



A Summary of Annotation Guidelines of Named Entities in Chinese Electronic Medical Records

Abstract: We summarize annotation guidelines of medical named entities in Chinese electronic medical records (CEMRs). EMRs contain a wealth of medical knowledge about the patient's health status, and the construction of medical named entity (NE) annotated corpus on EMR is significant to the knowledge mining research in the clinical domain. In view of the fact that annotated corpus of named entity on Chinese electronic medical records is still in blankness, under the guidance of professional doctors, we have developed the annotation guidelines on CEMRs based on i2b2 challenge with the analysis of a large number of CEMRs.

Keywords: Chinese electronic medical records (CEMRs); named entity; annotated corpus; annotation guidelines; inter-annotator agreement (IAA)

1 Introduction

Electronic medical records (EMRs), which are captured by medical staffs using health information systems in clinical medical activities, contain words, symbols, charts, graphs, numbers, and images detailing the health conditions of patients. These EMRs can be stored, managed, and reproduced [1]. Medical knowledge in EMRs consists of medical named entities and their relations [2]. Therefore, recognizing these entities and relations from EMRs by information extraction technologies is benefit to build intelligence softwares for assisting medical staffs to accomplish clinical medical activities. In EMRs, phrases that describe diseases, symptoms, tests taken by patients, and treatments are defined as medical named entities.

2 Categories of Medical Named Entities

CEMRs include discharge summaries, progress notes, doctor-patient agreements, ultrasound reports, and so on. The discharge summaries and the progress notes are two most important types of free text. To illustrate categories of medical named entities, structural features of these two types of free texts are shown in Figures 1 and 2.

In the discharge summary, diagnosis made by doctors is recorded in the section of diagnosis. Conditions of patients and test results are shown in patient conditions before and after discharge to support diagnosis and to confirm treatment effects. In the treatment procedure, treatment methods are shown in detailed. Follow-up treatments are indicated in the discharge summary dictated.

In the progress note, symptoms containing subject feelings, physical tests and results, and auxiliary tests and results are shown in clinical pathological characters. Clinical presumptive diagnosis is made by doctors on the basis of the clinical pathological characters. Treatments in the



treatment plan are taken based on the clinical presumptive diagnosis and the clinical pathological characters.

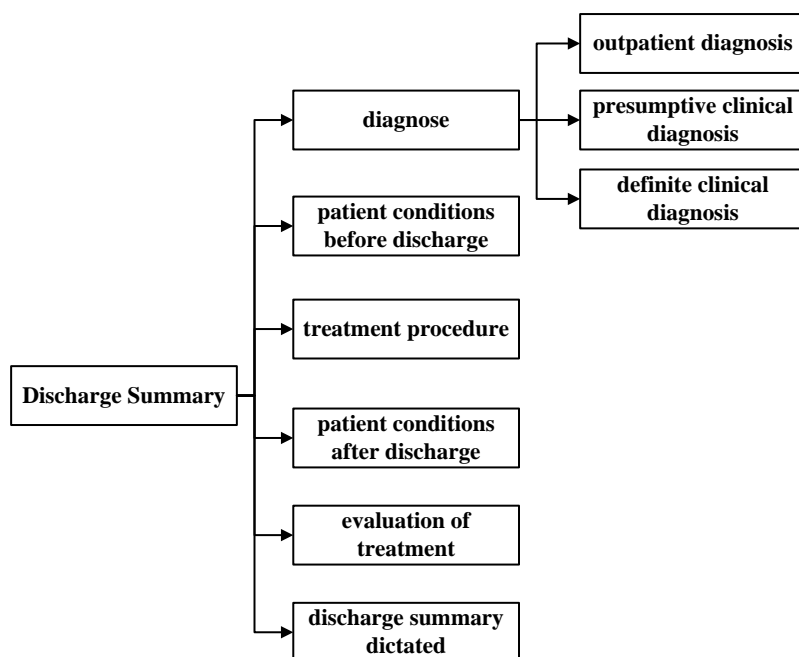


Figure 1. Structure of discharge summary

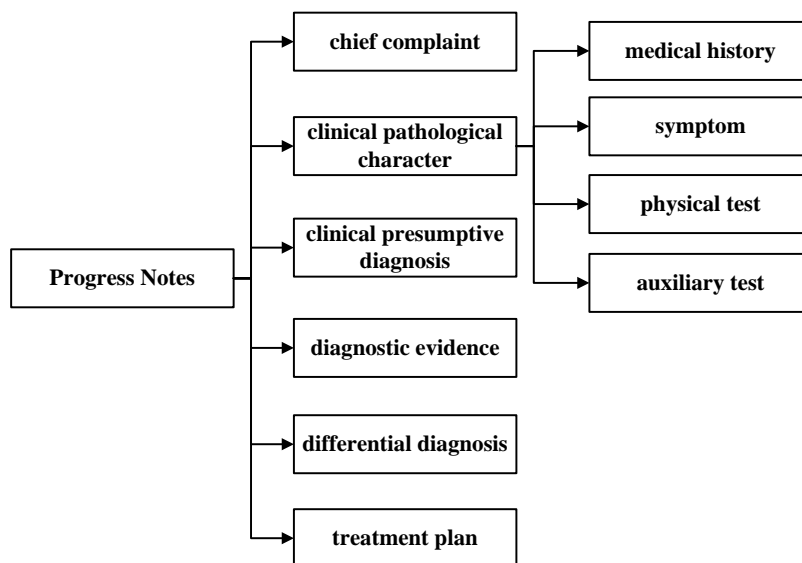


Figure 2. Structure of progress note

In general, clinical medical activities contain using (or not) tests to find symptoms of diseases, making diagnosis, and making treatments according to the diagnosis. Therefore, we classify medical named entities into five categories.

The first category of named entities are words or phrases describing diseases that refer to reasons to conditions that are wrong with the patient, and diagnosis which is made by doctors according to these conditions, where the diseases can be cured or improved.

The second category includes information of disease groups generally following a specific disease that are specific categories of diseases.

The third category involves words or phrases showing symptoms of diseases. The symptoms



used to describe discomfort feelings and abnormal test results are divided into two sub-categories: private prosecution symptoms and abnormal test results.

The fourth category contains words or phrases showing various tests that consist of test equipments, test procedures, and test items which are used to obtain more abnormal symptoms caused by diseases for supporting diagnosis.

The last category refers to treatments such as drugs and surgeries which are used to cure diseases and to alleviate or improve symptoms.

Relations among these medical named entities are shown in Figure 3.

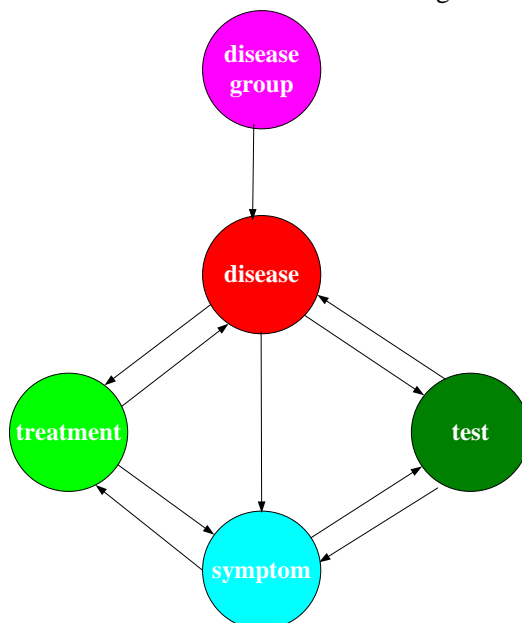


Figure 3. Relations among these named entities

The relations consist of those between diseases and treatments, those between treatments and symptoms, those between tests and diseases, those between diseases and symptoms, those between tests and symptoms, and those between diseases and disease groups.

3 Annotation Guidelines of Medical Named Entity

Five categories of medical named entities are defined in this annotation guideline, namely, diseases, disease groups, symptoms, tests and treatments. Scopes of each category of medical named entities are defined according to semantic types in UMLS [3].

Annotators must follow three main principles when tagging medical named entities: (1) entities do not overlap; (2) entities do not nest; (3) entities contain no punctuation.

3.1 Disease

Phrases that describing causes that are wrong with the patient or diagnosis made by doctors are defined as disease named entities. Semantic types in UMLS contain disease or syndrome, injury or poisoning, congenital abnormality, virus/bacterium, pathologic function, cell or molecular dysfunction, acquired abnormality, anatomic abnormality, neoplastic process, mental or behavioral dysfunction, and so on.



- Annotation examples of disease named entities
 - a) Disease names
 - ✧ 冠心病 (**coronary heart disease**)
 - b) Viruses and bacteria
 - ✧ 结核分枝杆菌 (**mycobacterium tuberculosis**)
 - c) Trauma and allergy history
 - ✧ 遗传病史 (**history of genetic disease**)
 - d) Diseases found by tests
 - ✧ 头 MRI 示: 腔隙性脑梗死 (head MRI shows: **lacunar infarction**)

3.2 Disease group

In the “diagnosis”, there are disease groups used to describe categories of diseases such as II 型 (II type) and 极高危组 (high-risk group) .

- Annotation examples of disease group
 - ✧ 高血压病 3 级**极高危组** (hypertension 3 level **high-risk group**)

3.3 Symptom

Symptoms refer to uncomfortable feelings or abnormal test results. Semantic types in UMLS contain symptom or sign.

3.3.1 Complaint symptoms

Complaint symptoms refer to uncomfortable or abnormal feelings which are told by patients or somebody who knows patient's conditions to doctors.

- Annotation examples of complaint symptoms
 - a) patient symptoms
 - ✧ 耳鸣 (**tinnitus**)
 - b) Status of behaviors or mental
 - ✧ 反应迟钝 (**slow response**)



3.3.2 Abnormal test results

Abnormal test results show explicitly and abnormal changes in patients' bodies which are found by doctors or equipments.

□ Annotation examples of abnormal test results

a) Sign

✧ 构音障碍 (dysarthria)

b) Abnormal results

✧ 胸片示左肺炎症病变 (Chest X-ray shows left lung inflammatory lesion)

3.4 Test

For discovering diseases or symptoms, related information of diseases or symptoms should be found by test processes, test items, and test equipments. Semantic types in UMLS contain laboratory procedures and diagnostic procedures.

For avoiding ambiguities of annotations, test named entities are only three categories as follows.

- (1) Auxiliary examinations, treatment plans, and examinations in the treatment procedure.
- (2) Fluid examinations, physiological tests, physical signs that are followed by numbers.
- (3) Phrases containing key words such as “显示(show)” and “测定(measure)”.

□ Annotation examples of test

a) Auxiliary examinations, treatment plans, and tests in the treatment procedure.

✧ 心电图 (electrocardiography)

b) Fluid examinations, physiological tests, physical signs that are followed by numbers.

✧ 血常规 (blood routine examination)

c) Key words in contexts such as “显示(show)”, “试验 (test)” and “测定(measure)”.

✧ 前庭功能试验 (vestibular function test)

3.5 Treatment

Medical named entities about treatments consist of treatment procedures, drugs, and intervening measures which are given to patients for alleviating diseases or symptoms. Semantic types in UMLS contain pharmacologic substance, therapeutic or preventive procedure, drug delivery device, medical device, steroid, biomedical or dental material, antibiotic, clinical drug, and so on.



□ Annotation examples of treatment

a) Drug names

✧ 20mg 布洛芬 (20mg **Ibuprofen**)

b) Treatment procedures

✧ 支具固定 (**braces fixation**)

c) Other clear treatment information

✧ 穿弹力袜 (wear **stretch sock**)

According to these guidelines above, professional annotators with medical backgrounds build a corpus including 992 EMRs annotated. IAA is used to evaluate the quality of the corpus [4,5]. And IAA of the corpus on named entities is larger than 92 percents, which means that the corpus tagged under the guidelines can be thought available [6].

4 Conclusions and future work

We proposed annotation guidelines for tagging medical named entities in Chinese EMRs. There are five categories of medical named entities: disease, disease group, symptoms, test, and treatment. Annotation results showed the reliability of the guidelines. However, there are also shortcomings in the guidelines. For example, entity category granularities defined are not enough to tag all entities clearly. Tagging granularity of treatment entities is too coarse-grained because drugs, surgeries, and treatment procedures are all annotated as treatment entities.

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