

Developing a Clinical Decision Support System Software Prototype that Assists in the Management of Patients with Self-Harm based on the Use of National Registries Harmonized in OMOP CDM: the PERMANENS Project

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Background

The damaging impact of **self-harm and suicide** is profound in society, with over 700,000 global suicides annually, signifying the loss of millions of life years and affecting numerous lives. Europe struggles with notable suicide rates but faces challenges in surveillance due to inconsistent definitions and methods. Emergency departments (EDs) serve as essential points of intervention for those who self-harm, yet there is variability in the quality of care provided, often influenced by stigma and a lack of specialist training. This inconsistency can affect treatment uptake and patient engagement.

In this study, we describe the process, usefulness, and challenges of harmonizing national registries **focused on suicide attempts** using the **Observational Medical Outcomes Partnership (OMOP) Common Data Model (CDM)** applied in the Towards Personalized Clinical Management of Suicide Risk through Data Driven Clinical Decision Support using Translational Electronic Registry Data (**PERMANENS**) project.

Methods

The PERMANENS project employs a multidisciplinary approach, combining clinical mental health research, public health, biostatistics, and informatics **to construct a Clinical Decision Support System (CDSS)**. This system is trained on diverse European registry data harmonized using the OMOP Common Data Model (CDM) and is designed to offer personalized risk assessments and management strategies for emergency department (ED) patients presenting with self-harm. The OMOP CDM, developed by the Observational Health Data Sciences and Informatics (OHDSI), is used to transform and harmonize all registry data from the four sites into a common data format using standard terminologies, vocabularies, and coding schemes.

The core of the CDSS is machine learning-based prediction models, designed to be clinically interpretable. These models predict key adverse outcomes, such as repeat self-harm or suicide, leveraging large datasets to understand complex interactions. Additionally, a systematic review creates a clinical knowledge base for effective interventions.

Table 1. The sources include the National Self-Harm Registry and the Hospital In-Patient Enquiry (Ireland); the Norwegian Patient Registry, the Norwegian Cause-of-Death Register, Statistics Norway's Events Database, and the Norwegian Central Population Registry (Norway); the Swedish National Patient Registry, the Swedish Cause-of-Death Register, the Swedish Total Population Register, and electronic healthcare records retrieved from Stockholm County Council (Sweden); and the Data Analytics Program for Health Research and Innovation (Catalonia, Spain).

	Ireland	Norway	Sweden		Catalonia (Spain)
Target population	All patients with hospital-presenting self-harm in the Republic of Ireland	All Norwegian residents	All psychiatric emergencies in Stockholm aged ≥ 18	All Swedish residents aged 18-39	All Catalan residents
N available for analysis	$\pm 163,000$ patients	± 5.4 mil	$\pm 75,000$ patients	± 5 mil	811,394 cases and controls
Time span	2002-2020	2008-2019	2016-2022	1993-2016	2014-2019

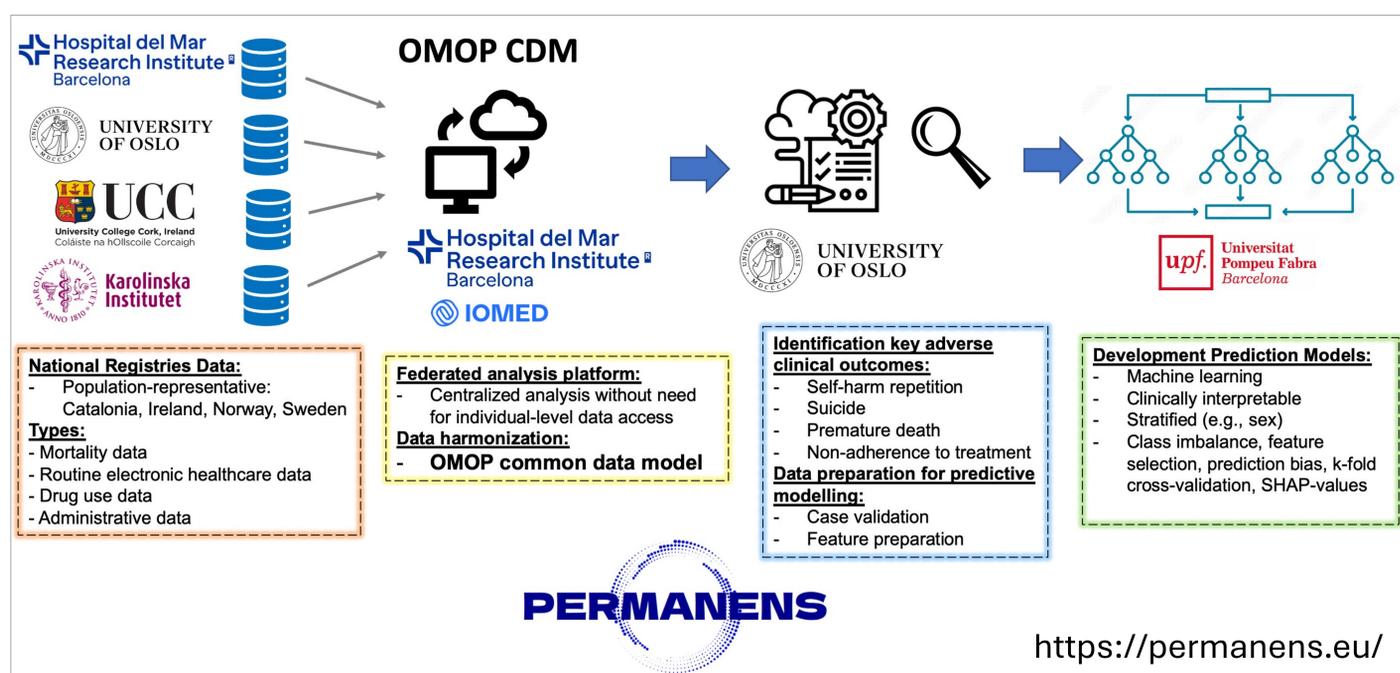


Figure 1. Pipeline utilizing OMOP CDM and Machine Learning technologies in the PERMANENS project, involving data harmonization, federated analysis, and development of predictive models for key clinical outcomes.

Conclusions

The PERMANENS project encapsulates the potential of personalized medicine in mental health care, particularly for those at risk of self-harm and suicide. **The project stands out for its inclusive machine learning models, implementation research with stakeholders, and focus on personalized care using the OMOP Common Data Model.** It emphasizes the indispensability of involving patients and healthcare professionals in the developmental process to ensure the system is aligned with real-world clinical needs. This initiative holds promise for revolutionizing suicide risk assessment and intervention in EDs, setting a new standard for personalized, data-informed healthcare solutions.

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