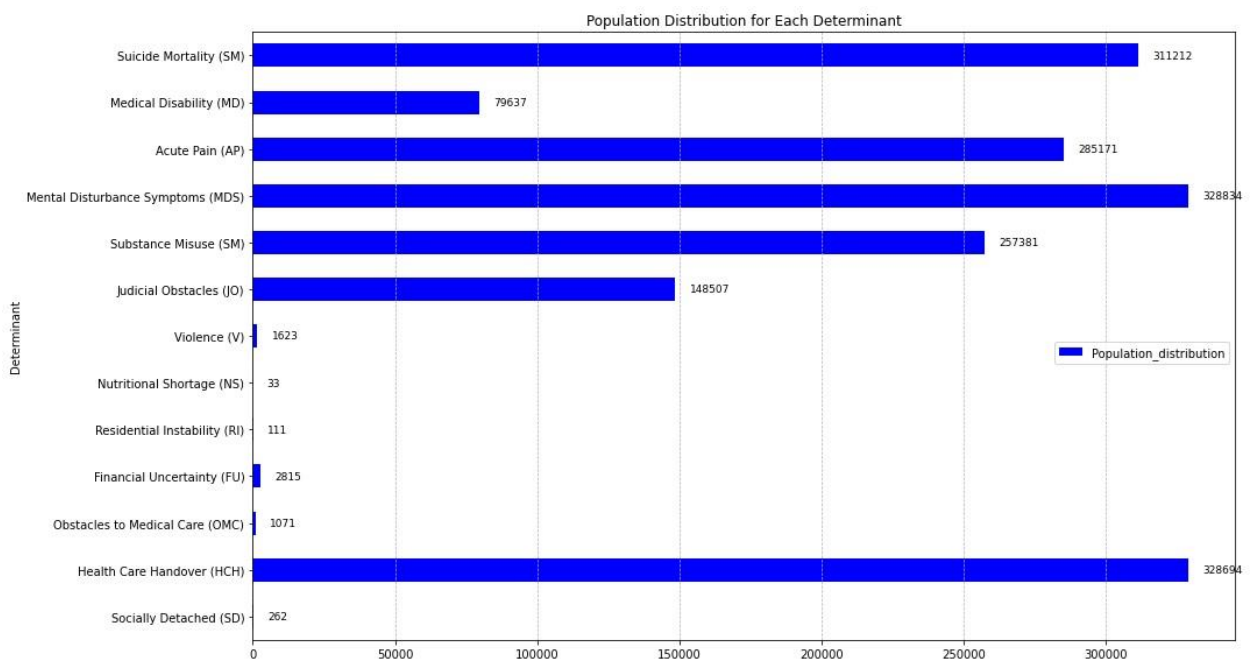


Supplementary Document 2

Finding Causal Impacts of Social Determinants of Mental Health on Opioid Use Disorder from Clinical Notes

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I. POPULATION DISTRIBUTION FOR EACH SOCIAL DETERMINANT IN OUR GENERATED SDMH-LOUD-CLINIC DATASET. THIS REPRESENTS THE NUMBER OF PATIENTS WHOSE CLINICAL NOTES INDICATE THE PRESENCE OF EACH SOCIAL DETERMINANT AS A TREATMENT VARIABLE.



II. OUR PROPOSED FRAMEWORK, HLLIA SHOWCASES EXAMPLE OF INTERACTIONS AND THE RESULTING TEXT RESPONSES GENERATED

You

Classify a text with the following Binary classes with explanation for each of them, why ChatGPT classified them such?

Class 0: No Opioid abuse exists.

Class 1: Opioid abuse exists.

New, if ChatGPT classifies as Class 1: Opioid abuse exists, then it will check for binary class of social determinants of Mental Health. Please Classify a text with the following Binary classes with explanation for each of them, why ChatGPT classified them such?

Class 0: No social determinants of Mental Health exist.

Class 1: One or more Social determinants of Mental Health exists.

New, ChatGPT classifies as Class 1: one or more social determinants of mental health exist, please classify further classification as one or more of the following classes of social determinants of mental health with appropriate explanation, why ChatGPT classified it such. Include Class numbers as well.

Class 1: Socially Detached (SD); Description: Recognizing the isolation experienced by individuals, the deficit of social engagement or support from relatives, and their nutritional or partnership conditions. Identifying the paucity of social ties and the resultant strain on family networks; Prototype Tokens or Keywords: Alone, unaccompanied, reclusive, estranged, lonesome, desolate.

Class 2: Health Care Handover (HCH); Description: Shifts in healthcare management, including medication changes or healthcare personnel transitions; updates in patient status involving discharge procedures or patient transfer protocols; Prototype Tokens or Keywords: Transfer, handover, treatment change, shift, care passage, service movement

Class 3: Obstacles to Medical Care (OMC); Description: Barriers in effective communication, especially impacting individuals with cognitive impairments; transportation issues that limit access to medical services, and the lack of relational trust or connectivity with healthcare providers; Prototype Tokens or Keywords: Accessibility hurdles, medical service barriers, entry obstacles, healthcare blockades, appointment difficulties, resource limitations

Class 4: Financial Uncertainty (FU); Description: Facing monetary hurdles, experiencing barriers to stable employment, and enduring underprivileged economic states; Prototype Tokens or Keywords: Financial insecurity, economic instability, monetary struggle, fiscal hardship, employment uncertainty, economic adversity

Class 5: Residential Instability (RI); Description: Dealing with residential instability, grappling with concerns over stable shelter, and uncertainties surrounding living conditions; Prototype Tokens or Keywords: Homelessness, eviction, housing instability, shelter issues, residential instability, lodging insecurity

Class 6: Nutritional Shortage (NS); Description: Insufficient access to balanced and healthy food options, dependency on community support and social welfare for meeting basic dietary needs, and the necessity of utilizing emergency food services; Prototype Tokens or Keywords: Hunger, malnutrition, food deficit, nutritional lack, famine, undernourishment

Class 7: Violence (V); Description: The existence or potential for violent encounters, experiencing or fearing severe mistreatment or aggression, the impact of discriminatory practices on personal security, and the psychological repercussions of violent thoughts or environments; Prototype Tokens or Keywords: Violence, cruelty, viciousness, ferocity, harshness, abuse

Class 8: Judicial Obstacles (JO); Description: The complexities of navigating legal systems, the repercussions of legal sanctions, the experience of being subject to judicial constraints, and the difficulties arising from legal disputes or criminal accusations; Prototype Tokens or Keywords: Legal hurdles, prosecution, legal entanglements, court challenges, legal disputes, juridical complications

Class 9: Substance Misuse (SM); Description: The complications associated with excessive or illicit consumption of substances, the medical and social challenges of addiction, and the risks and consequences of acute intoxication leading to overdose; Prototype Tokens or Keywords: Substance misuse, addiction, drug dependency, intoxication, overdose, chemical abuse

Class 10: Mental Disturbance Symptoms (MDS); Description: Experiences of profound emotional distress, the social withdrawal associated with mental health issues, barriers to cognitive and emotional regulation, and the patterns that may lead to seeking psychiatric or psychological intervention; Prototype Tokens or Keywords: Emotional distress, mental disorder, behavioral symptoms, psychological distress, mental disruption, affective disorder

Class 11: Acute Pain (AP);Description: Intense and severe physical suffering that may require clinical attention and management, often indicative of a significant underlying health issue; Prototype Tokens or Keywords: Torment, severe discomfort, throbbing, sharp pain, intense suffering, piercing agony

Class 12: Medical Disability (MD);Description: The reliance on support due to medical disabilities, the impact of disabilities on one's quality of life and autonomy, and the role of medical aids in providing functional assistance; Prototype Tokens or Keywords: Functional limitation, physical disability, cognitive impairment, sensory limitation, health disability, medical limitation

Class 13: Suicide Mortality (SM);Description: Acts or considerations towards ending one's own life, including the mental states that precede such actions and the tragic outcomes of these considerations; Prototype Tokens or Keywords: Self-harm, suicidal ideation, self-inflicted mortality, life-ending act, deliberate self-harm, existential despair

Below is the Text example to classify according to the above strategy:

"A right-handed woman with a history of substance abuse, depression, and gastric bypass surgery was present in a detox program when she experienced an unresponsive episode with shaking. She doesn't recall the event that occurred last week. Initially, she felt normal, had breakfast, and drove herself, though later she admitted to having a panic attack. Facility staff reported witnessing her minor and severe shaking episodes, during which she dropped a cup due to a tremor and later became rigid and unresponsive with eye rolling and incontinence. Post-episode, she was lethargic but regained alertness over time. She reported sleep deprivation and stress, with recent nightmares and an average of one hour of sleep per night. She denies any history of seizures, but mentioned a past incident of collapse after which she was hospitalized and diagnosed with an ankle fracture. No history of CNS infections or seizures in the family was reported. Her examination was largely normal, with no neurological deficits. Hospital tests, including MRI and EEG, indicated mild slowing potentially from medication, with no conclusive evidence of seizure activity. Her condition was thought to be consistent with a panic attack rather than a seizure, with no changes to her medication regimen."

ChatGPT Response

Based on the provided text, the classification process would unfold as follows:

Initial Classification:

Opioid Abuse Exists

Class 1: Opioid Abuse Exists

Explanation: The text explicitly mentions a "history of substance abuse" alongside the individual's participation in a detox program, indicating prior issues with substance misuse, which could include opioids. This context suggests the presence of opioid abuse, thus justifying the classification into

Class 1: Secondary Classification: Social Determinants of Mental Health Exist

Class 1: One or more Social determinants of Mental Health Exist

Explanation: The text provides several indications of factors that could influence the individual's mental health: The history of substance abuse and participation in a detox program point towards challenges that may have a social determinant component. The mention of depression and a physical health condition (gastric bypass surgery) indicates health-related and potentially socially influenced factors affecting mental health.

The description of a panic attack, sleep deprivation, stress, and nightmares further suggests mental health issues influenced by external factors.

Further Classification: Specific Social Determinants Given the information, multiple classifications are appropriate:

Class 9: Substance Misuse (SM)

Explanation: The explicit mention of a history of substance abuse and the current participation in a detox program indicates ongoing struggles with substance misuse. This directly aligns with the criteria for Substance Misuse classification.

Class 10: Mental Disturbance Symptoms (MDS)

Explanation: The individual's experience with depression, panic attacks, sleep deprivation, and stress, along with the absence of a seizure but the presence of episodes resembling panic attacks, suggest significant mental health disturbances. These symptoms necessitate classification under Mental Disturbance Symptoms due to their impact on the individual's Mental health and well-being. The classifications above are based on the explicit details provided in the text. The identified classes, Substance Misuse (SM) and Mental Disturbance Symptoms (MDS), are derived from the described behaviors, health history, and symptoms, reflecting the individual's struggle with both substance abuse and significant mental health issues.

III. PERFORMANCE COMPARISON OF MODELS ACROSS T1, T2, AND T3 METRICS. T1 CLASSIFIES OPIOID PRESENCE, T2 IDENTIFIES SOCIAL DETERMINANTS PRESENCE, AND T3 IDENTIFIES WHICH OF THE 13 SOCIAL DETERMINANTS ARE PRESENT IN THE CLINICAL NOTES.

Model	Metric	H1	H2	H3
RoBERTa	Accuracy	98.48	94.30	94.15
Bio_ClinicalBERT:	Accuracy	98.10	96.20	96.08
ClinicalBERT	Accuracy	98.48	95.82	96.43
Clinical-Longformer	Accuracy	99.00	95.82	96.29
Clinical-BigBird	Accuracy	98.48	95.06	94.76