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Machine learning model development to retrospectively predict suicide attempts in the Millenium Cohort Study sample

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Introduction: Suicidal behavior is a complex phenomenon that affects all demographics, with children and adolescents being particularly vulnerable. It is associated with multifactorial conditions that must be considered for the development of more effective prevention strategies. The use of machine learning (ML) models to predict suicide attempts is becoming widespread, as they allow for the simultaneous testing of numerous factors, their complex interactions, and non-linearity in predictive model creation. The Millennium Cohort Study (MCS) is an observational, multidisciplinary cohort study that encompasses a wide range of dimensions, including psychological, genetic, biological, familial, social, and economic factors, as well as traumatic life events, family history, and medical history. This allows for the exploration of their relationship with suicidal behavior throughout individual development using ML models.

Objectives: The aim was to develop a statistical method that applies ML models to retrospectively predict suicide attempts using structured tabular data from an adolescent cohort defined by the MCS.

Methods: The sample consists of 9,824 MCS participants (age 17) who were asked if they had ever purposely hurt themselves in an attempt to end their life. Of these, only 7.4% (725) responded affirmatively. Before starting the modeling phase and fine-tuning any algorithm, several stages were completed: data cleaning, feature extraction and engineering, and feature scaling and selection. We used a wide range of algorithms, from low-complexity (linear regression) to high-complexity (neural networks), while tracking their effectiveness, robustness, generalization, sensitivity, and accuracy.

Results: Even though overall accuracy ranged from 0.83 to 0.87, we generally obtained low f1-scores (˜0.45-0.55) for the targeted class (suicide attempt) and high f1-scores (˜0.95) for the control class. Similar results were observed for precision scores; however, the recall scores were good for both classes, ranging from 0.67 to 0.87. The best performing models were logistic regression and neural networks.

Conclusions: These preliminary results shows that ML models trained with multidimensional data from a young cohort are sensitive in classifying individuals who have attempted suicide. We aim to improve the f1-score and area under the curve (AUC) metrics for the target class through several techniques: over/under-sampling, target encoding, class weight adjustments, ensemble methods, and various neural network architectures.

Disclosure of Interest: None Declared

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Early Interventions for Preventing Self-Harm Recurrence: A Systematic Review and Meta-Analysis

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Introduction: Deliberate self-harm (DSH) is a strong predictor of future suicide attempts (SAs), highlighting the need to evaluate interventions that reduce recurrence risk.

Objectives: This systematic review and meta-analysis aimed to evaluate pharmacological and non-pharmacological interventions for preventing repeated DSH in individuals recently engaged in DSH. We also examined how participants' characteristics and trial inclusion criteria impacted interventions' effectiveness.

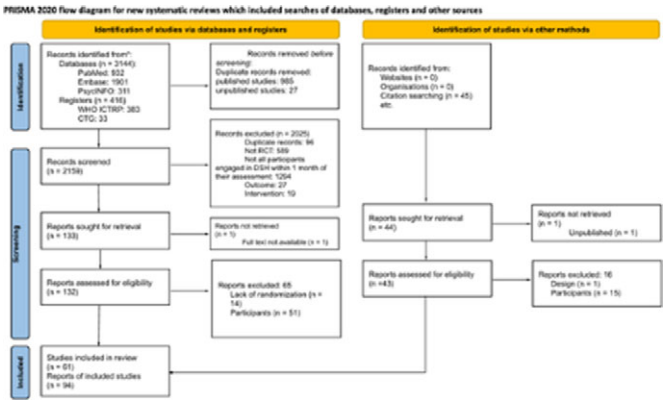
Methods: Randomized controlled trials (RCTs) with participants engaged in DSH within one month before enrollment were included. Studies with participants showing only suicidal ideation or older DSH were excluded. We searched five databases (PubMed, Embase, PsycINFO, WHO ICTRP, and ClinicalTrials.gov) with no language restrictions through September 2023. Two reviewers independently selected studies and resolved discrepancies through discussion. Outcomes were assessed at three time points: T1 (0–6 months), T2 (6–12 months), and T3 (>12 months). The primary outcome was repeat DSH; secondary outcomes included suicidal ideation, suicide deaths, all-cause mortality, anxiety, depression, hopelessness, and quality of life. Interventions were categorized by type and delivery format (individual or group, remote or in-person).

Results: The PRISMA flowchart is shown in Image 1. Sixty-one trials involving 125 comparisons and 21,147 participants were included in this review. Average age was 31.5 years, with most being female (66.58%), unmarried (60.82%), and white (65.49%). Participants' history of self-harm was noted in 48 studies, with at least 56% having engaged in another act before inclusion. In 42 studies, suicidal intent was either not investigated or not required. The most common types of interventions were Treatment As Usual (TAU) (46 arms), Psychotherapy (36), and Active Contact and Follow-up (25). Interventions were primarily applied individually and in person (84), with Cognitive Behavioral Therapy (16) being the most frequent psychotherapy framework. Psychotherapies were associated with a reduced risk of new self-harm acts within the first six months (T1) compared to TAU (k = 12; N = 2110; OR = 0.69; 95% CI 0.48–0.99). Active contact and follow-up interventions

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outperformed TAU in the longer-term follow-up (T3) (k = 4; N = 3724; OR = 0.83; 95% CI 0.70–0.99).

Image 1:



Conclusions: The superiority of psychotherapies at six months was not sustained at twelve months. However, active contact and follow-up interventions may offer benefits in reducing the risk of self-harm recurrence after one year.

Disclosure of Interest: None Declared

O079

Modeling data-driven clusters of social determinants of health (SDoH) and their associations with US suicide from 2009-2019

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Introduction: Social determinants of health (SDOH) have been linked to disparities in suicide rates across various demographics, including racial/ethnic groups, sex, age, and geography in the U.S. However, most studies have focused on individual or selected SDOH, rather than examining comprehensive, multi-dimensional SDOH factors. A more nuanced understanding of how clusters of SDOH contribute to suicide disparities across counties is needed to inform targeted prevention strategies.
Objectives: To identify multi-dimensional SDOH county clusters and estimate their geographic and temporal associations with county-level suicide rates.
Methods: This study used national SDOH data from 3,109 U.S. counties over three time periods (2009, 2014, and 2019), matching them with county-level suicide rates from the National Vital Statistics System aggregated into three-year periods (2008-2010, 2013-2015, and 2018-2020). A total of 284 county-level SDOH variables, spanning six domains (social context, economic context, education, physical infrastructure, healthcare context, and natural environment), were analyzed using unsupervised machine learning algorithms to identify SDOH clusters. Associations between SDOH clusters and county-level suicide rates were estimated using negative binomial and LASSO regression.
Results: Three distinct SDOH clusters were identified (Figure 1):

- Cluster 1 ("REMOTE") included rural counties with elderly, marginalized populations and substandard housing.
- Cluster 2 ("COPE") represented counties with complex family dynamics, overburdened health systems, poverty, and extreme heat challenges.
- Cluster 3 ("DIVERSE") encompassed densely populated areas with immigrants, racial/ethnic minorities, environmental challenges, and economic inequality.

Geographically, REMOTE was more common in North and Central U.S., COPE in the South and Central U.S., and DIVERSE along the coasts. Suicide rates were highest in REMOTE counties, especially among men. COPE counties had elevated suicide rates among Whites, while DIVERSE counties saw higher rates among women and Black/Hispanic populations. Most counties (70%) remained within the same cluster over time, with stable suicide rate associations.
Conclusions: This study identified three multi-dimensional SDOH clusters that were associated with varying suicide rates across U.S. counties. These clusters offer insight into the social and environmental conditions contributing to suicide risk. Future prevention strategies should focus on addressing the distinct challenges within each cluster, such as housing inadequacies, healthcare access, and economic inequality, to reduce overall suicide rates and related disparities.

Disclosure of Interest: None Declared

O080

Machine learning based prediction of suicidal behaviors in patients with perinatal depression: a nationwide register-based cohort study

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Introduction: Previous results show that women who suffered from perinatal depression (PND) have a higher risk of suicidal behavior. However, clinical tools for predicting suicidal behavior among patients with PND are lacking.
Objectives: To develop a prediction model for suicidal behavior after PND using machine learning.
Methods: Leveraging nationwide Swedish register data, we included 57,848 women with PND diagnosed during 2001-2018 and identified 2,303 events of suicidal behavior up to 5 years after PND diagnosis. Based on our previous association studies, 16 predictors containing information on demographics and pregnancy characteristics were included after multiple imputation. The sample was randomly split into 80% as a training set and 20% for testing. Classification and Regression Tree (CART), Random