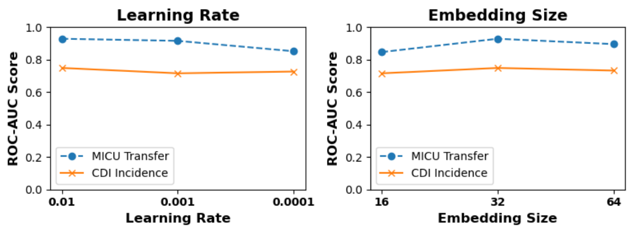


Figure 1: Variation of Learning Rate for CDI Incidence (left) and MICU Transfer (right) for **UIHC**

1 Further Details about Datasets

1.1 UIHC UIHC is a large (800-bed) tertiary care teaching hospital in the U.S. mid-western region. In this data, each patient visit includes a list of diagnoses, a timestamped record of room transfers, physician-performed procedures, and prescription medications. We extracted patient contacts with medications, doctors, and rooms in 2010 between January 1 and March 31. For the period, there were interactions between 6496 unique patients, 575 unique doctors, 686 unique medicines, and 557 rooms.

1.2 MIMIC-IV The database contains information on 46,520 patients from 2008 to 2019 and includes demographic information, International Classification of Diseases codes (ICD-9 and ICD-10), hourly vital signs, laboratory tests and microbiological culture results, medication administrations, and survival statistics. All dates in MIMIC-IV are shifted by a factor of years to protect patient information but the sequence of hospital events for every patient is maintained. Compared to MIMIC-III [**?**], which receives data from heterogeneous sources, MIMIC-IV has more patient data and precise information on procedure events, which are a primary source of clinical information in the ICU, making MIMIC-IV data homogeneous. We extracted patient contacts with medications, doctors, and units between January 1, 2128, and April 4, 2128. Note that the dates in the dataset are shifted from the true values to ensure patient data privacy.

1.3 Data Split The split is as follows: (1) **UIHC**: MICU Transfer- 1/1/2010-2/7/2010 train, 2/8/2010-2/21/2010 validation, 2/22/2010-3/31/2010 test. CDI Incidence: 1/1/2010-2/20/2010 train, 2/21/2010-3/12/2010 validation, 3/13/2010-3/31/2010 test.(2) **MIMIC-IV**: MICU Transfer- 1/1/2128-2/20/2128 train, 2/21/2128-3/11/2128 validation, 3/12/2128-4/4/2128 test. CDI Incidence: 1/1/2128-2/19/2128 train, 2/20/2128-3/1/2128 validation, 3/2/2128-4/4/2128 test.

2 Ablation Study for PHOP

The results of the sensitivity study for **UIHC** are present in Figure 2. Like **MIMIC-IV** medication interactions are the dominant type, as their elimination causes the most significant drop in ROC-AUC for both tasks. Similarly, we also observed that removing doctor interactions and room/unit interactions have similar effects on both CDI Incidence Prediction MICU Transfer Prediction in **UIHC**. When we look at different components being removed, we first note that removal of any component leads to a drop in performance indicating that all components are critical in maintaining the performance of our proposed approach. We performed additional experiments on **UIHC** data for both MICU transfer prediction and CDI prediction where we replaced our semantic knowledge-based augmentations with random augmentations while keeping everything else in our model fixed. We noticed that the performance dropped by up to 4.7% in MICU transfer prediction and by up to 1.5 % in CDI prediction. This result highlights the importance of incorporating semantic knowledge for the prediction of health risks.

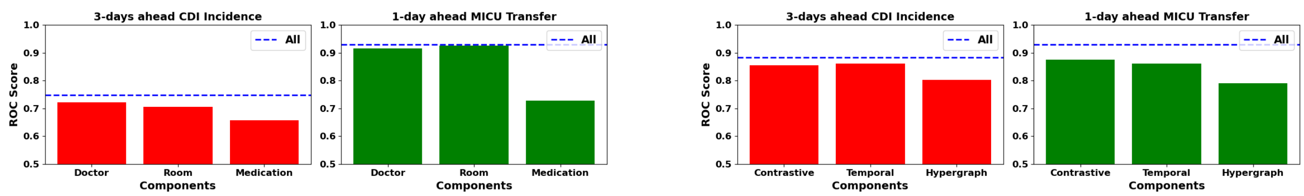
3 Sensitivity Study for PHOP

We show the result of varying the parameters for **UIHC** and show them in Figure 1. Notice that the embedding size of 32 gives the best performance for both tasks and the learning rate of 0.01 gives the best performance in this case as well.

4 Experimental Setup

We conducted all experiments on AMD EPYC 7763 64-Core Processor with 1.08 TB memory and 8 NVIDIA A40 GPUs with CUDA version 12.2. Our code and experimental setup, including data construction, are available for peer review [1].

[1] `https://github.com/Soothysay/HyperHAI.git`



(a) (b)

Figure 2: Ablation Studies for **UIHC** (a) shows the result of removing each type of interaction while (b) shows the result of removing different components of our proposed model.