

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

Milton Hoz de Vila<sup>1</sup>, Alejandro F. Frangi<sup>1</sup>

<sup>1</sup>Center for Computational Imaging & Simulation Technologies in Biomedicine (CISTIB), University of Leeds, UK

## Introduction

The EU funded Back-Up research project ([www.backup-project.eu](http://www.backup-project.eu)) will develop, integrate, and validate, patient-specific multifactorial prognostic models to support 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.

## Materials and Methods

NLBP is a dynamic process where biological, psychological, social and economic factors change over time following complex patterns<sup>1</sup>. Information and statistical models from those multidisciplinary dimensions will be integrated into a comprehensive unified system (Fig. 1) 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 broader psychological, socioeconomic and lifestyle context.

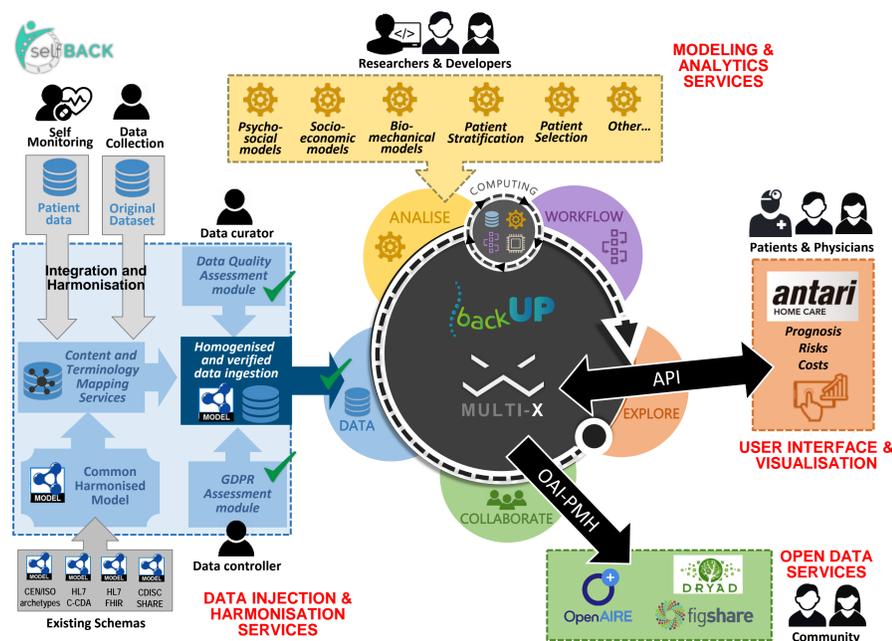


Fig. 1 Diagram of the integration of the different components of the Back-UP Platform

**MULTI-X** ([www.multi-x.org](http://www.multi-x.org)) will be the underlying core of the system. An integration with **SelfBACK**<sup>2</sup> ([www.selfback.eu](http://www.selfback.eu)) will incorporate records of the patient's physical activities tracked by wearable sensors, and self-assessment data submitted using a mobile application. All these resources will be made available through tight integration with **ANTARI Home Care** ([www.gmv.com](http://www.gmv.com)), an existing 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.

## 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: (i) personalised prognostics on the probability of recovery, (ii) risk of recurrence, (iii) cost analysis of treatment and return to work timeframe, and (iv) simulations of affected musculoskeletal function. Quantifiable results will be reported in subsequent studies.

## Acknowledgments

The authors would like to thank the European Research Council (Back-UP, ID 777090) for providing financial support to this project.

## Conclusion and Future Work

The ultimate assessment-intervention model will be individually tailored for each patient with chronic pain. Patients, clinicians, insurance entities and prevention services, will benefit from the proposed solution, which approach goes beyond the traditional scope of medicine, also encompassing, social and occupational science.

Within this project, MULTI-X will be further enhanced and will continue to support scientists by providing a general-purpose, scalable, and integrative computational framework (Fig. 4).

## References

- [1] Bevers K., et al. "The Biopsychosocial Model of the Assessment, Prevention, and Treatment of Chronic Pain". *US Neurology* 12.2 (2016): 98-104
- [2] Bach, K., et al., "Case Representation and Similarity Assessment in the selfBACK Decision Support System," *Cham*, 2016, Springer pp. 32-46

## MULTI-X, an ecosystem for biomedical research

All Back-UP heterogeneous datasets, models, and analysis pipelines will be integrated into MULTI-X, a cloud-based cross-domain research-oriented platform, designed for collaborative, and reproducible science (Fig. 2).

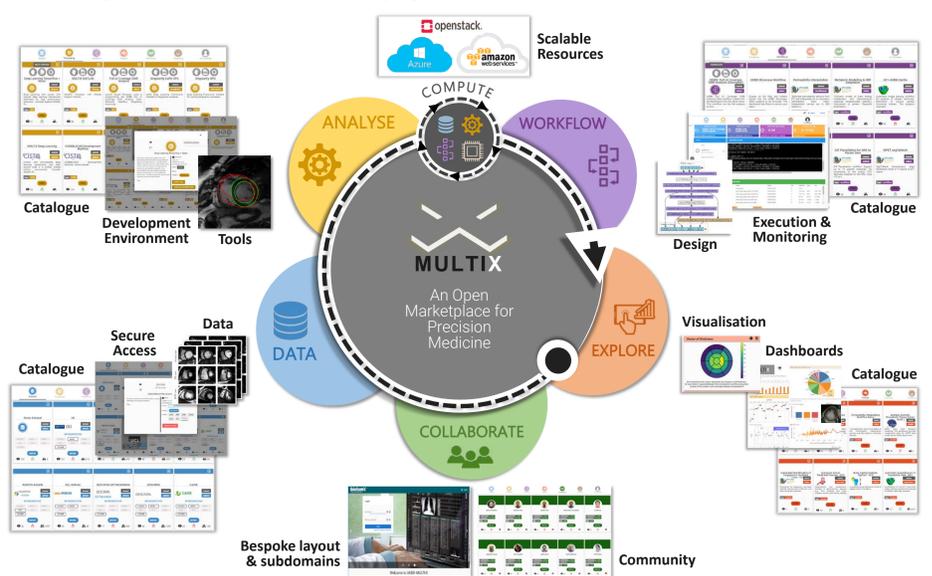


Fig. 2 Diagram of components and screenshots of the corresponding areas of MULTI-X

This computational and data-intensive analysis platform is the outcome of more than a decade of collaboration within different VPH-related projects (Fig. 3).

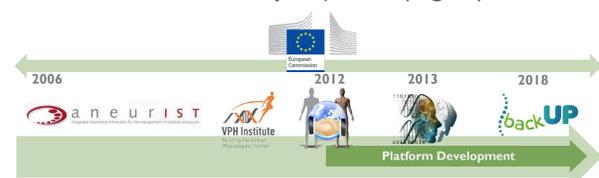


Fig. 3 EU Projects involved in the conception and development of MULTI-X

MULTI-X was designed to foster development, integration, and testing of scientific tools, facilitating their connection with large-scale federated data repositories and providing analysis tools to get immediate insights about the data processed. It integrates highly demanded research services, such as container-based workflow execution, big data analytics, on-demand machine learning tools and data visualisation components. Back-UP will fully leverage the capabilities offered by this comprehensive and modular platform.

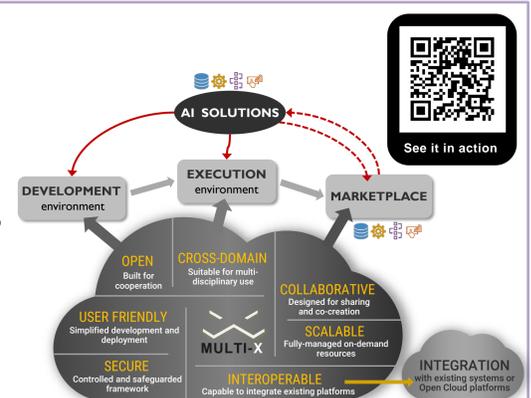


Fig. 4 MULTI-X addresses the complete process of co-creation of data analytics solutions.

## Acknowledgments

The authors would like to thank the European Research Council (Back-UP, ID 777090) for providing financial support to this project.

## References

- [1] Bevers K., et al. "The Biopsychosocial Model of the Assessment, Prevention, and Treatment of Chronic Pain". *US Neurology* 12.2 (2016): 98-104
- [2] Bach, K., et al., "Case Representation and Similarity Assessment in the selfBACK Decision Support System," *Cham*, 2016, Springer pp. 32-46