



**IMDL**  
Intelligent Medical Data Lab

# A Study on the Prediction of Depression using Semi-supervised Learning

Korea University,  
Department of Medical Informatics,  
Intelligent Medical Data Lab,  
Eun Song Bang(Bang08877@gmail.com)

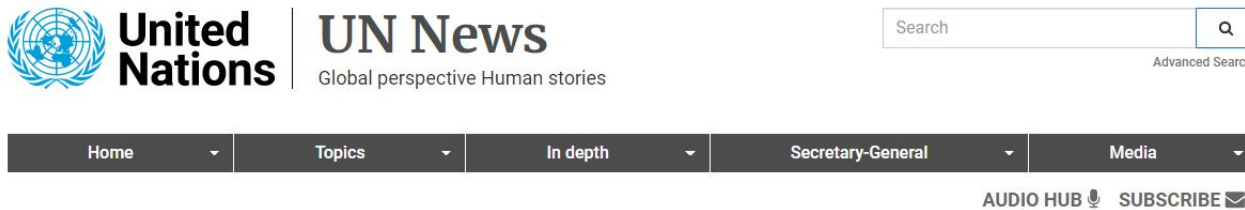
# Index

---

- Introduction
- Material
- Method
- Results
- Conclusion

# Introduction

- Major Depressive Disorder(MDD)
  - known as **clinical depression**, **unipolar depression** or, simply, **depression**.



COVID-19: Depression, anxiety soared 25 per cent in a year

Number of depressed patients in the last 5 years  
(2017-2021)

-The Health Insurance Review and Assessment Service-



# Introduction

---

- Major Depressive Disorder(MDD)

- known as **clinical depression**, **unipolar depression** or, simply, **depression**.

- Major symptom

- Depressed mood
    - Loss of interest/pleasure
    - Slow or agitated psychomotor skills
    - Experience of insomnia or hypersomnia
    - Fatigue or loss of energy
    - Recurring thoughts of death, suicidal ideation, or having a suicide plan or suicide attempt

# Material

- Korea National Health and Nutrition Examination Survey 2020.
  - provided by the Korea Disease Control and Prevention Agency (KDCA).

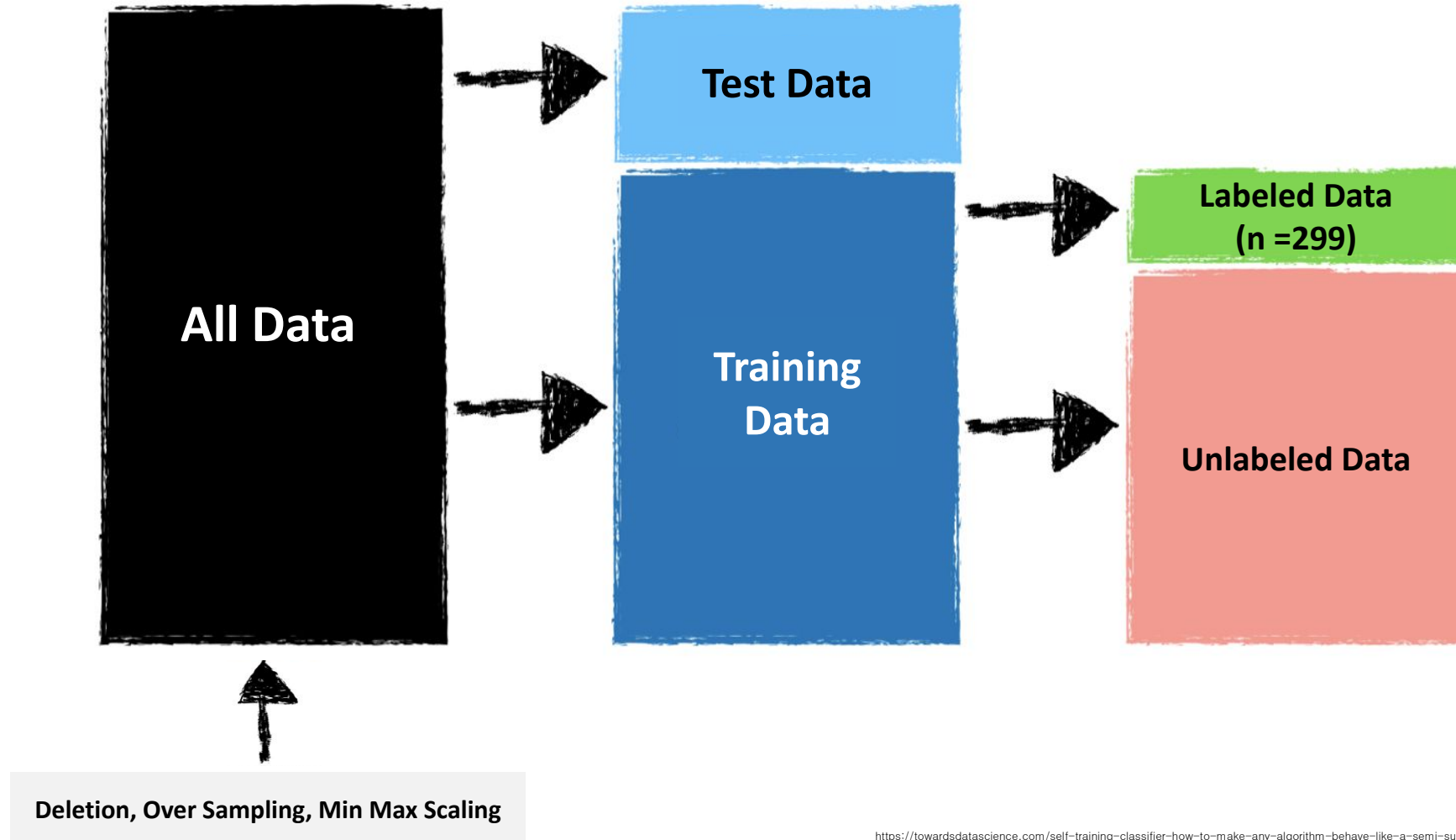
Data	Description
Survey period	January 2020 – December 2020
Total participants	7,359
Used participants (age $\geq 19$ )	<b>5,386</b>
Number of Features	<b>17</b>
Total Male	46.4%

# Material

	Variable	Description
Basic factors	Region	The area of residence
	Sex	Male/Woman
	Age	≥19 age
	Income	Income quartile
	Edu	Level of Education
household survey factors	EC1_1	Economic Activity
	Cfam	Household member
	Allownc	Beneficiary of National Basic Livelihood
	House	Home ownership
	Marri_2	marital status
self-rated health indicators	D_1_1	self-health recognition
	D_2_1	feel bad over the past two weeks
	BD1_11	drinking frequency
	BE3_75	daily exercise
	Mh_stress	stress level
	BS3_1	Smoking
	DF2_pr	Depression / No Depression / Unknown

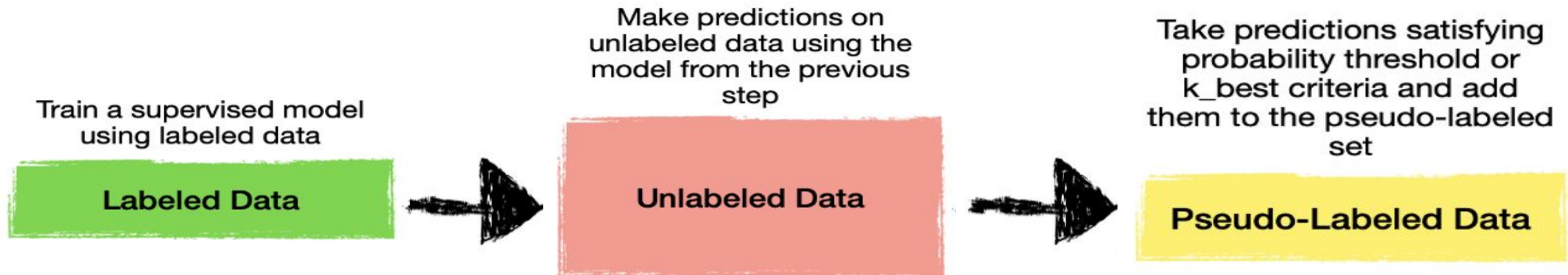
# Method

- Semi-Supervised Learning



# Method

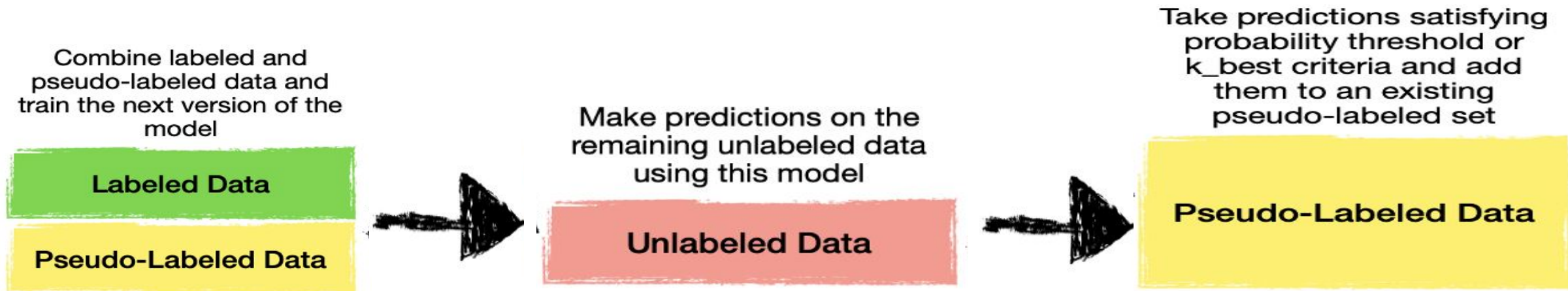
- Semi-Supervised Learning





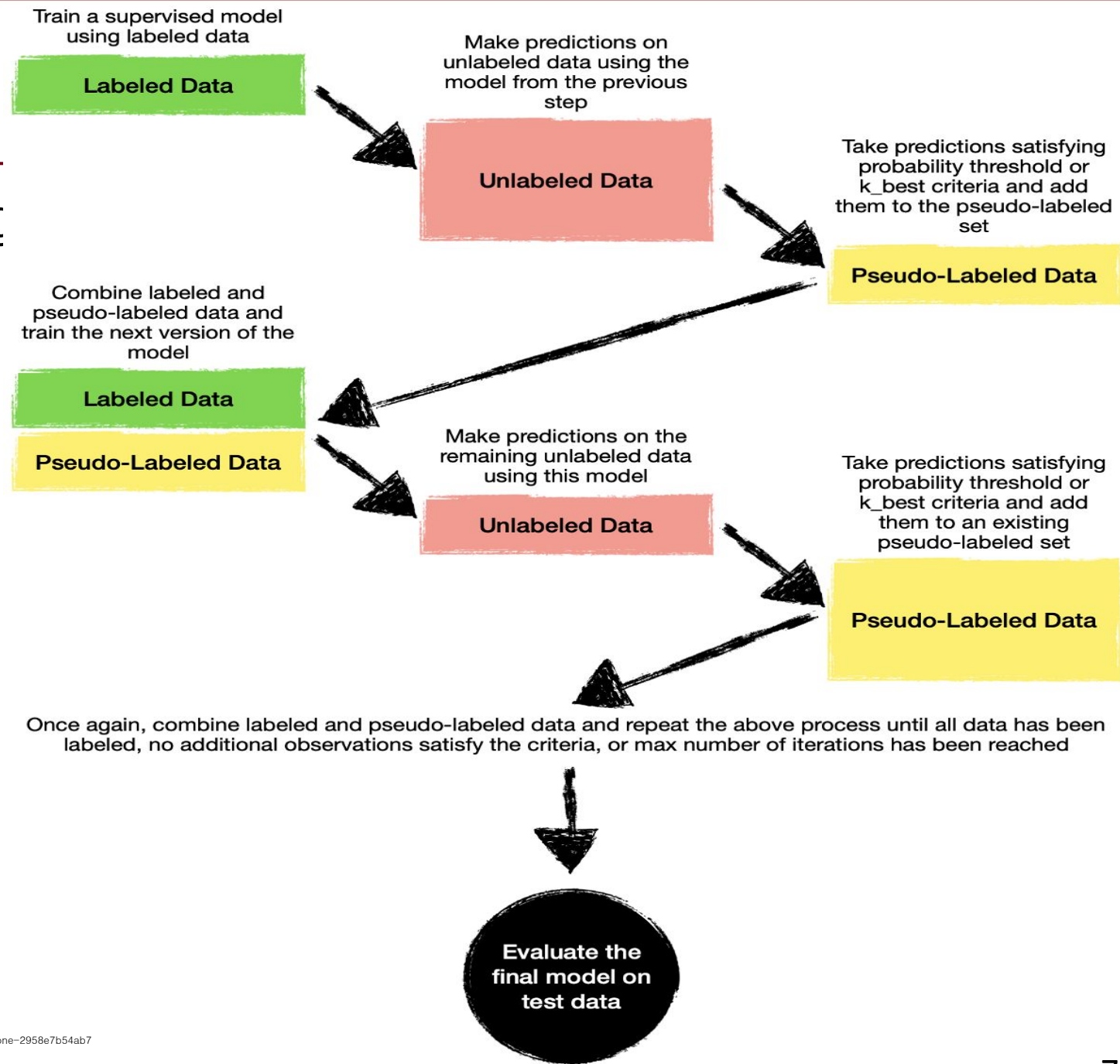
# Method

- Semi-Supervised Learning



# Method

## ◦ Semi-Supervised Learning



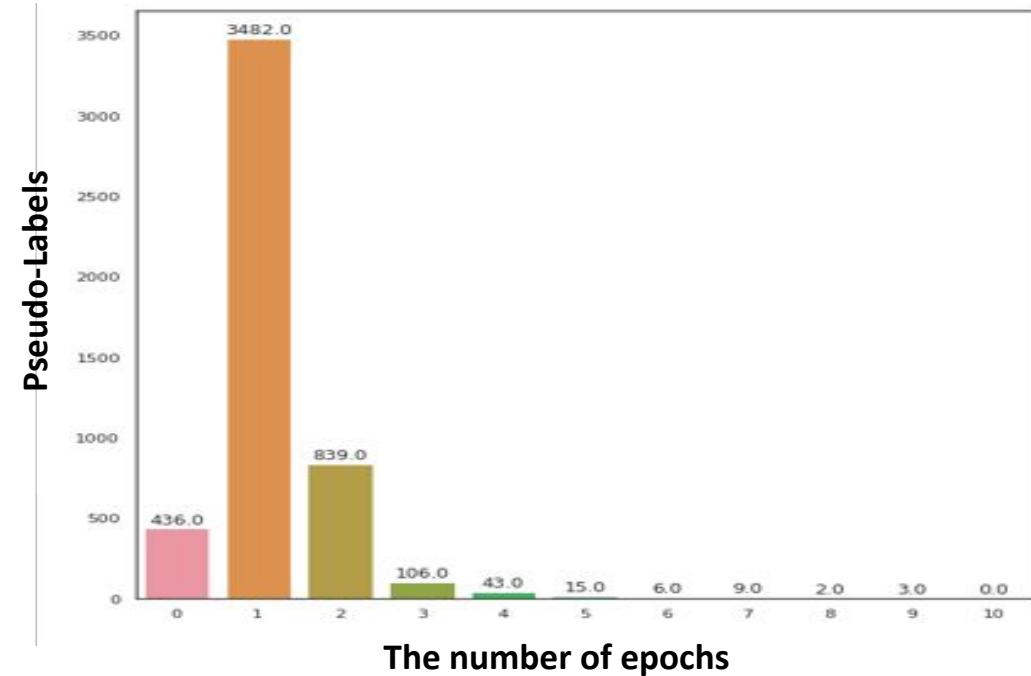
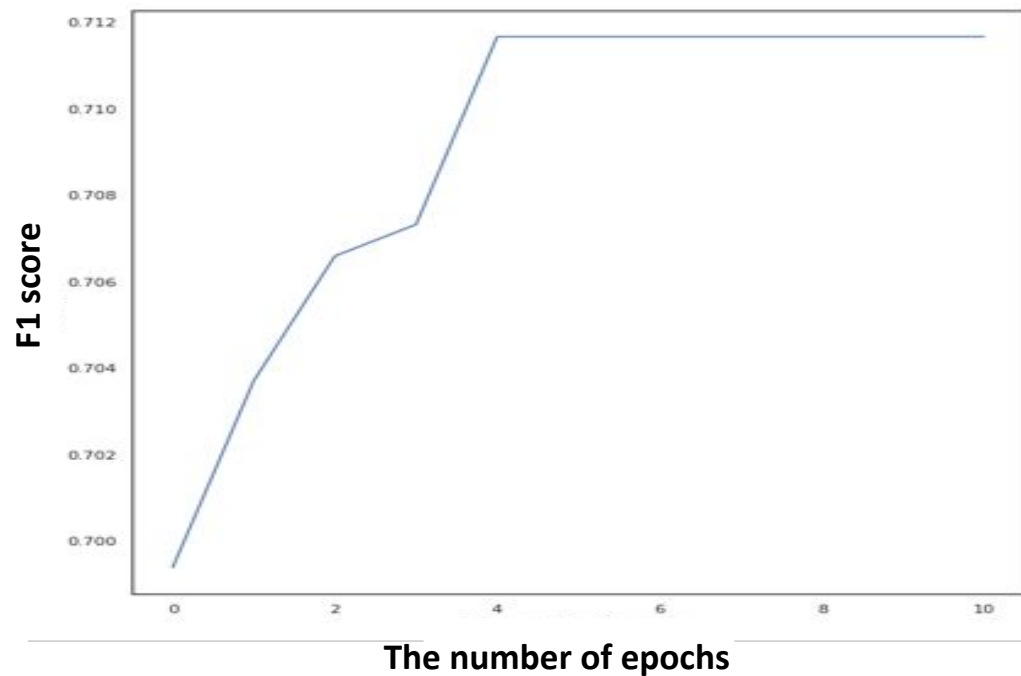
# Results

- The result of the supervised learning models – Make a Classifier

Model	Type of source	Precision	Recall	F1 score
Decision Tree Classifier	Original source	0.63	0.64	0.64
	Oversampling	0.63	0.61	0.62
Random Forest Classifier	Original source	0.61	0.72	0.66
	Oversampling	0.59	0.6	0.6
SVM	Original source	0.65	0.76	0.7
	Oversampling	0.67	0.56	0.61
Logistic Regression	Original source	0.64	0.71	0.68
	Oversampling	0.69	0.59	0.63
Ada Boost Classifier	Original source	0.61	0.71	0.65
	Oversampling	0.63	0.71	0.67
XGB Classifier	Original source	0.61	0.72	0.66
	Oversampling	0.61	0.67	0.64
LGBM Classifier	Original source	0.62	0.71	0.66
	Oversampling	0.63	0.59	0.61

# Results

- The result of the semi-supervised learning model



Model	Type of Learning	Precision	Recall	F1 score
SVM	Supervised learning	0.65	0.76	0.7
	Semi-supervised learning	0.66	0.77	0.71

# Conclusion

---

- We can identify that there is a improvement of model performance on semi-supervised learning.
- We anticipate that this study could help predict depression in people who have not yet a diagnosis.

THANK YOU FOR LISTENING 😊

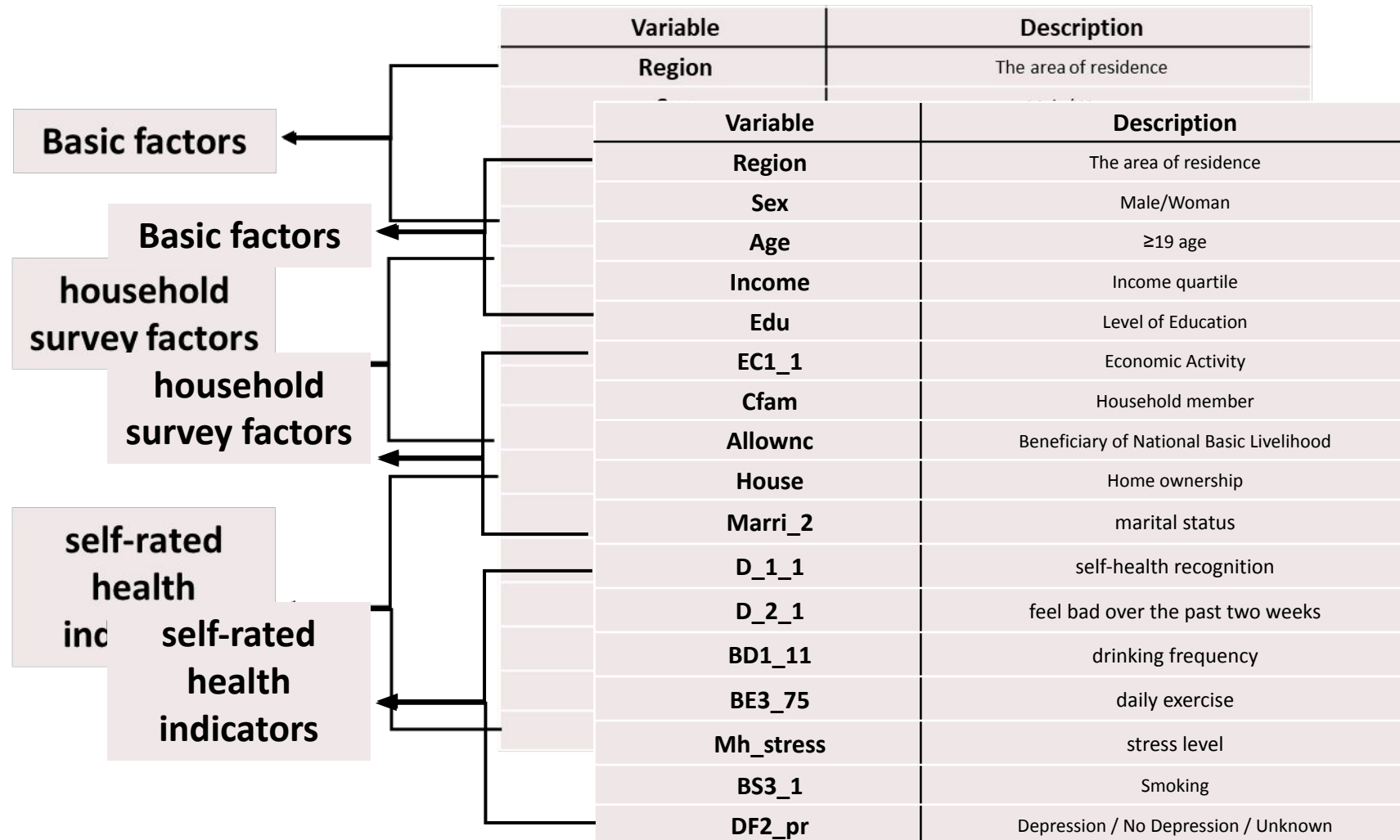
# Reference

- Santomauro, D.F., et al.: Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic. *The Lancet*. 398, 1700–1712 (2021)
- World Health Organization.: *World mental health report: transforming mental health for all*. World Health Organization (2022)
- World Health Organization. Regional Office for the Eastern Mediterranean.: *Depression*. World Health Organization. Regional Office for the Eastern Mediterranean (2019)
- Van Engelen, J.E., Hoos, H.H.: A survey on semi-supervised learning. *Machine Learning* 109, 373–440 (2019)
- Aleem, S., Huda, N.u., Amin, R., Khalid, S., Alshamrani, S.S., Alshehri, A.: Machine Learning Algorithms for Depression: Diagnosis, Insights, and Research Directions. *Electronics*. 11, 1111 (2022)
- Yazdavar, A.H., Al-Olimat, H.S., Ebrahimi, M., Bajaj, G., Banerjee, T., Thirunarayan, K., Pathak, J., Sheth, A.: Semi-Supervised Approach to Monitoring Clinical Depressive Symptoms in Social Media. *Proceedings of the 2017 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining 2017*, pp. 1191–1198 (2017)
- Wang, D., Lei, C., Zhang, X., Wu, H., Zheng, S., Chao, J., Peng, H.: Identification of Depression with a Semi-supervised GCN based on EEG Data. *2021 IEEE International Conference on Bioinformatics and Biomedicine (BIBM)*, pp. 2338–2345 (2021)
- Guimin Dong, M.T., Lihua Cai, Laura E. Barnes, Mehdi Boukhechba: Semi-supervised Graph Instance Transformer for Mental Health Inference. *2021 20th IEEE International Conference on Machine Learning and Applications (ICMLA)*, pp.1221–1228 (2021)

---

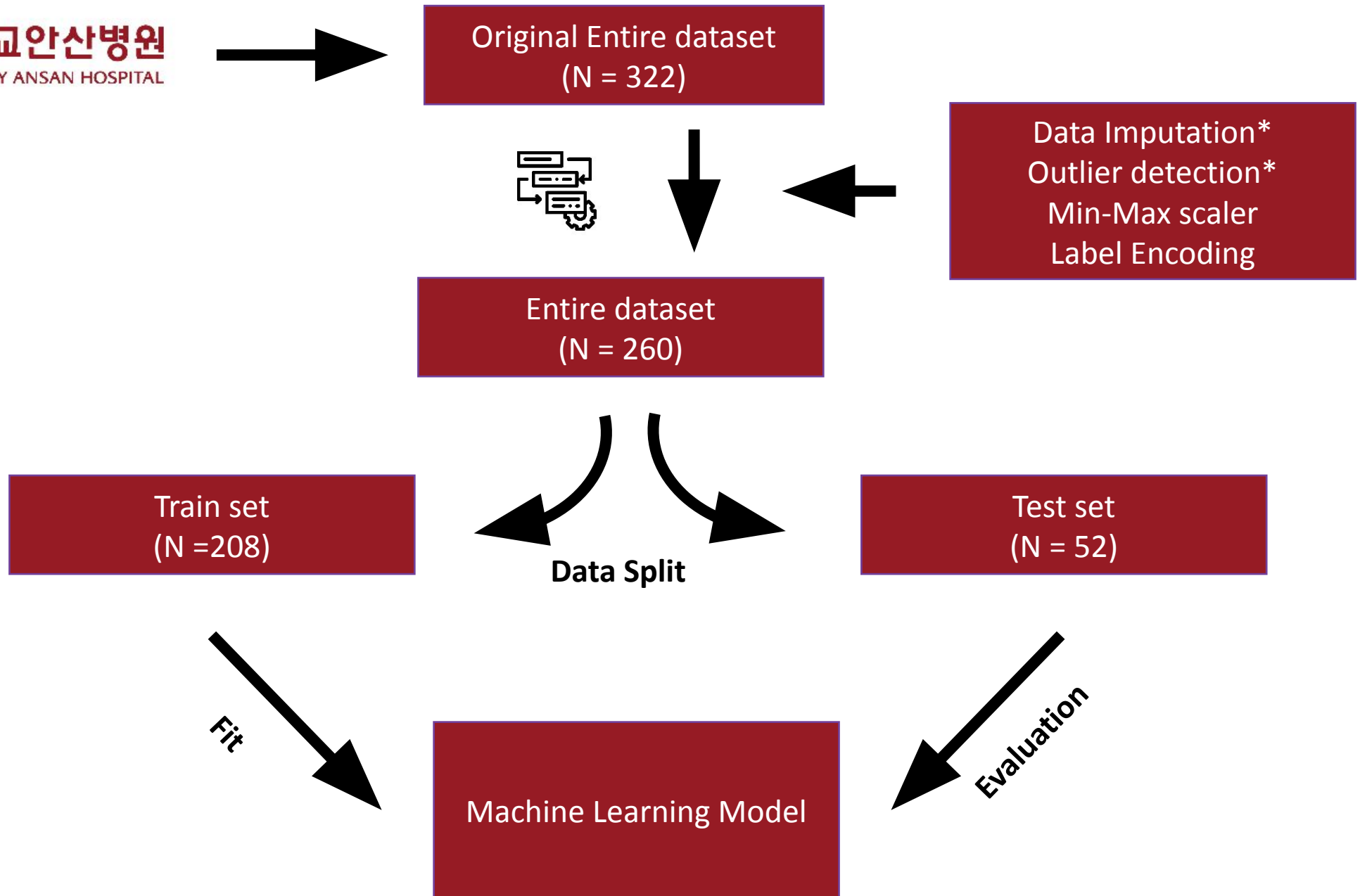
**Acknowledgments.** This research was supported by the MSIT(Ministry of Science and ICT), Korea, under the ICAN(ICT Challenge and Advanced Network of HRD) program(IITP-RS-2022-00156439) supervised by the IITP(Institute of Information & Communications Technology Planning & Evaluation) and the Basic Science Research Program of the National Research Foundation (NRF) funded by the Korean government (MSIT) (NRF-2021R1A2C1009290).





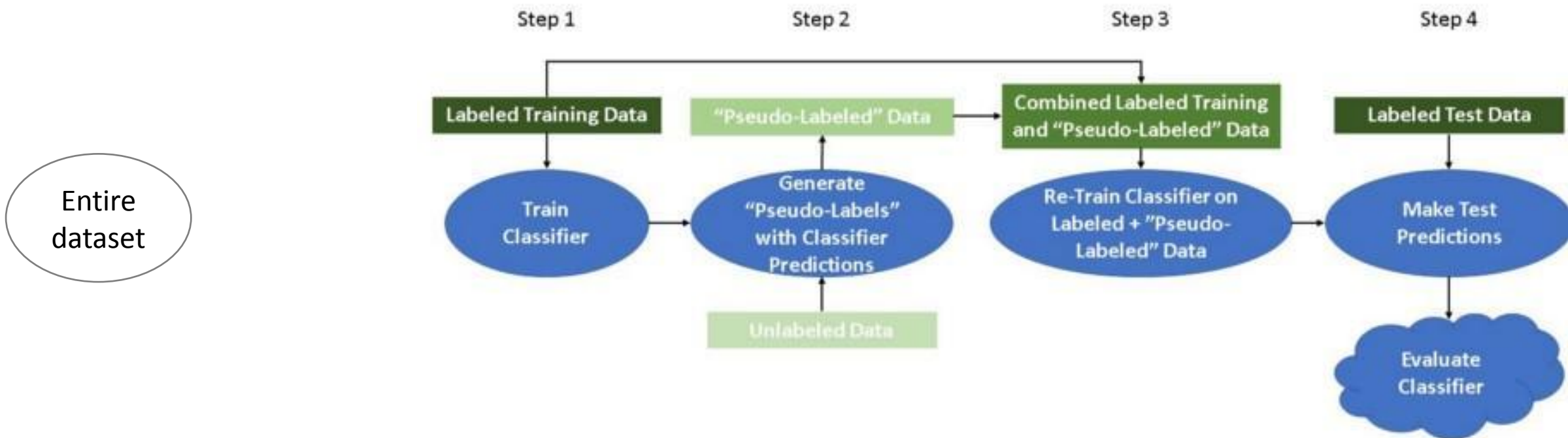


고려대학교안산병원  
KOREA UNIVERSITY ANSAN HOSPITAL



# Method

- Semi-Supervised Learning



# Introduction



UN News

Global perspective Human stories

Search



Advanced Search

Home

Topics

In depth

Secretary-General

Media

AUDIO HUB SUBSCRIBE

## COVID-19: Depression, anxiety soared 25 per cent in a year



## Major Depressive Disorder(MDD)

- known as clinical depression, unipolar depression or, simply, depression.

## Major symptom

- Depressed mood
- Loss of interest/pleasure
- Slow or agitated psychomotor skills
- Experience of insomnia or hypersomnia
- Fatigue or loss of energy
- Recurring thoughts of death, suicidal ideation, or having a suicide plan or suicide attempt