Multi-institutional collaborative research using ophthalmic medical image data standardized by Radiology Common Data Model (R-CDM)

2022. 10. 14

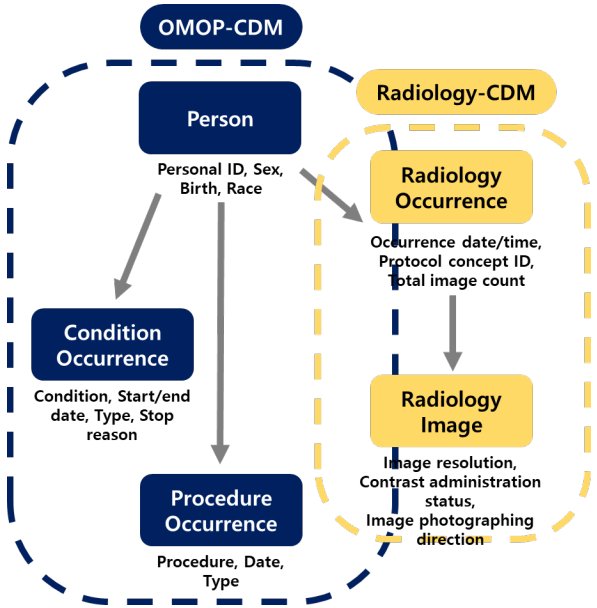
Chul Hyoung Park

Dept. Biomedical Informatics, Ajou University School of Medicine (AUSOM)

Background

- **Unstructured data** which is beyond the scope of OMOP-CDM standardization is difficult to be used for multi-institutional collaborative research

- **Radiology Common Data Model (R-CDM)** has been developed to standardize the terminology and structure of **medical image data**
  - Park CH, You SC, Park RW et al. Development and Validation of the Radiology Common Data Model (R-CDM) for the International Standardization of Medical Imaging Data. Yonsei Med J. 2022;63(Suppl):S74-S83.

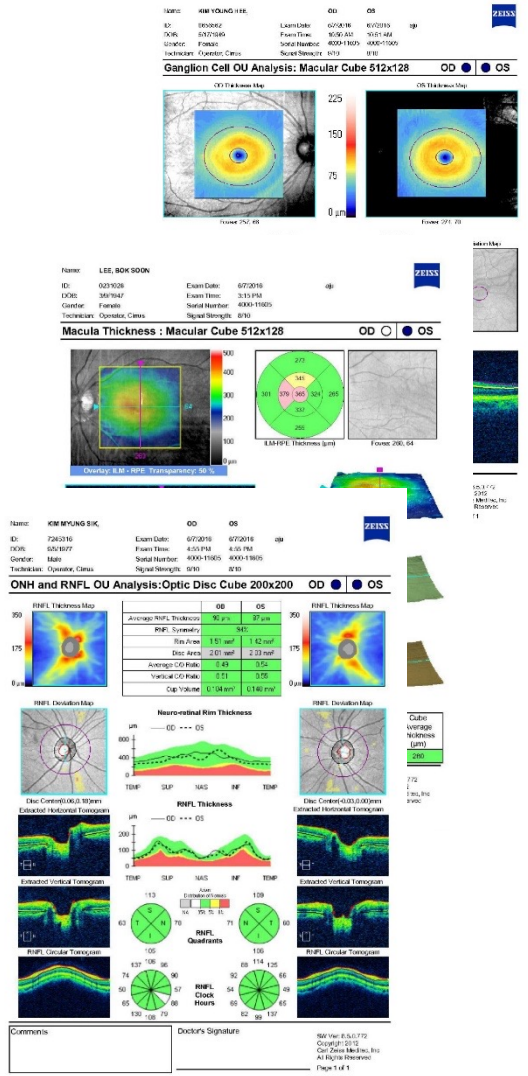


Background

- **Optical coherence tomography (OCT)** calculates various features about **retinal thickness** by scanning internal structure of the eyeball

- By using OCT data, studies showed significant relationship between age, hypertension, type 2 diabetes, vitamin D deficiency, and retinal thickness
  - All of the studies analyzed a small number of patients in a single medical institution due to the **data acquisition issues**

- In this study, a **multi-institutional collaborative research** was conducted by standardizing OCT data into a format of R-CDM



Methods

Data Acquisition

- OCT data was collected from **Ajou University School of Medicine (AUSOM)** and **Seoul National University Bundang Hospital (SUNBH)**, tertiary hospitals in Korea
  - OCT from AUSOM was taken with ZEISS medical device **from Jan 2013 to Apr 2022**
  - OCT from SNUBH was taken with HEIDELBERG medical device from **Jul 2006 to Aug 2019**

Data Standardization

- OCT data collected from both hospitals were standardized in the form of R-CDM

Radiology Occurrence table

study_id	person_id	study_date	modality	manufacturer	protocol_concept_id
1654861	3154381	2012-02-28	OCT	ZEISS	4213040 (Optical coherence tomography)
5156120	3215613	2012-08-15	OCT	ZEISS	4213040
3202305	1564510	2013-04-13	OCT	ZEISS	4213040

Radiology Image table

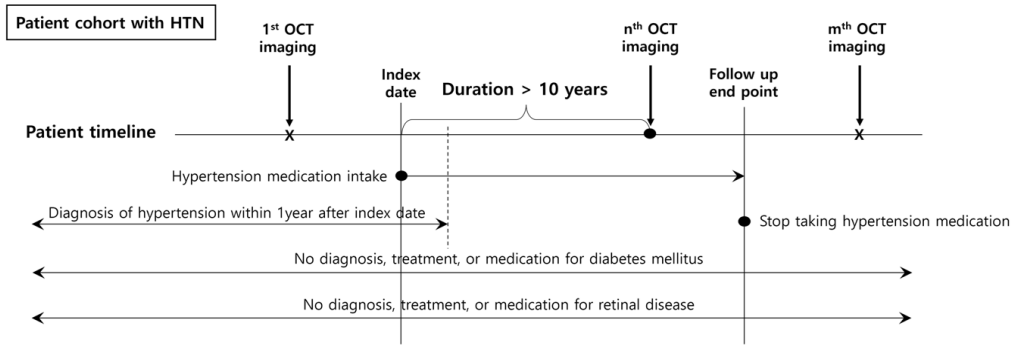
image_id	series_id	study_id	series_type_source_value	file_path
12345342	3752728	1654861	RNFL analysis report	E:₩E4038199₩I05010.dcm
45395345	7827354	5156120	Macular cube analysis report	F:₩E3995248₩I06882.dcm
78676888	7837321	3202305	GCIPL analysis report	F:₩E3235248₩I06880.dcm

Methods

Study design to analyze changes in retinal thickness due to chronic disease

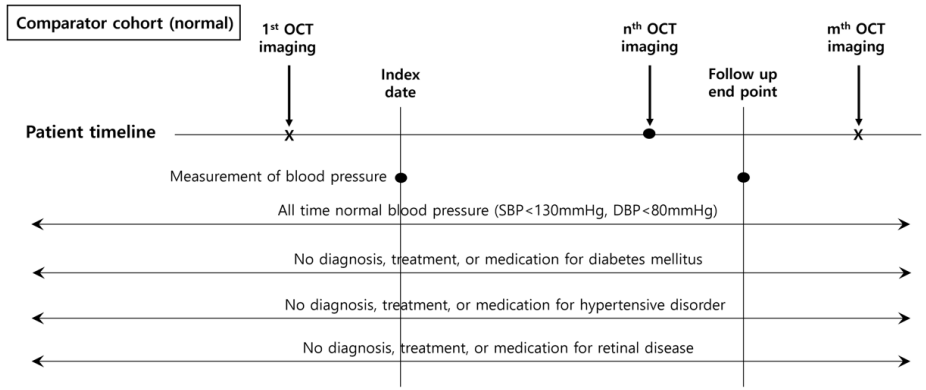
HTN cohort

- HTN medication intake (index date)
  + Diagnosis of HTN
- Taking HTN medication for more than 10 years
  + Exits cohort if patient has stopped taking HTN drug for more than 180 days
- No DM, retinal disease



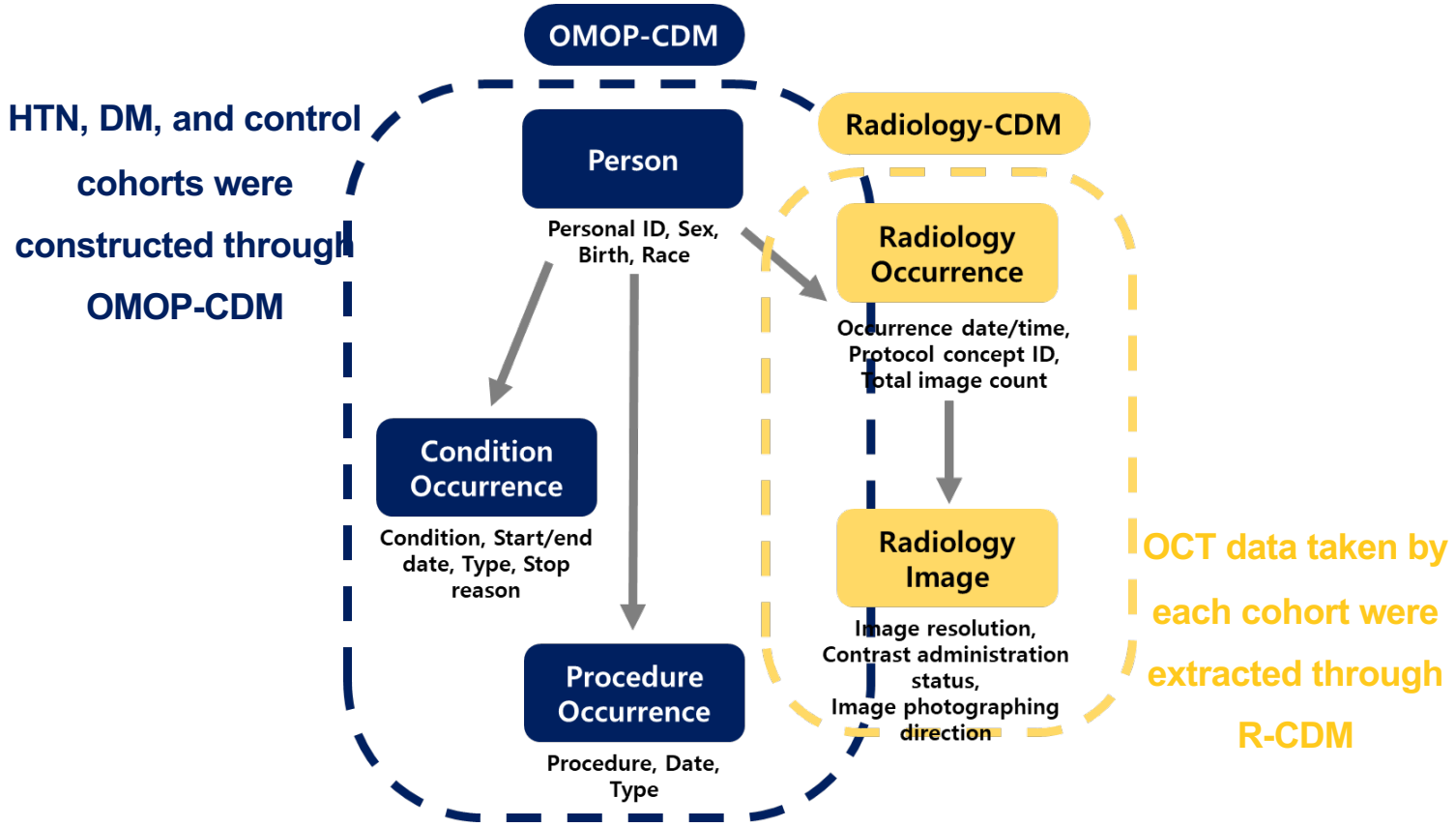
Comparator cohort (normal)

- All time normal blood pressure
- No DM, HTN, retinal disease



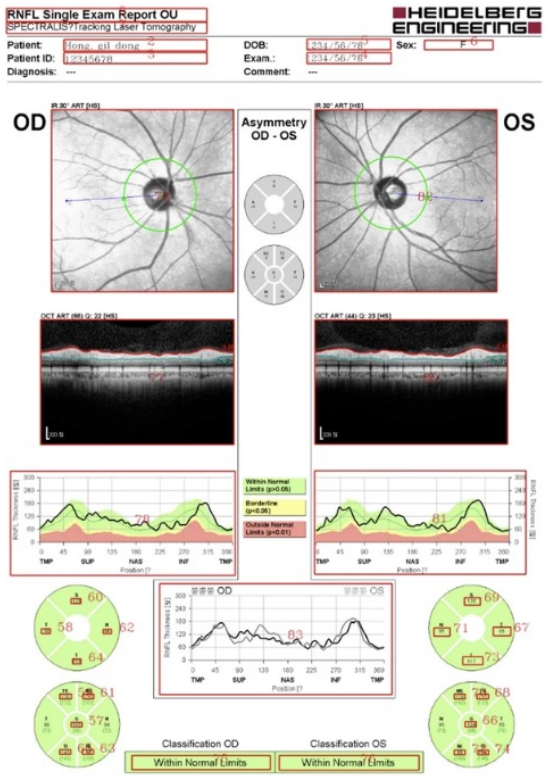
Methods

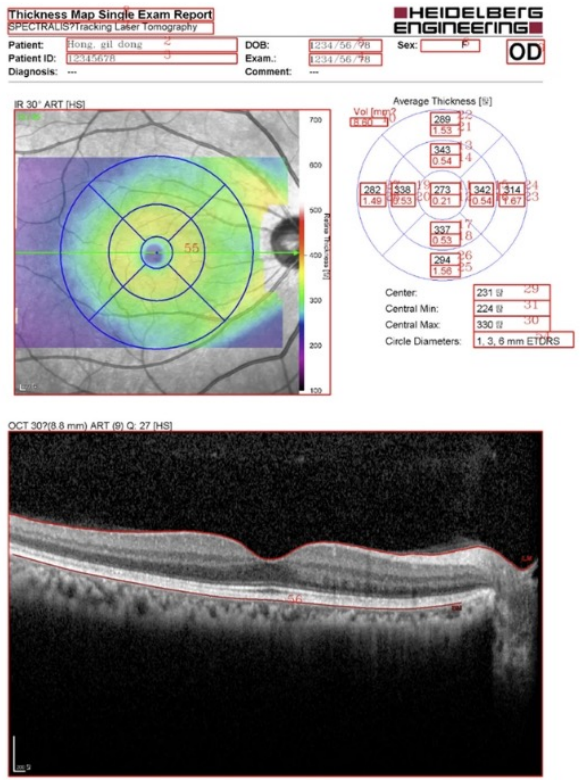
OCT data extraction through interworking of R-CDM and OMOP-CDM

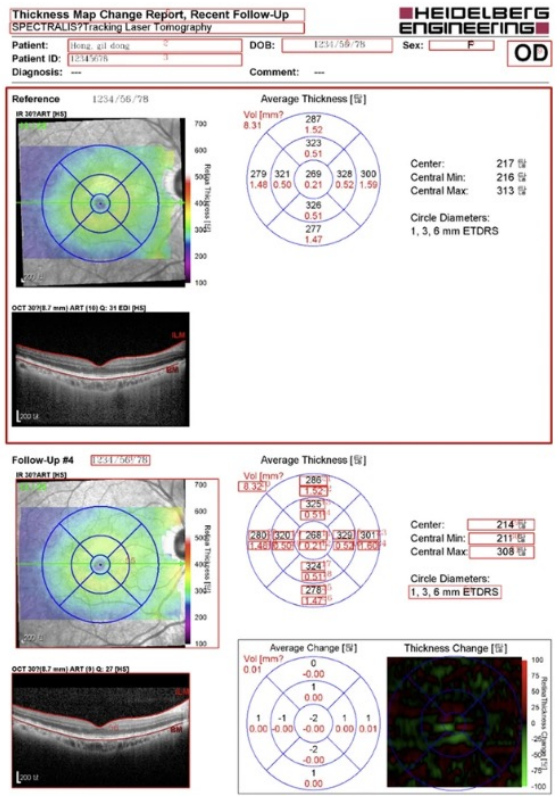


Methods

Retinal thickness data extraction using OCR technique



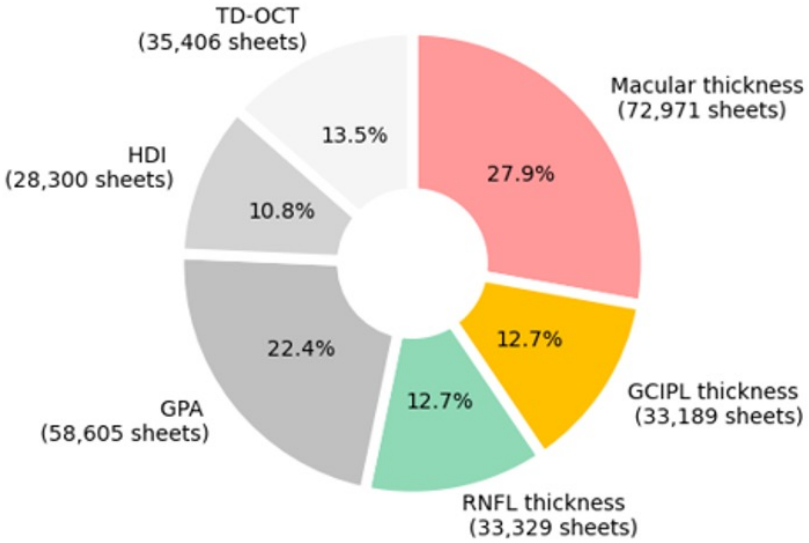




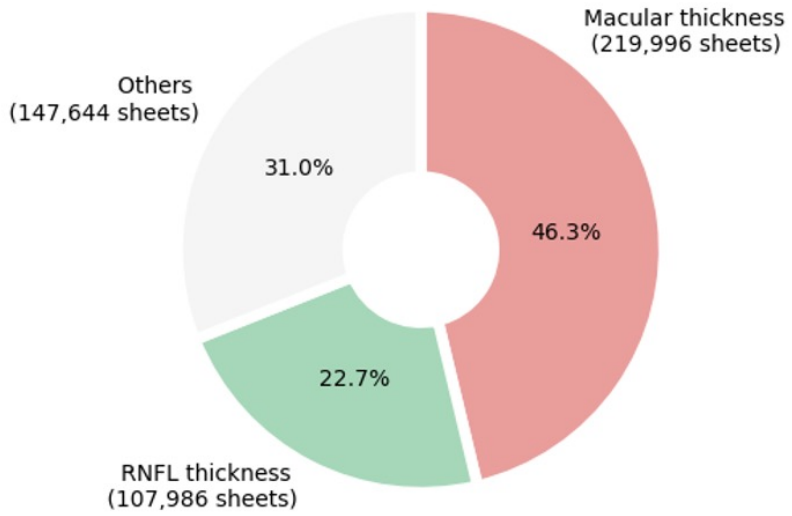
Results

Composition of R-CDM standardized OCT data

Ajou University School of Medicine (261,874 images)



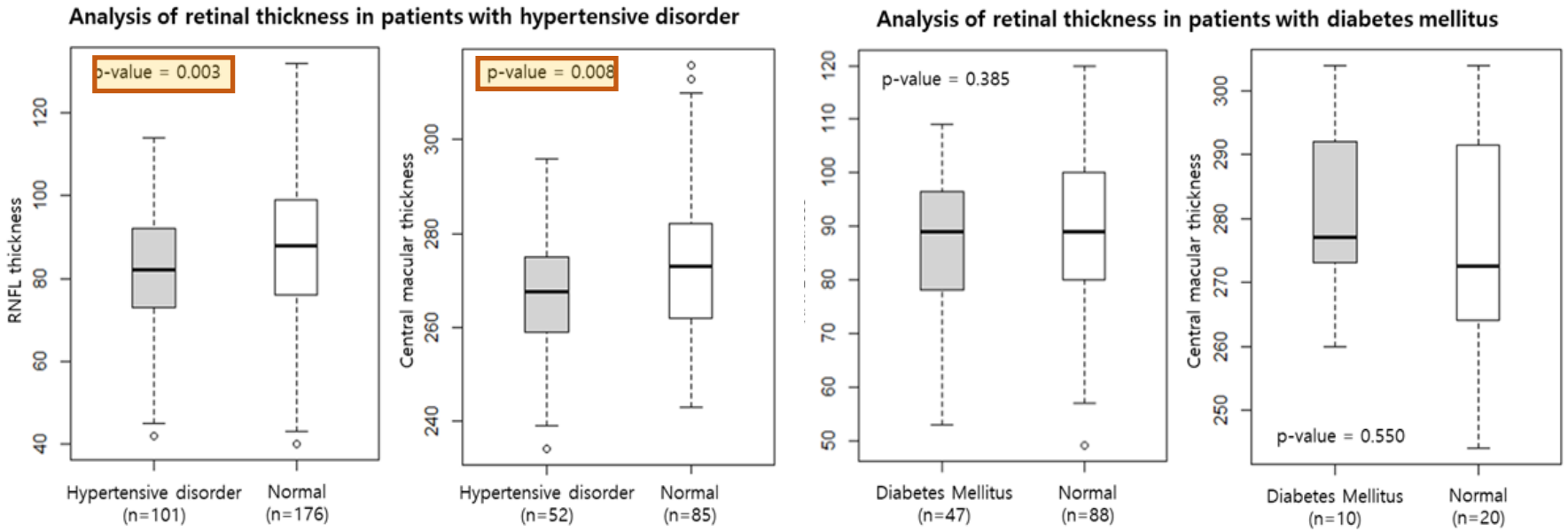
Seoul National University Bundang Hospital (475,626 images)



Results

Analysis of retinal thickness differences between cohorts

- RNFL thickness, and Central macular thickness from **HTN cohort was significantly lower** than that of the normal control cohort.



Conclusion

- In this study, OCT data of AUSOM and SNUBH were obtained for research purposes and standardized in the form of R-CDM

- The retinal thickness was compared between the patients with chronic disease and the normal
  - Retinal thickness was significantly lower in the patients with hypertension for more than 10 years

- It is meaningful in that multi-institutional collaborative research which combines clinical and image data in various ways can be conducted very efficiently

Thank you

Chul Hyoung Park, M.D, Ajou University School of Medicine
Email: hihipch@ajou.ac.kr

Rae Woong Park, M.D, Ph.D, Ajou University School of Medicine
Email: veritas@ajou.ac.kr