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COVID-19 and Suicide Tendency: Prediction and Risk Factor Analysis Using Machine Learning and Explainable AI

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Abstract

INTRODUCTION: Pandemics and epidemics have frequently led to a significant increase in the suicide rate in affected regions. However, these unnecessary deaths can be prevented by identifying the risk factors and intervening earlier with those at risk. Numerous empirical studies have exhaustively documented multiple suicide risk factors. In addition, many evidence-based approaches have employed machine learning models to diagnose vulnerable groups, a task that would otherwise be challenging if only human cognition were employed. To date, to the best of our knowledge, no research has been conducted on COVID-19-related suicide prediction.
OBJECTIVES: This research aims to develop a machine-learning model capable of identifying individuals who are contemplating suicide due to COVID-19-related complexities and assessing the potential risk factors.
METHODS: We trained a gradient-boosting model based on tree-based learners on 10067 data consisting of 76 features, which were primarily responses to socio-demographic, behavioural, and psychological questions about COVID-19 and suicidal behaviours.
RESULTS: The final model predicted individuals at risk with an auROC score of 0.77 and a 95% confidence interval of 0.77 to 0.88. The optimal cutoff produced a sensitivity of 31.37 percent and a specificity of 82.35 percent in predicting suicidal tendencies. However, the auPRC was only 0.26, with a 95 percent confidence interval of 0.13 to 0.38, as the class distribution was extremely unbalanced. Consequently, the scores for precision and recall were 0.35 and 0.31, respectively.
CONCLUSION: We investigated the risk factors, the majority of which were associated with sleeping difficulties, fear of COVID-19, social interactions, and other socio-demographic factors. The identified risk factors can be considered when formulating a policy to prevent COVID-19-related suicides, which can impose a long-term economic and health burden on society.

Keywords: COVID-19, Suicide, Machine Learning, Risk Factor, Explainable AI

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1. Introduction

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