self-Back [2] platform will incorporate records of patient's physical activities tracked by wearable sensors, and self-assessment data submitted using a mobile application.

All heterogeneous data, models, and analysis pipelines will be integrated into MULTI-X [3], a cross-domain research-oriented platform, designed for collaborative, and reproducible science. This computational and data-intensive analysis platform is the outcome of more than a decade of collaboration within different VPH-related projects. Its service-oriented architecture tailored to data federation was initially defined in @neurIST [4]. The first shared *infostructure* was delivered by VPH-Share [5]. Afterwards, VPH-DARE@IT [6] took over its development incorporating highly demanded research services, such as container-based workflow execution, big data analytics, on-demand machine learning and data visualisation tools. MULTI-X will be the underlying core of the system. All its resources and capabilities will be made available through tight integration with ANTARI Home Care [7], an existing innovative e-health platform that will be the portal for patients, clinicians, and employers to track and support personalised plans of intervention for recovery and adaptation of workplace.

3. Results
With a combination of mechanistic and data-driven approaches, Back-UP has the potential to extend *in-silico* techniques to the level of virtual clinical trials to produce personalised prognostics on the probability of recovery, risk of recurrence, cost analysis of treatment and return to work timeframe, and simulations of affected musculoskeletal function. The ultimate biopsychosocial assessment-intervention model will be individually tailored for each patient with chronic pain. Quantifiable results will be reported in subsequent studies.

4. Discussion and Conclusions
Patients, clinicians, insurance entities and prevention services, will benefit from the proposed solution, which approach goes beyond the traditional scope of medicine, encompassing also, social and occupational science. Both, the integrative multi-scale methodology, and the development upon technologies targeted to the VPH community represent an example of the prevalence and success of the VPH initiative.

5. References
1. Bevers, K., et al., US Neurology, 2016;12(2):98–104
2. Bach, K., et al., Cham: Springer Int. Pub, 2016;32-46
3. MULTI-X portal, https://multi-x.org
4. http://cordis.europa.eu/project/rcn/79500_en.html
5. http://cordis.europa.eu/project/rcn/97442_en.html
6. http://cordis.europa.eu/project/rcn/108367_en.html
7. https://www.gmv.com/en/Products/antari_ehealth_epidemiology_solutions/antari_home_care

Acknowledgements: