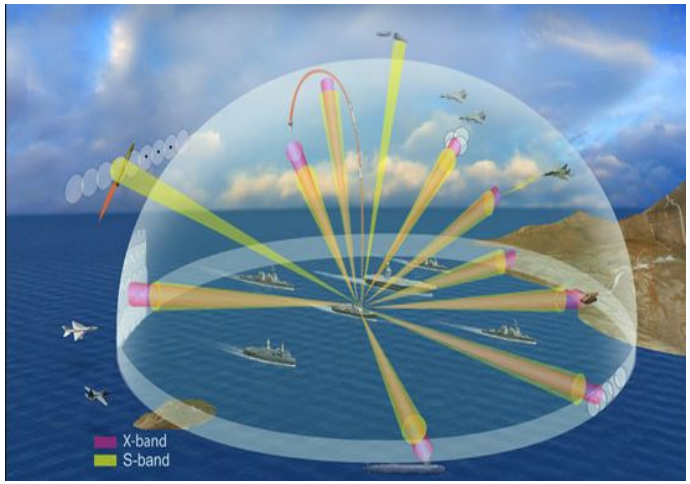
AEGIS (Application for Epidemiological Geographic Information System)



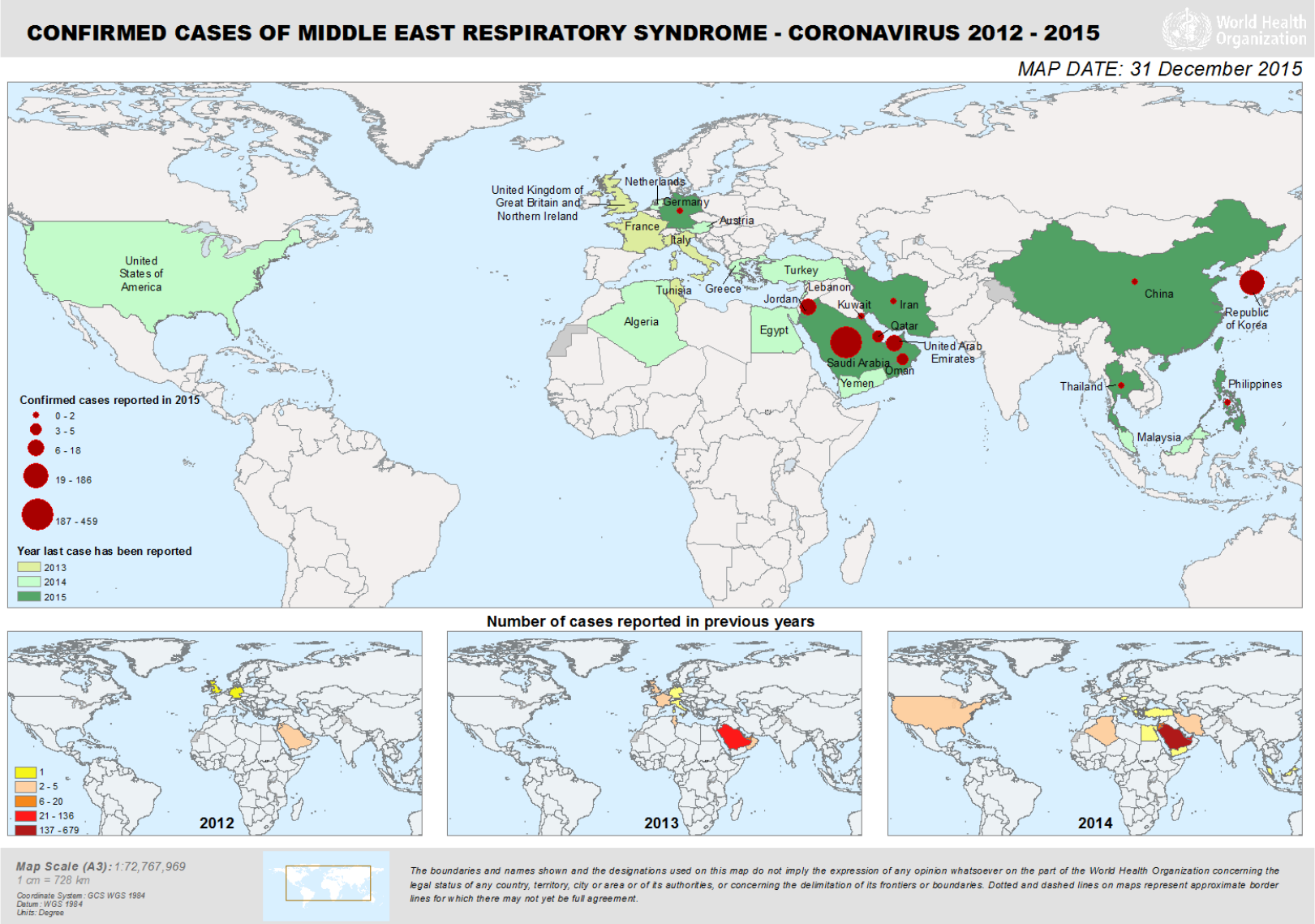
▲

AEGIS Combat system

▲

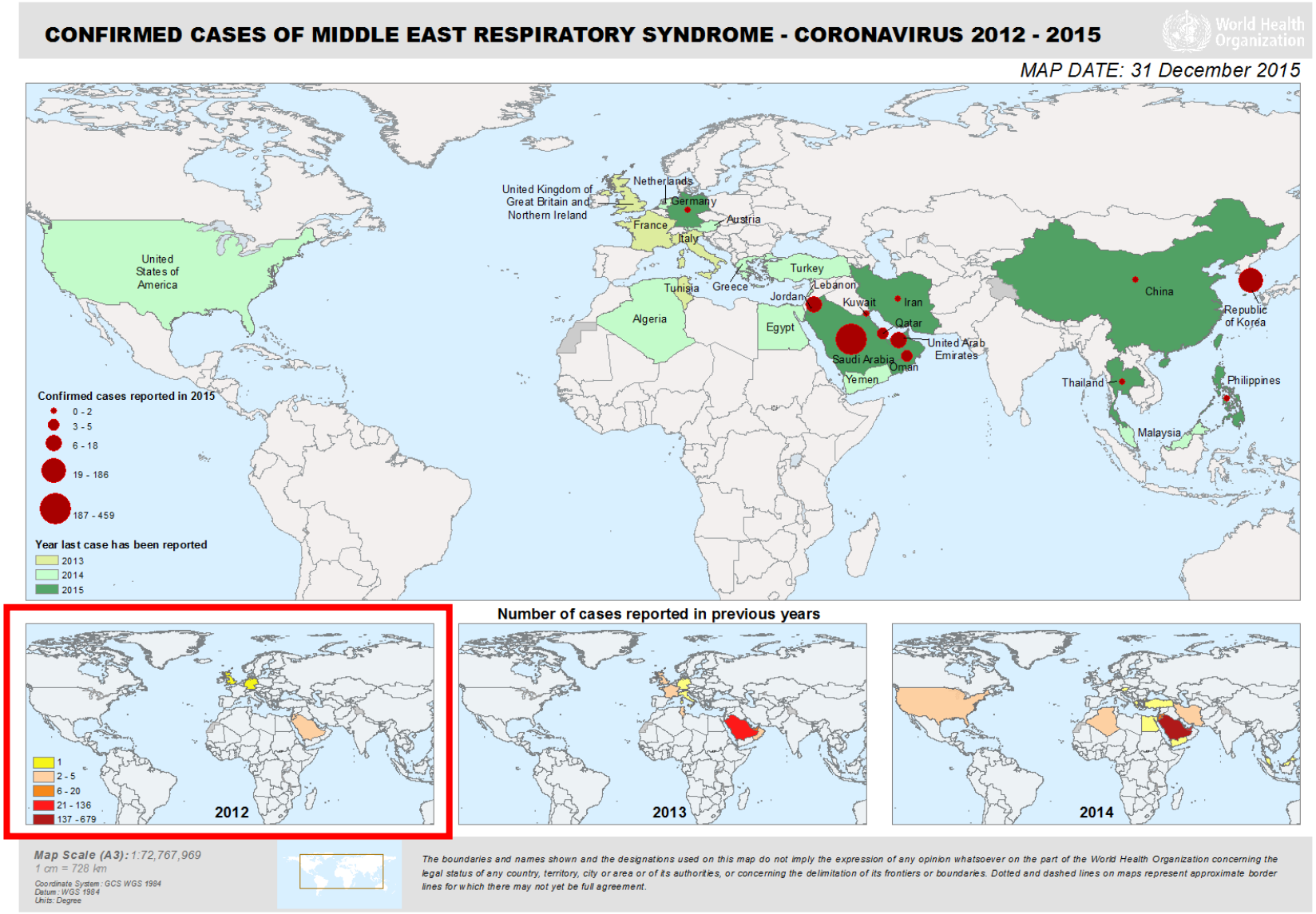
The shield used by the god Zeus in Greek Mythology.

GIS visualization



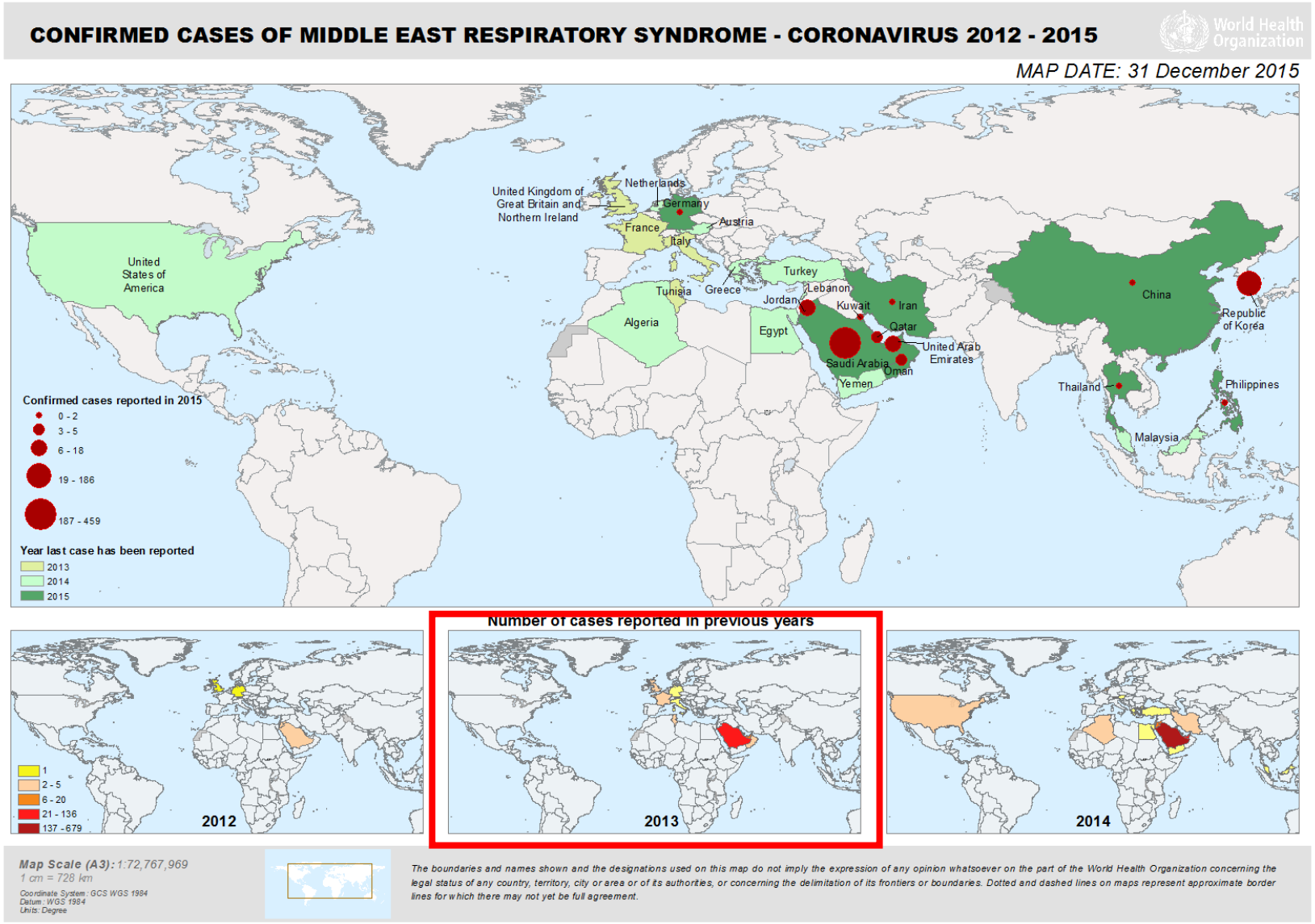
*reference : World Health Organization

GIS visualization



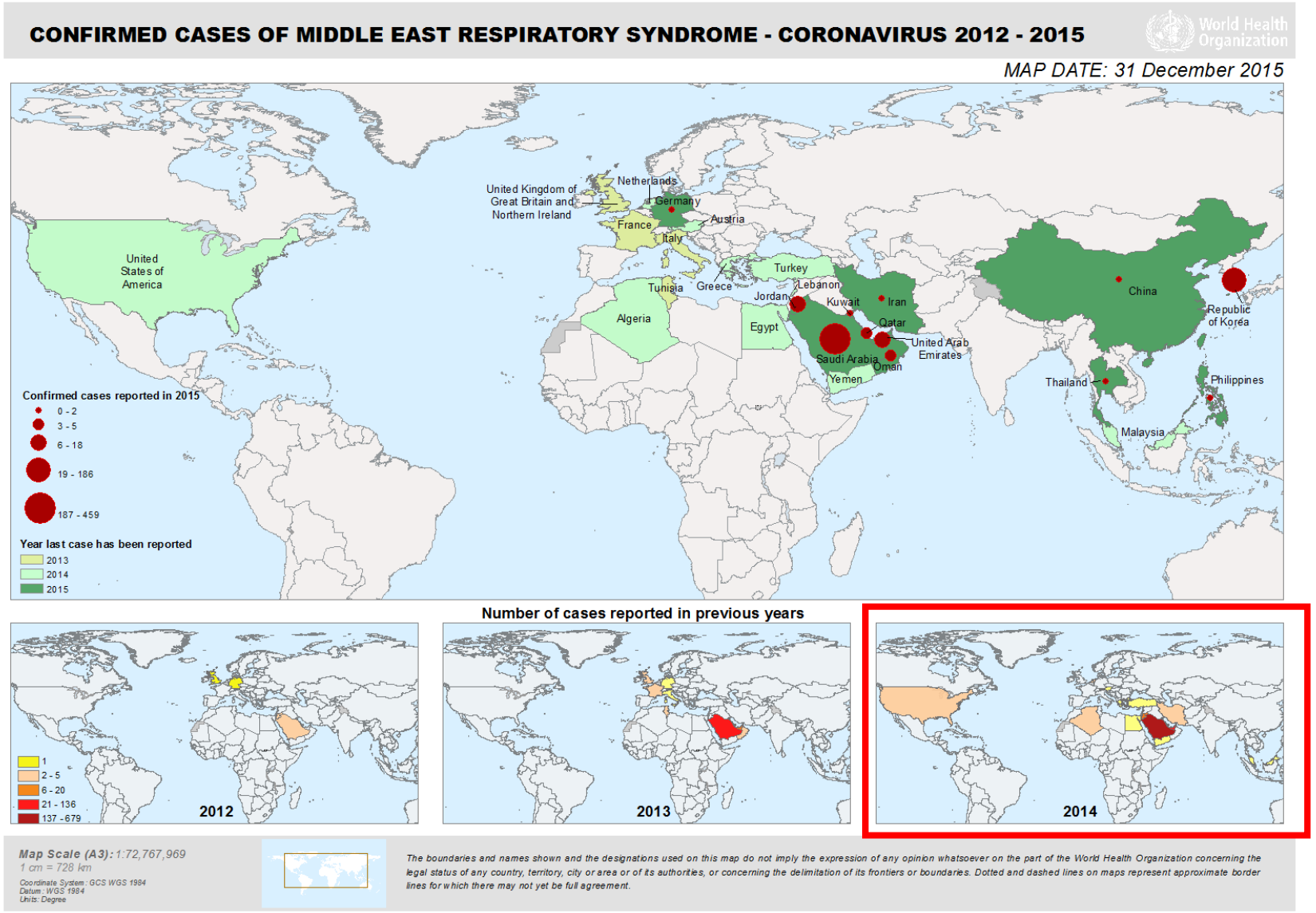
*reference : World Health Organization

GIS visualization



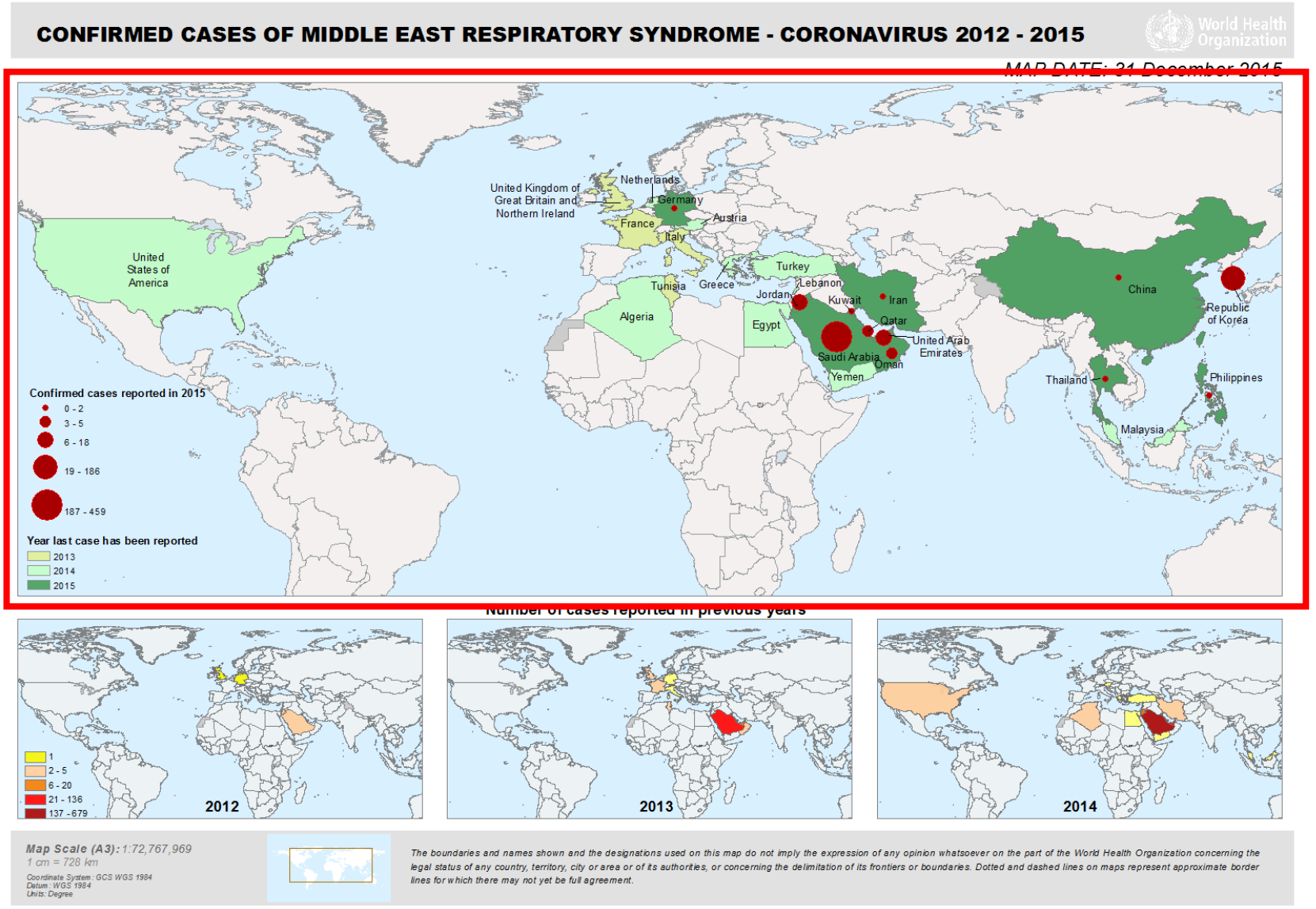
*reference : World Health Organization

GIS visualization



*reference : World Health Organization

GIS visualization



*reference : World Health Organization

OMOP-CDM

- Analytics tools
  - ATLAS
    - a web-based integrated platform for database exploration, standardized vocabulary browing, cohort definition, and population-level analysis
  - ACHILLES
    - Profiling tool for database characterization and data quality assessment
  - CaseControl, SelfControlledCaseSeries, etc.
    - R packages for traditional observational study designs
  - **GIS visualization tools**
    - **None**

AIM

- AEGIS development

  * AEGIS : Application for Epidemiological Geographic Information System

  - Tools based on OMOP-CDM

  - Semi-automated medical map generation

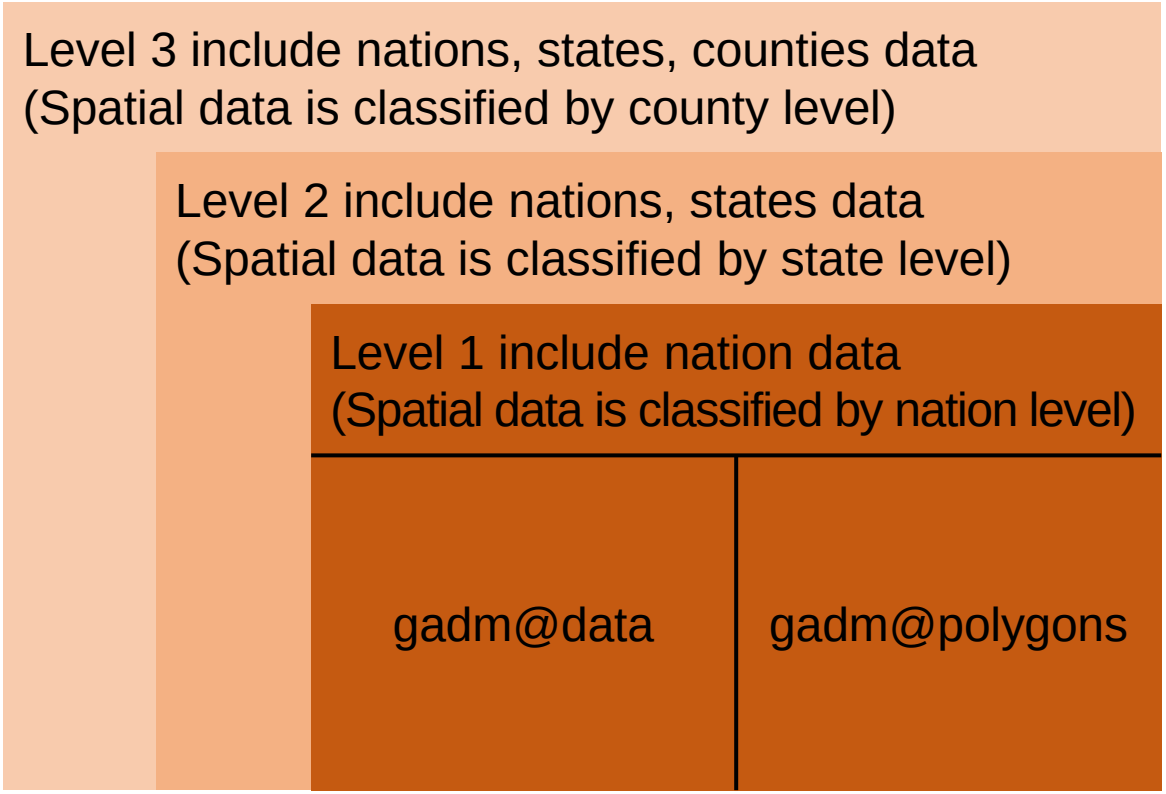
GADM database

- Database of Global Administrative Area (GADM)
  - spatial database of the location of the world's **administrative areas**
- Most administrative areas : level 1-3
  (China has level 4 areas)

	Korea	USA
level 1 : nation	Korea	USA
level 2 : state	Seoul	Illinois
level 3 : county	Gangnam-gu	Springfield

GADM database

- Database of Global Administrative Area (GADM)
  - RDS file



GADM database

- Database of Global Administrative Area (GADM)
  - gadm@data : Administrative information table

OBJECTID	ID_0	ISO	NAME_0	ID_1	NAME_1	ID_2	NAME_2	HASC_2	CCN_2	CCA_2	TYPE_2
1	244	USA	United States	1	Alabama	1	Autauga	US.AL.AU	*NA*		County
2	244	USA	United States	1	Alabama	2	Baldwin	US.AL.BD	*NA*		County
3	244	USA	United States	1	Alabama	3	Barbour	US.AL.BR	*NA*		County
4	244	USA	United States	1	Alabama	4	Bibb	US.AL.BI	*NA*		County
5	244	USA	United States	1	Alabama	5	Blount	US.AL.BU	*NA*		County
6	244	USA	United States	1	Alabama	6	Bullock	US.AL.BL	*NA*		County
7	244	USA	United States	1	Alabama	7	Butler	US.AL.BT	*NA*		County
8	244	USA	United States	1	Alabama	8	Calhoun	US.AL.CN	*NA*		County
9	244	USA	United States	1	Alabama	9	Chambers	US.AL.CM	*NA*		County
10	244	USA	United States	1	Alabama	10	Cherokee	US.AL.CH	*NA*		County
11	244	USA	United States	1	Alabama	11	Chilton	US.AL.CI	*NA*		County
12	244	USA	United States	1	Alabama	12	Choctaw	US.AL.CC	*NA*		County
13	244	USA	United States	1	Alabama	13	Clarke	US.AL.CK	*NA*		County
14	244	USA	United States	1	Alabama	14	Clay	US.AL.CY	*NA*		County
15	244	USA	United States	1	Alabama	15	Cleburne	US.AL.CB	*NA*		County
16	244	USA	United States	1	Alabama	16	Coffee	US.AL.CF	*NA*		County

GADM database

- Database of Global Administrative Area (GADM)
  - gadm@polygons : Spatial information table (latitude/longitude)
    - Autauga County, AL, United States

```
Slot "coords":
             [,1]     [,2]
  [1,] -86.91668 32.66431
  [2,] -86.82678 32.66050
  [3,] -86.71295 32.66214
  [4,] -86.71416 32.70586
  [5,] -86.48744 32.70788
  [6,] -86.48526 32.70788
  [7,] -86.41278 32.70739
                 :
                 :
                 :
[136,] -86.91207 32.61741
[137,] -86.91051 32.63336
[138,] -86.91822 32.64654
[139,] -86.91496 32.64928
[140,] -86.92099 32.65609
[141,] -86.92046 32.65883
[142,] -86.91668 32.66431
```

GADM database

- I had to create mapping table between GADM database and OMOP-CDM

CDM Location

Location_id	Addres_1	Addres_2	…
11000	Alabama	Autauga	…
11100	Alabama	Baldwin	…
11200	Alabama	Barbour	…
11300	Alabama	Bibb	…

GADM Location

NAME_1	ID_1	NAME_2	ID_2	NAME_3	ID_3	…
USA	244	Alabama	1	Autauga	1	…
USA	244	Alabama	1	Baldwin	2	…
USA	244	Alabama	1	Barbour	3	…
USA	244	Alabama	1	Bibb	4	…

Local Arbitrary ID

Different regional classification systems

Mapping table

Location_id	NAME_1	ID_1	NAME_2	ID_2	NAME_3	ID_3
11000	USA	244	Alabama	1	Autauga	1
11100	USA	244	Alabama	1	Baldwin	2
11200	USA	244	Alabama	1	Barbour	3
11300	USA	244	Alabama	1	Bibb	4

GADM database

- Processing result

LEVEL 2

NAME_1	ID_1	NAME_2	ID_2	COUNT
South Korea	213	Seoul	16	538
South Korea	213	Gyeonggi-do	8	583

LEVEL 3

NAME_1	ID_1	NAME_2	ID_2	NAME_3	ID_3	COUNT
South Korea	213	Seoul	16	Gang-Seo	207	30
South Korea	213	Seoul	16	Gang-Nam	206	26
South Korea	213	Gyeonggi-do	8	Suwon	100	50
South Korea	213	Gyeonggi-do	8	Goyang	84	59

AEGIS

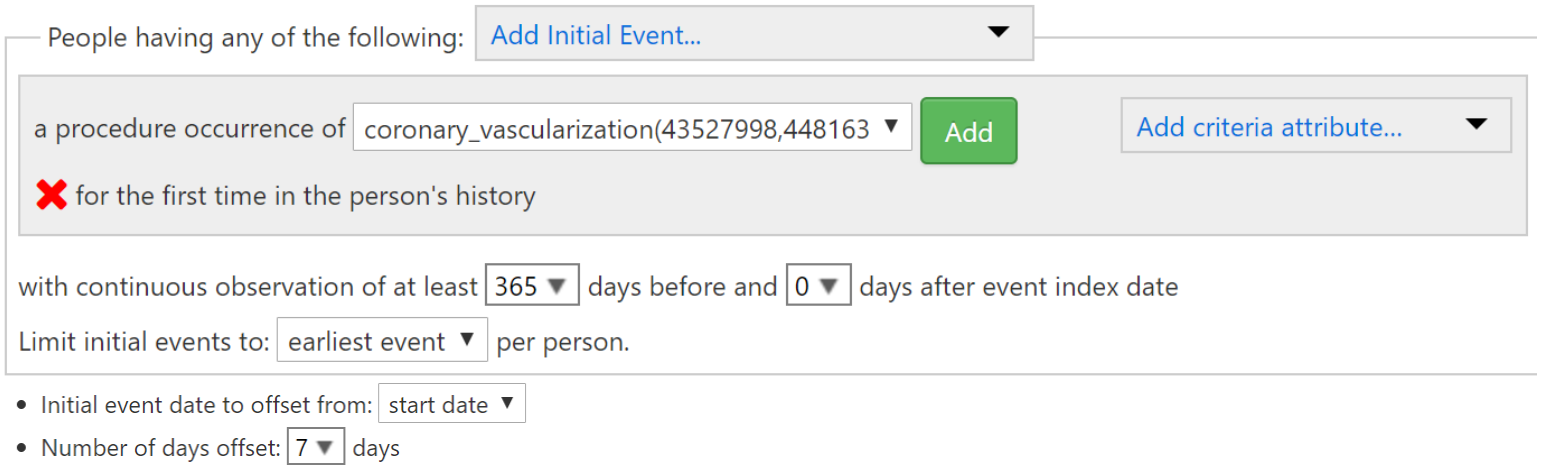
- Options that visualize patient distribution
  - Considers the target (denominator) cohort and the outcome (numerator) cohort
  - The observation period of the outcome cohort considers only patients within the observation period of the target cohort
  - Number of count (no. of outcome cohort)
    - 1. Distinct patient
    - 2. Total count from cohort
  - Proportion = outcome cohort / target cohort

※Example

$$\frac{\text{Patients with specific statin user (Outcome cohort)}}{\text{Patients with coronary or vascular disease (Target cohort)}}$$

Target cohort

- Target: Coronary vascularization (n=7,128)



※Coronary vascularization

- Percutaneous transluminal coronary angioplasty
- Off-pump coronary artery bypass
- (Aorto)coronary bypass of one coronary artery
- Percutaneous transcatheter placement of intracoronary stent(s), with coronary angioplasty when performed; single major coronary artery or branch
- Insertion of intravascular stents in artery

Outcome cohort

- Outcome: Rosuvastatin users (n=17,439)

People having any of the following: Add Initial Event...

a drug era of rosuvastatin Add Add criteria attribute...

with era length Greater Than 30 days

with continuous observation of at least 365 days before and 0 days after event index date

Limit initial events to: all events per person.

Initial event inclusion criteria: From among the initial events, include:

having all of the following criteria: Add New Criteria...

with at most 0 using all occurrences of:

a drug era of atorvastatin Add Add criteria attribute...

with era length Greater Than 7 days

starting between 7 days Before and 30 days After event index date and ending any time.

Limit cohort of initial events to: all events per person.

Outcome cohort

- Outcome: Atorvastatin users (n=84,885)

People having any of the following: Add Initial Event...

a drug era of atorvastatin Add Add criteria attribute...

with era length Greater Than 30 days

with continuous observation of at least 365 days before and 0 days after event index date

Limit initial events to: all events per person.

Initial event inclusion criteria: From among the initial events, include:

having all of the following criteria: Add New Criteria...

with at most 0 using all occurrences of:

a drug era of rosuvastatin Add Add criteria attribute...

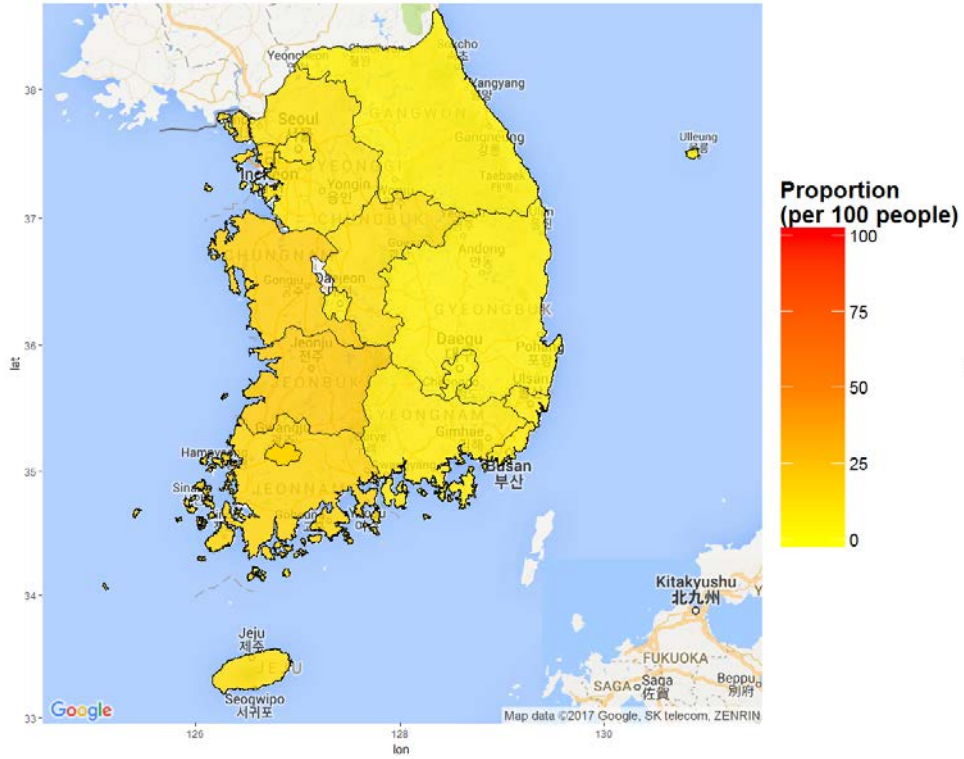
with era length Greater Than 7 days

starting between 7 days Before and 30 days After event index date and ending any time.

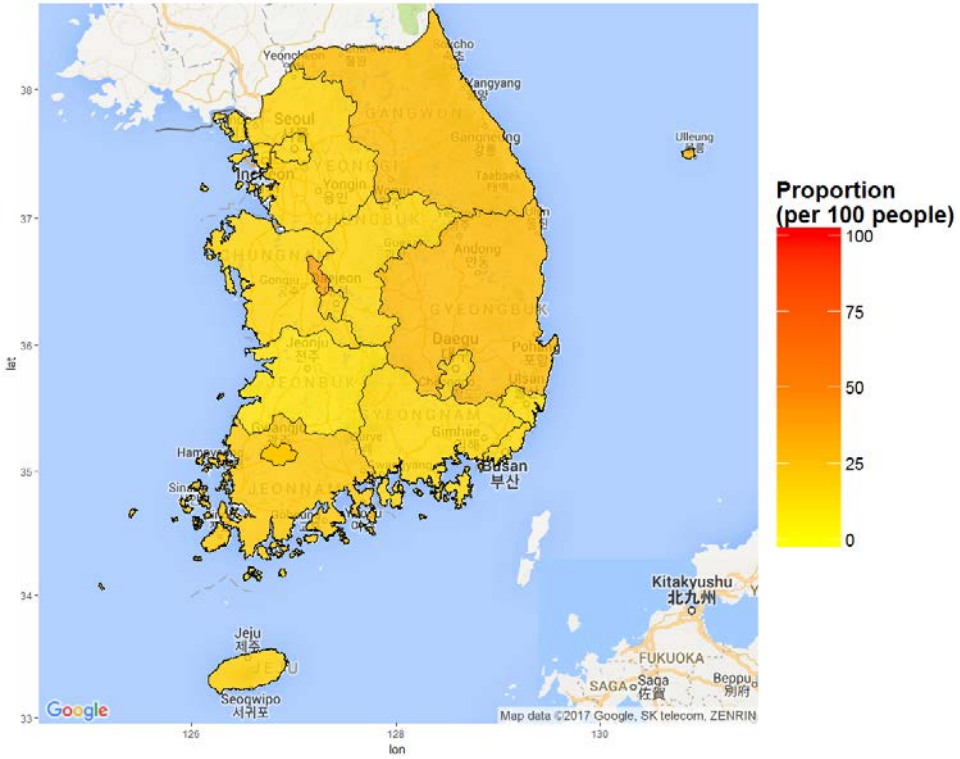
Limit cohort of initial events to: all events per person.

Result from AEGIS (Lv 2, Proportion)

Rosuvastatin (n=761)

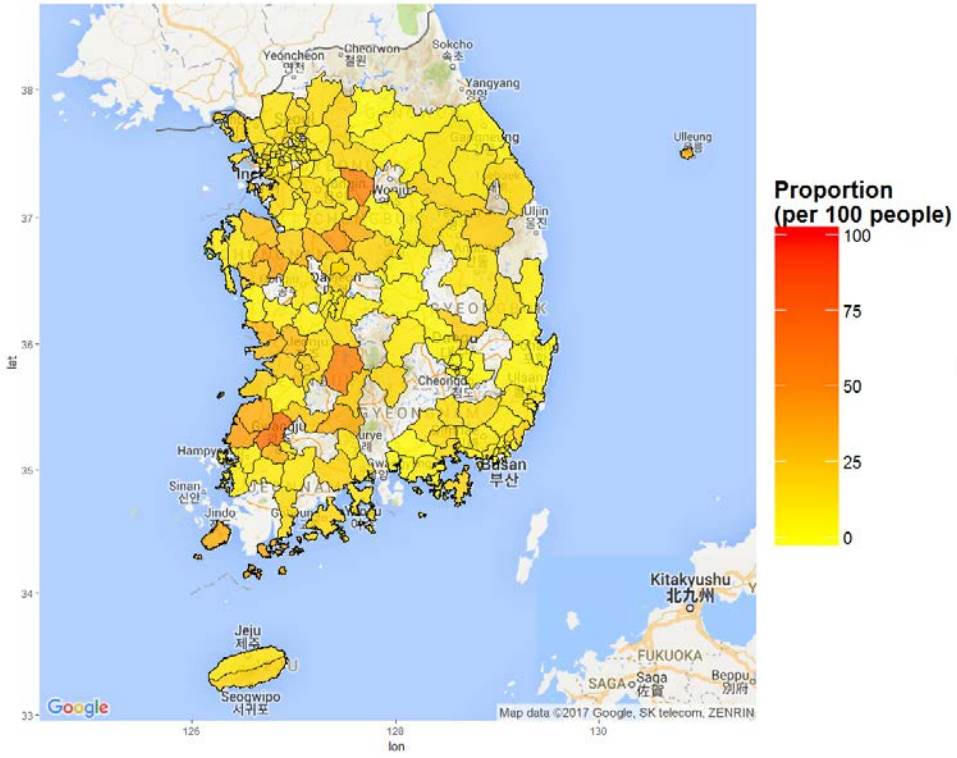


Atorvastatin (n=1277)

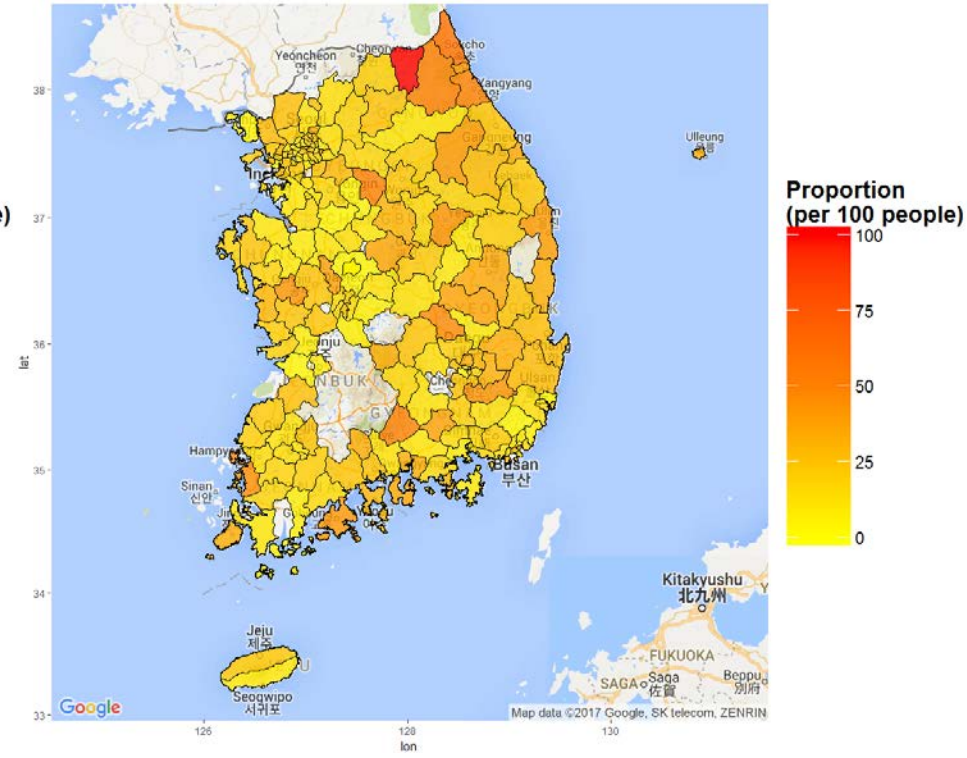


Result from AEGIS (Lv3, Proportion)

Rosuvastatin (n=761)

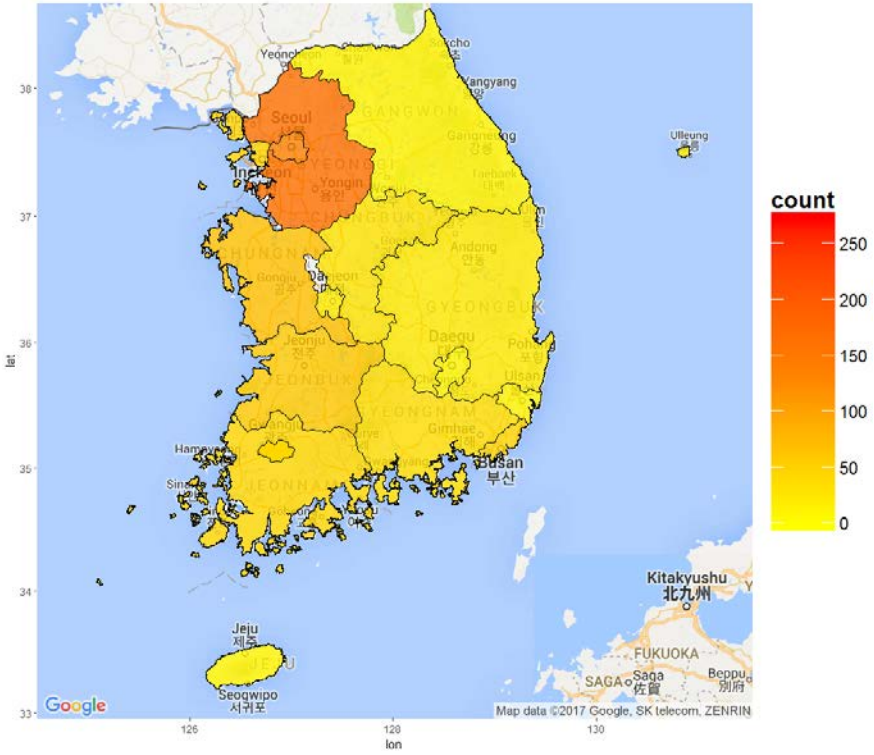


Atorvastatin (n=1277)

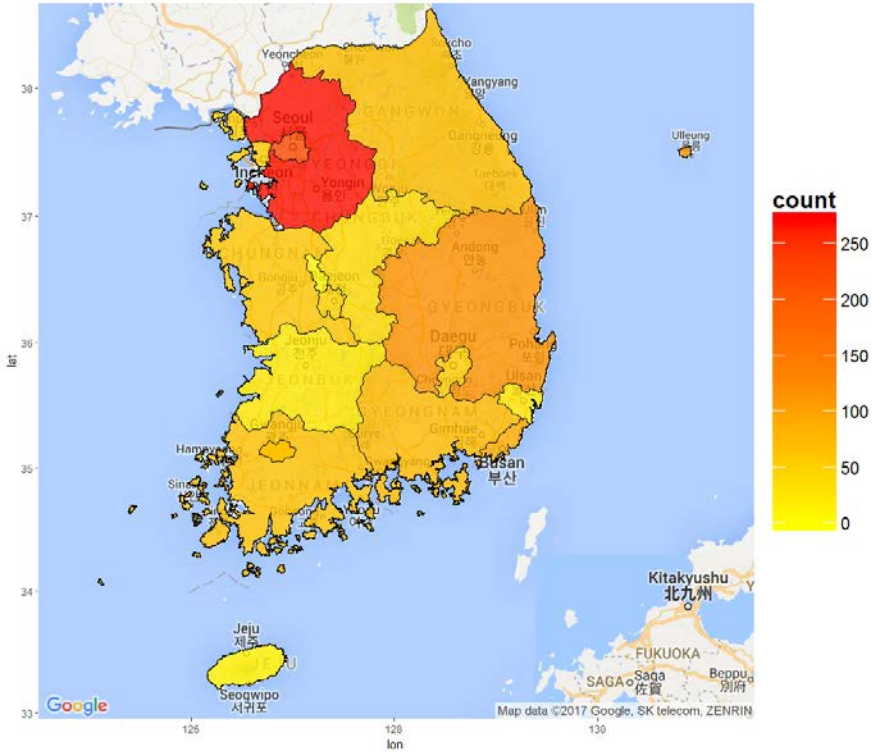


Result from AEGIS (Lv2, count)

Rosuvastatin (n=761)

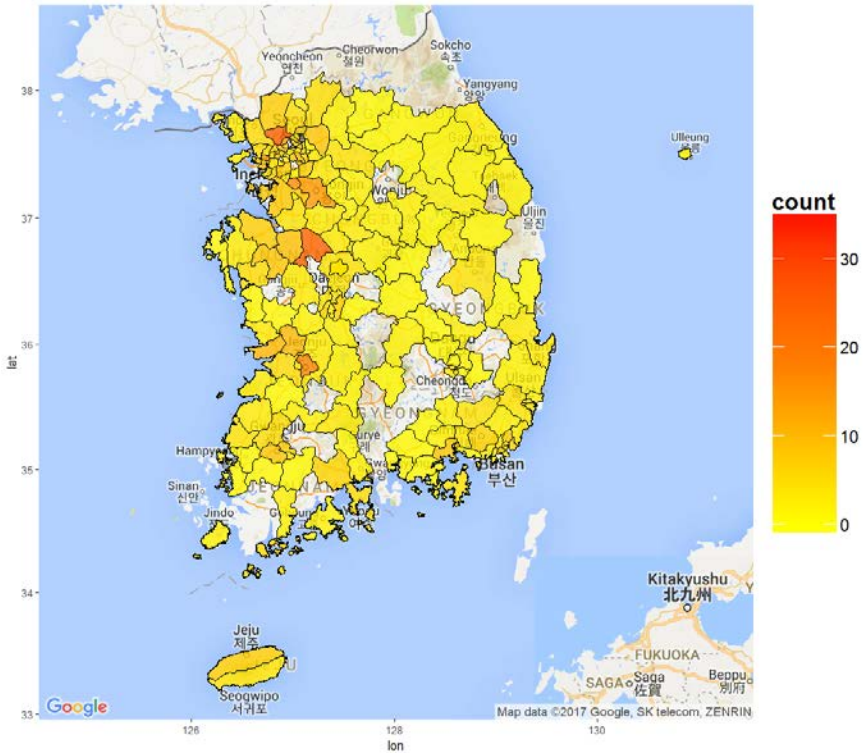


Atorvastatin (n=1277)

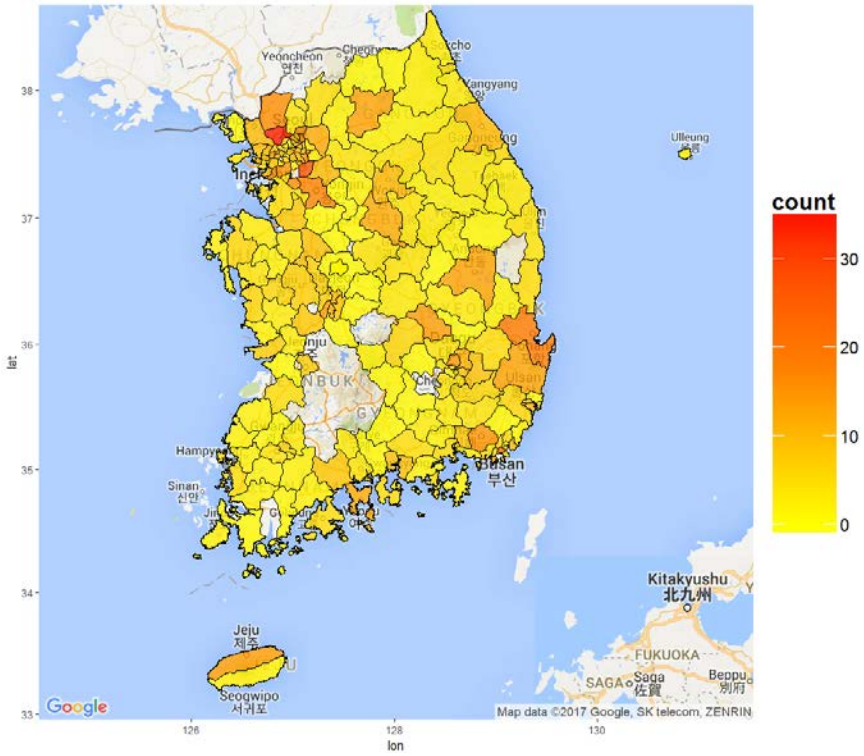


Result from AEGIS (Lv3, count)

Rosuvastatin (n=761)



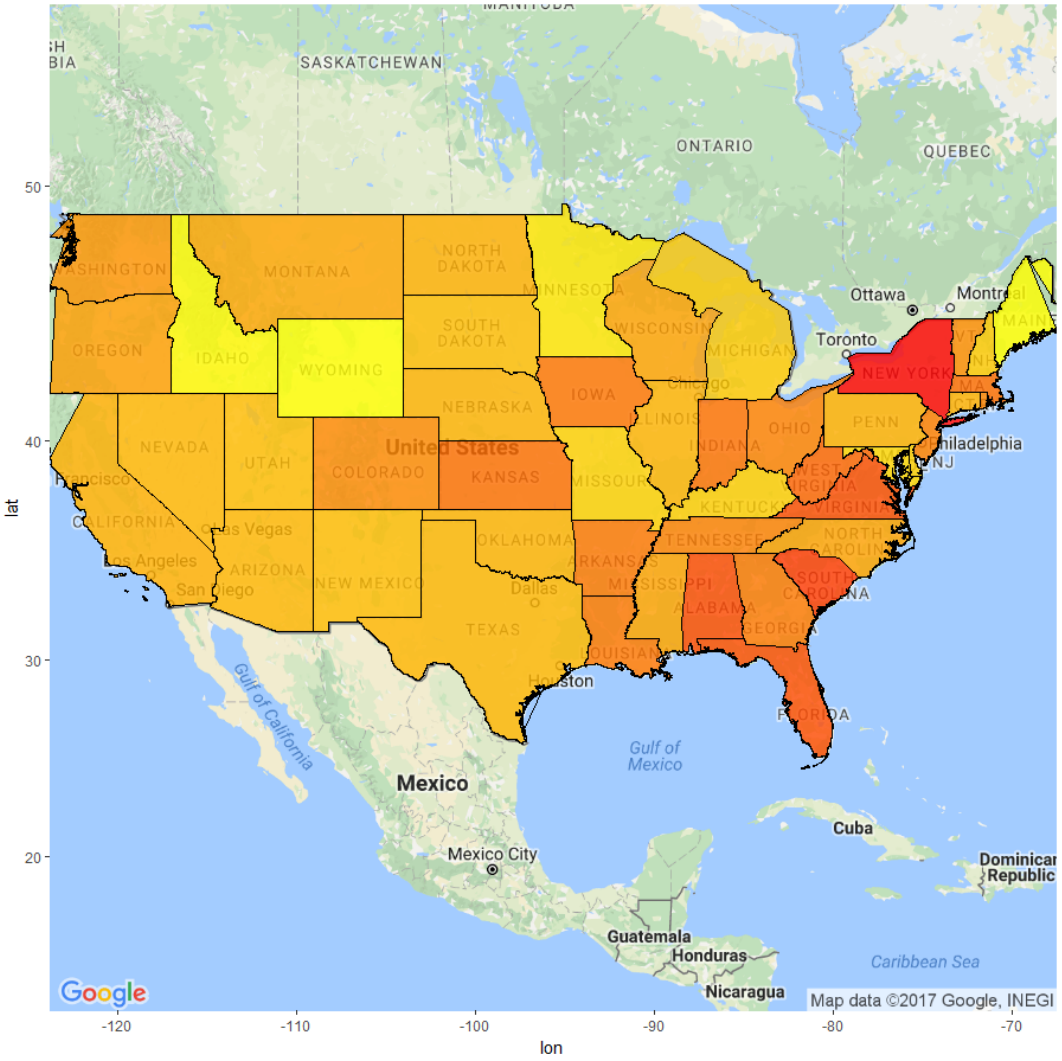
Atorvastatin (n=1277)



AEGIS UI

- **AEGIS UI**

- Example - US


SASKATCHEWAN
ONTARIO
QUEBEC
Ottawa
Toronto
MONTANA
NORTH DAKOTA
SOUTH DAKOTA
OREGON
IDAHO
WYOMING
NEBRASKA
IOWA
NEVADA
UTAH
COLORADO
KANSAS
United States
CALIFORNIA
ARIZONA
NEW MEXICO
OKLAHOMA
TEXAS
Dallas
Houston
Chicago
NEW YORK
PENN
Philadelphia
Las Vegas
Los Angeles
San Diego
Gulf of California
Gulf of Mexico
Mexico
Mexico City
Cuba
Guatemala
Honduras
Nicaragua
Caribbean Sea
Google
Map data ©2017 Google, INEGI
lat
lon
50
40
30
20
-120
-110
-100
-90
-80
-70

- Administrative areas : level 1 or level 1 - 4

	Vatican City	China
level 1 : nation	Vatican City	China
level 2 : state	-	Shandong
level 3 : countie	-	Qingdao
level 4 : township	-	Huangdao

- Administrative areas : level 1 or level 1 - 4

	Vatican City	China
level 1 : nation	Vatican City	China
level 2 : state	-	Shandong
level 3 : countie	-	Qingdao
level 4 : township	-	Huangdao

Suggestion

- What we're suggesting:
  - Adopting GADM as standard vocabulary for geographical index in CDM

  - ex1) Autauga County, AL, United States (LEVEL 3)

nation ID		level		object ID		Vocabulary
'244'	+	'03'	+	'0001'	=	'244030001'

ex2) Huangdao, Qingdao, Shandong, China (LEVEL 4)

nation ID		level		object ID		Vocabulary
'049'	+	'04'	+	'1707'	=	'049041707'

Suggestion

- What we’re suggesting:
  - Not in OMOP vocabulary table itself, but via using mapping table
    - Mapping between GADM and CDM location using FACT_RELATIONSHIP table

Future work

- Add for various plot option
- Optimization of UI
- Add functions for counting number of patients according to the care site

Thank you