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Machine Learning-Based Clinical Decision Support System for Suicide Risk Management: The PERMANENS Project

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Abstract. The PERMANENS European project addresses the global public health challenge of self-harm and suicide by developing a machine learning-based Clinical Decision Support System (CDSS) to assist emergency departments (EDs) in providing personalized care. With over 700,000 suicides annually, suicide prevention is critical, especially in Europe where consistent surveillance is lacking. The project harmonizes national suicide attempt registries from regions in Spain, Ireland, Norway, and Sweden using the OMOP Common Data Model (CDM) to create a comprehensive database for real-time analysis.

Keywords. Suicide, self-harm, machine learning, clinical support system

1. Introduction

Self-harm and suicide represent a significant global public health challenge, with over 700,000 suicides annually, leading to a tremendous loss of life and profound societal impacts [1]. Europe faces particularly high suicide rates, yet a consistent understanding of its prevalence is hindered by the lack of standardized definitions and surveillance

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methods across countries. The focus of this study is to explain the potential of the "Towards Personalised Clinical Management of Suicide Risk through Data-Driven Clinical Decision Support using Transnational Electronic Registry Data" (PERMANENS) European project [2], which aims to harmonize national registries focused on suicide attempts using the Observational Medical Outcomes Partnership (OMOP) Common Data Model (CDM) [3]. The project runs from March 2023 to February 2026.

2. Methods

The PERMANENS project adopts a multidisciplinary approach, merging clinical mental health research, public health expertise, biostatistics, and biomedical informatics to develop a robust CDSS. It is a non-interventional retrospective registry-based case-control study. This system will be trained on registry data from four European regions - Catalonia (Spain), Ireland, Norway, and Sweden, including more than 10 million patients. The project aims to produce machine learning-based prediction models that will help clinicians identify key adverse outcomes, such as repeated self-harm or suicide, providing them with personalized risk profiles and tailored management plans.

3. Results, Discussion and Conclusions

The PERMANENS project holds significant promise in transforming how self-harm and suicide risks are managed in EDs. Through the integration of machine learning and clinical knowledge bases, the CDSS developed under this project has the potential to provide more precise, data-driven interventions, ultimately improving patient outcomes [4]. The PERMANENS project exemplifies the potential of combining precision medicine with clinical decision support systems to enhance the care of patients at risk of self-harm and suicide.

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