

Personalised Rehabilitation via Novel AI Patient Stratification Strategies

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Background

Rehabilitation is a multimodal collaborative person-centered process, based on prediction and stratification (1). **Idiopathic Scoliosis** has specificities as it deals with the prevention of future disability in adulthood due to progression or spinal fusion. **Prediction models** are needed to better understand its natural history and determinants of the success of treatments. These models will allow to better tailor therapies and avoid over- and under-treatment. Some predictors of treatment success are individually known, but they have rarely been combined in more complex models. **Artificial Intelligence (AI)** methods could allow new insights into these predictors. PREPARE aims to advance rehabilitation by developing, validating, and implementing robust, clinically relevant, and **data-driven computational prediction and stratification tools**.

Methods

PREPARE Rehab is a 4 years **HaDEA-Horizon project**. Machine learning (ML) techniques will be utilized on nine extensive patient datasets. A **platform** will be created to share model results, leveraging the open-science **EHDEN** platform and adopting the Observational Medical Outcomes Partnership (**OMOP**) Common Data Model (**CDM**) standard. The partners will develop prediction and stratification ML strategies, which will be validated through **demonstration studies** in the nine health conditions. For the case of Idiopathic Scoliosis ISICO, that delivers rehabilitation to children with scoliosis, will exploit a tertiary care facility's database. Data comprise demographics, disease characteristics, clinical reported outcomes and PROMs, and are collected electronically at baseline and every 4 to 6 months. Natural history information is available for patients who had previous X-rays without treatment.

Transforming Rehabilitation: Personalised Care for a Better Quality of Life

PREPARE aims at improving the lives of people with chronic noncommunicable diseases by developing tools that will enable patients and their healthcare providers to select optimal therapy strategies.



Results

For the case of **Idiopathic Scoliosis**, data from **21026 patients** (4588 males) are being analysed. Age was 12.6 ± 2.6 years, Cobb angle $25.6 \pm 13.6^\circ$, Angle of Trunk Rotation $8.3 \pm 4.1^\circ$. A brace was prescribed to 9704 patients, and specific exercises to 7854 patients. The ISYQOL questionnaire of 6377 patients showed a score of $61.6 \pm 14.6\%$, and the SRS-22 of 9174 was 4.1 ± 0.4 .

Final expected results are 1) A unified advanced decision-support platform for the management of big data and federated access to clinical data; 2) Novel patient stratification methods and prediction models enhanced by advanced ML/AI tools; 3) Medical Device Regulation roadmap for any (software as a) medical device embedding. Deployment and validation of PREPARE tools/applications in realistic operational conditions through nine pilot cases, with the effective participation of end-users.

Conclusion

Exploiting the latest advances in clinical, socio-behavioural and public health research, data science, and advanced statistical and AI learning methods, PREPARE will pave the way to more personalized, reliable, and holistic rehabilitation and care that considers external circumstances and patient factors to improve quality of care and life, for nine clinical cases, including idiopathic scoliosis.

References

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