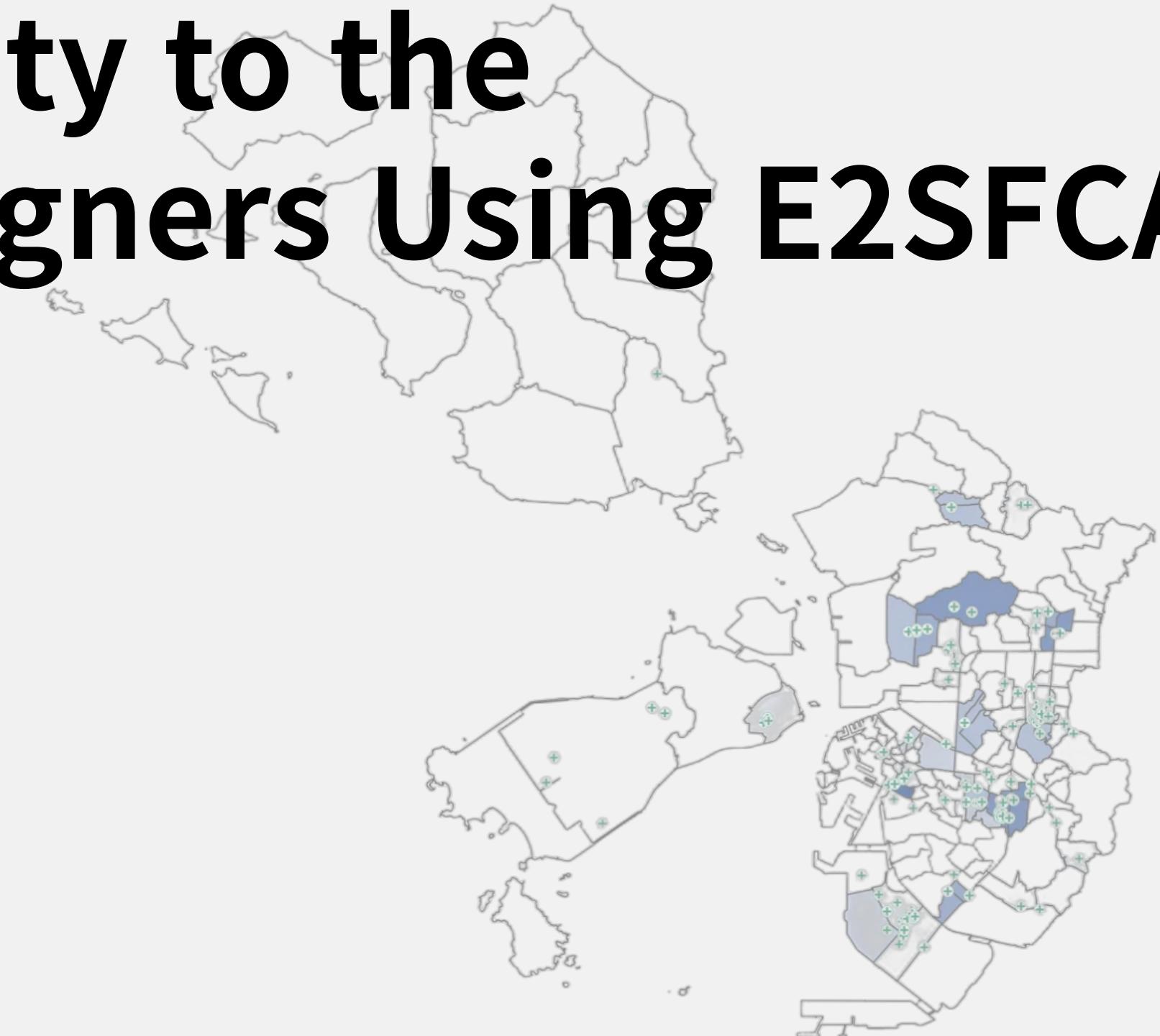


2024-2 Global Risk and Geographical Imagination

Spatial Accessibility to the Hospitals to Foreigners Using E2SFCA : A Case Study of Incheon



Geography 2020110218 Jiyeon Hwang

Geography 2019103683 Byungwoo Lee

History & Sociology 2024006887 Noah Miller

Philosophy, Politics & Economics 2024006861 Noé Sauvage

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- 1 Why is healthcare accessibility crucial?**

- 2 Problem Statement**

- 3 Selection of study area based on data analysis**

- 4 Measuring Spatial Accessibility to the Hospitals to Foreigners Using E2SFCA**

- 5 Conclusion & Provide Solutions**

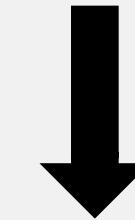
1. Why is healthcare accessibility crucial?

Why is healthcare accessibility crucial?



SDGs Goal 3 : Good Health and Well being

SDGs Goal 10 : Reduced Inequalities



Basic human right

Problem Statement

Are Big 5 hospitals in Korea foreigner-friendly?

👤 Marianne Chang | 🕒 Published 2023.01.18 11:33

"It's not that English services don't exist but ***you will need to search for specific hospitals which might not be near to you,*** and usually the bill will also be more expensive."

"Most hospitals have international health programs but often specifically designed for medical tourism purposes."

**"Tragedy of the foreign worker
despite he paid for medical insurance"**

사회 사회일반

**[뉴스AS] 12만원씩 건강보험 낸 속행은
왜 치료 못 받고 숨졌다**

비닐하우스 속소 이주노동자의 비극

이재호 기자

수정 2021-01-05 04:59 등록 2021-01-05 04:59

A survey of 1,060 foreigners living in Korea about medical service

54.1% : Unable to use medical services due to cost burden

27.9% : Difficult to communicate

17.7% : I don't know where to go

11.6% : Transportation is inconvenient

"We need to lower the burden on foreign health insurance subscribers and increase access to medical services to guarantee health rights."

Problem Statement

All over the world

: discrepancies in healthcare provisions between foreigners and non-foreigners

- Language barrier
- Financial barrier
- Lack of trust
- ...



South Korea also experiences this lack of inclusivity

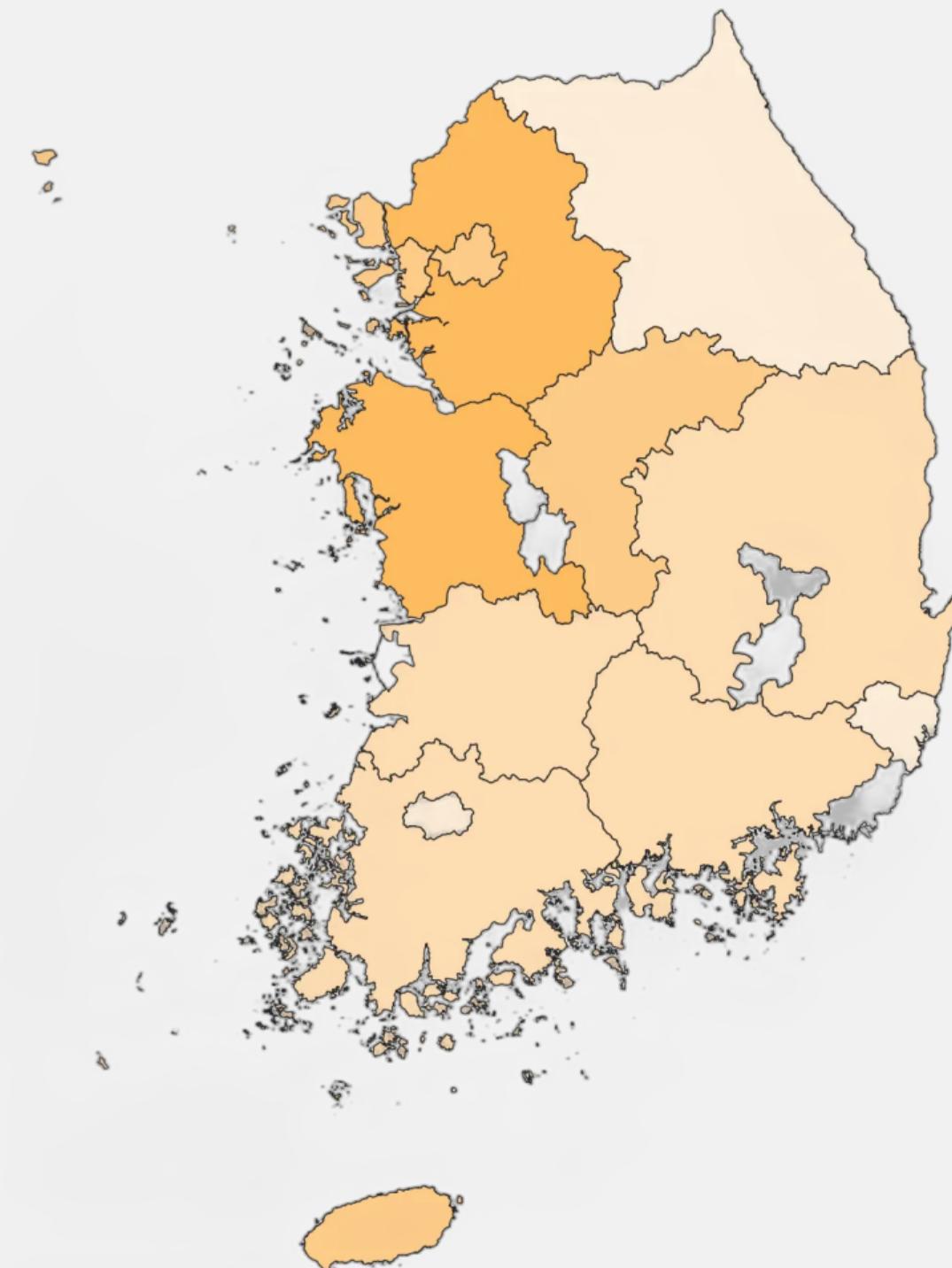
→ Need for an inclusive approach to address this

- E2SFCA analysis of Incheon
- High proportion of foreigners



2022 Foreign Population Density in Korea

Incheon has the second highest foreign population density after Seoul

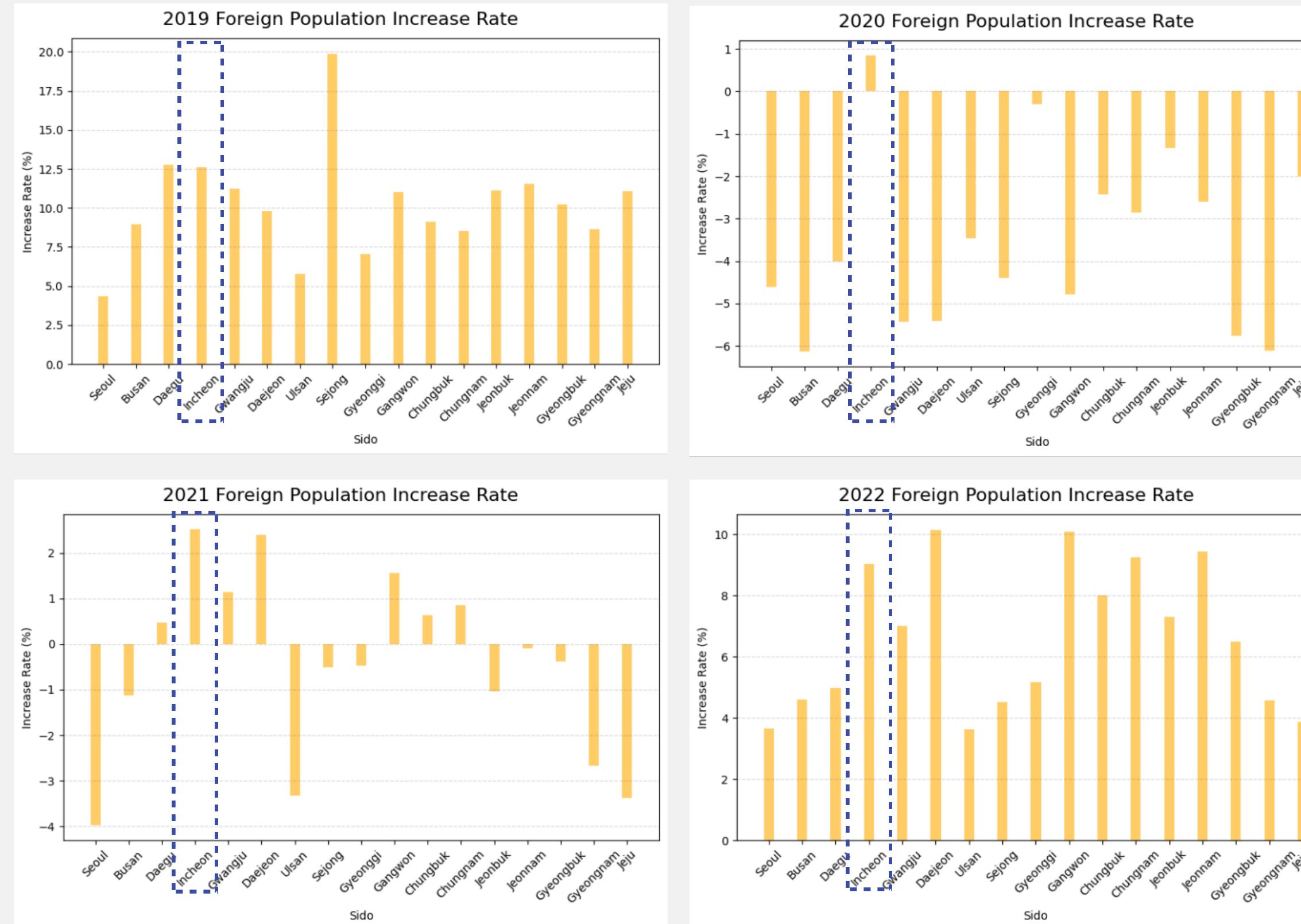


| SIDO_NM | 22_density |
|---------------|-------------|
| 서울특별시 Seoul | 0.000730809 |
| 인천광역시 Incheon | 0.000137649 |

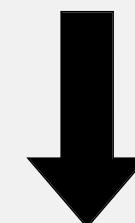
Foreign population/Area (people/m²)

3. Selection of study area based on data analysis

2019 to 2022 Foreign Population Increase Rate



1. Incheon is always ranked in the top5 in Korea for foreign population growth rate for 4years(19-22)
2. In addition, even during the COVID-19 period in 2020, Incheon was the only foreign population growth rate in Korea.
3. Incheon ranks first in foreign population growth in Korea in 2021. Top5 in 2022

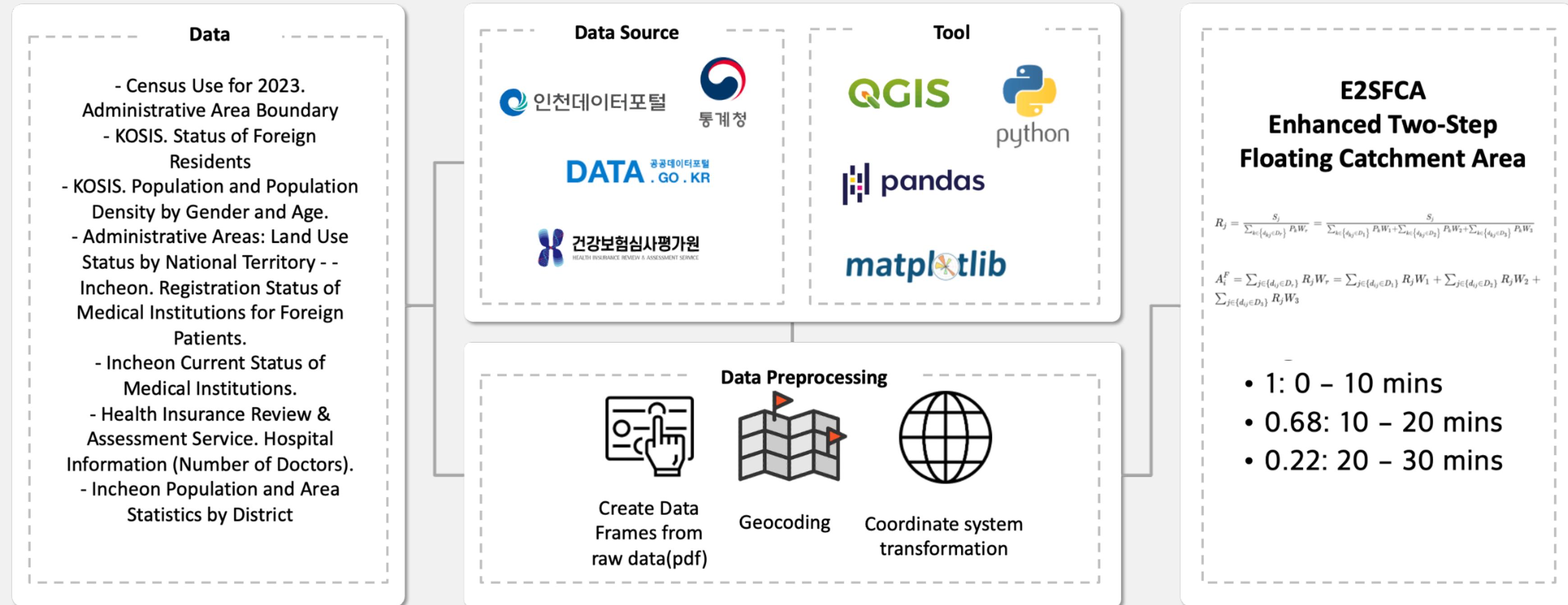


From these things, Incheon is a region where the foreign population is steadily increasing.

Select Incheon as the Research Area

4. Measuring Spatial Accessibility to the Hospitals to Foreigners Using E2SFCA

Analysis Pipeline



E2SFCA Process Summary

Step 1 Goals

< Measurement of supply capacity of each hospitals which have foreign medical service >

1. Create a buffer from a supply points(hospitals).
2. Sum of demand in the buffer(demand = foreign population)
3. Calculate supply capacity = dividing the supply amounts of each hospitals by the sum of demand

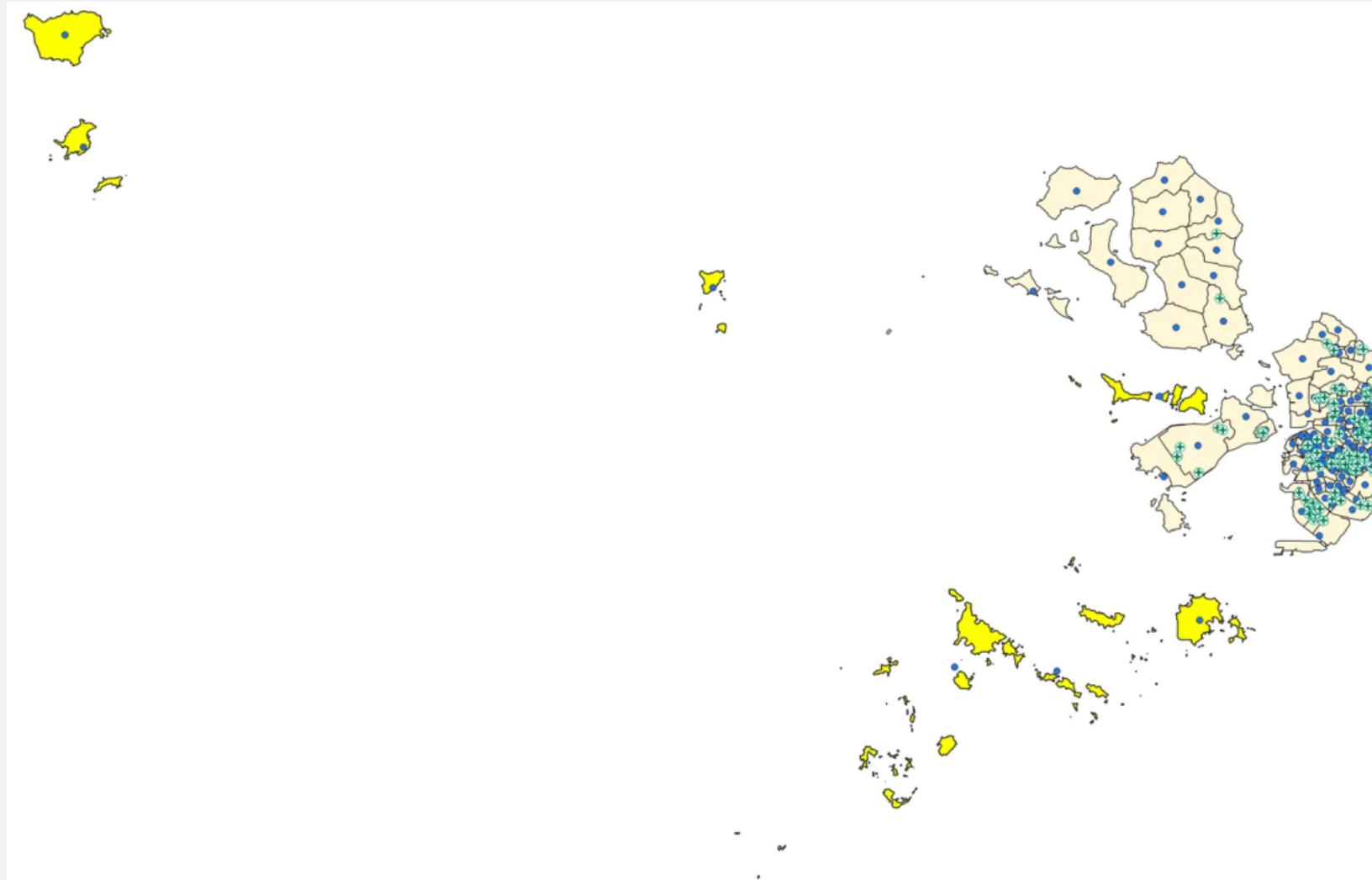
Step 2 Goals

< Measurement of accessibility to hospitals to foreigners of each town in Incheon >

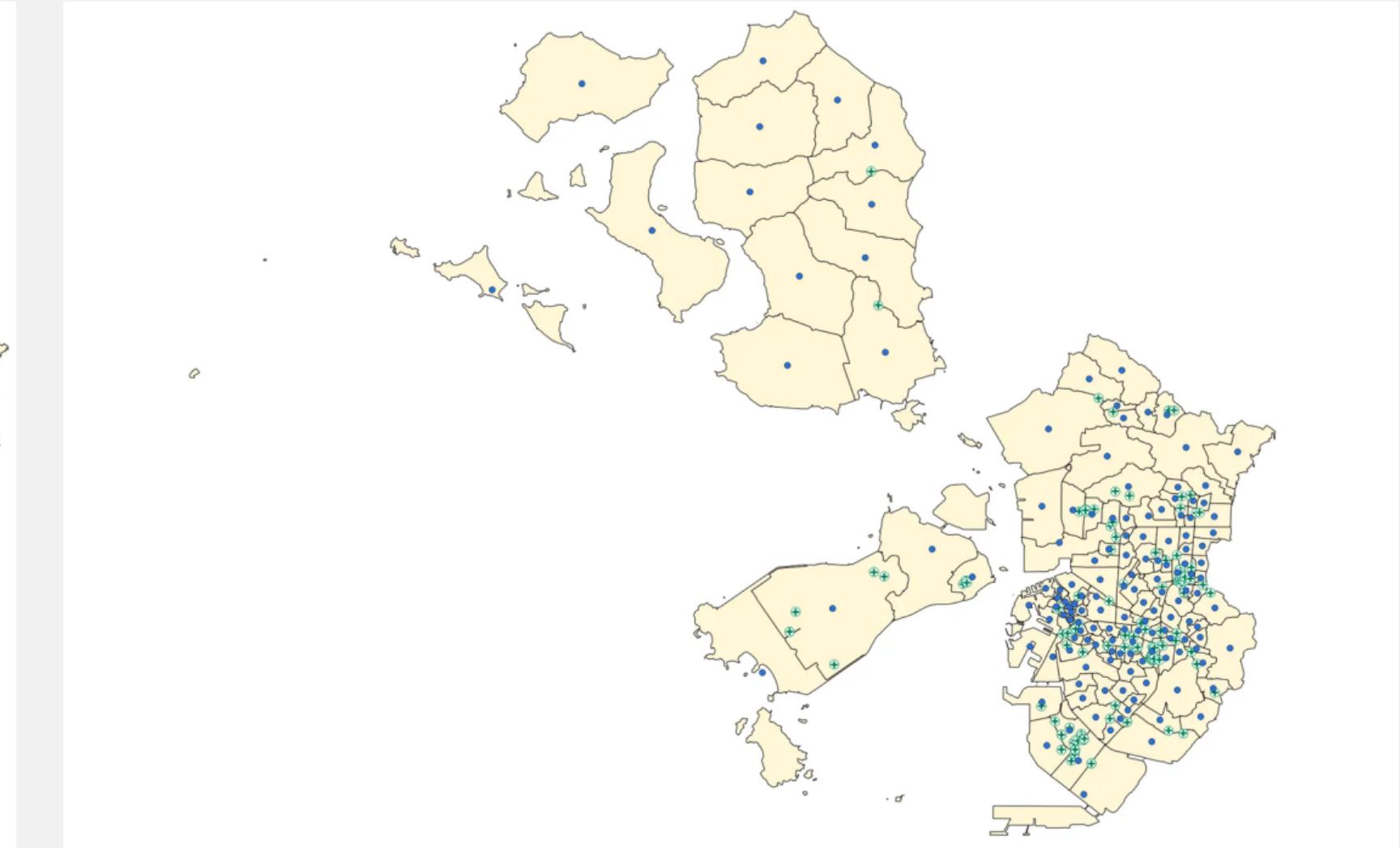
1. Create a buffer from a demand points(centroid of town).
2. Sum of supply capacity(PPR) in the buffer
3. Calculate of accessibility of each town in Incheon

Data Preprocessing

Exclusion Ongjin-gun from the study area.
Reason : No hospital for foreigners.



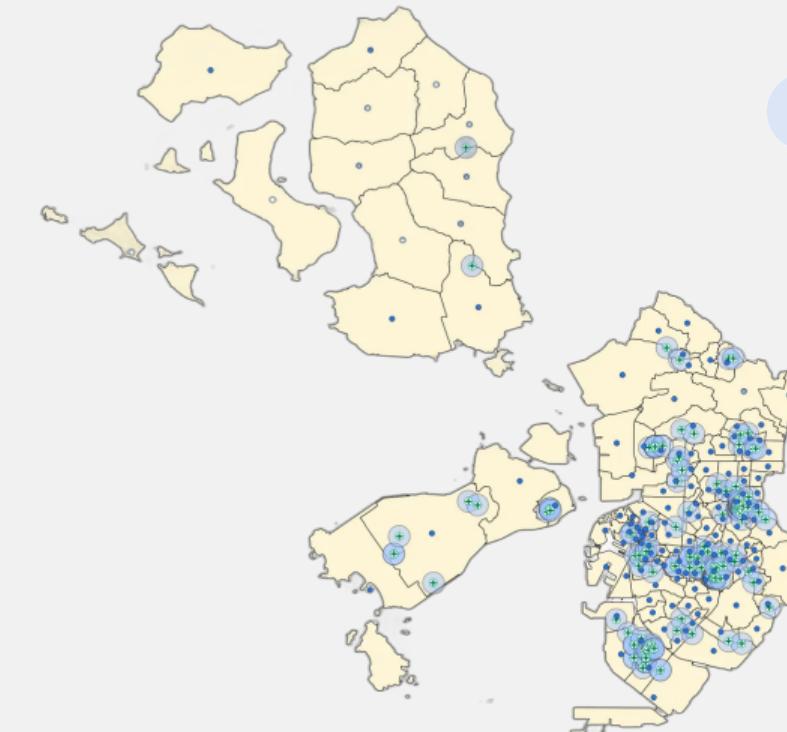
Create a centroid
for each town (Eup_Myeon_Dong)



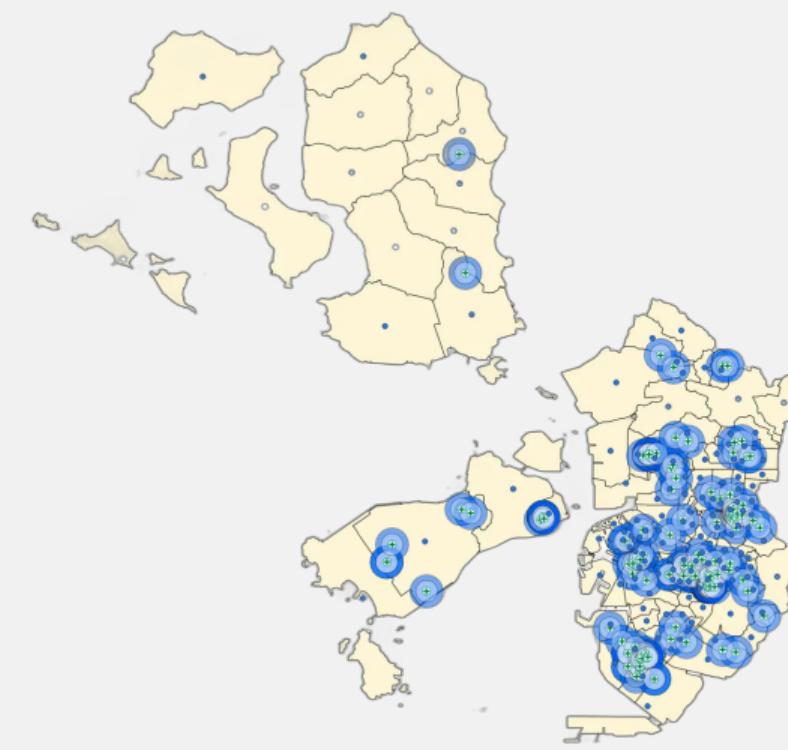
4. Measuring Spatial Accessibility to the Hospitals to Foreigners Using E2SFCA

E2SFCA Step1_Creating buffers from hospital points

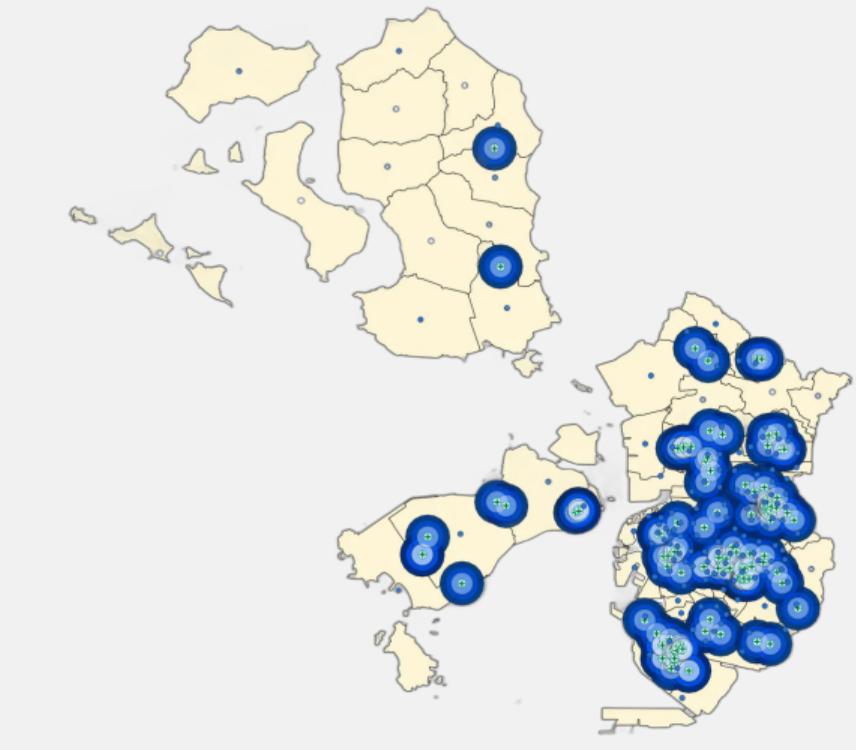
Create 870m, 1250m, and 1670m buffers
from supply point hospitals



10min walk (870m)



10-15min walk (1250m)

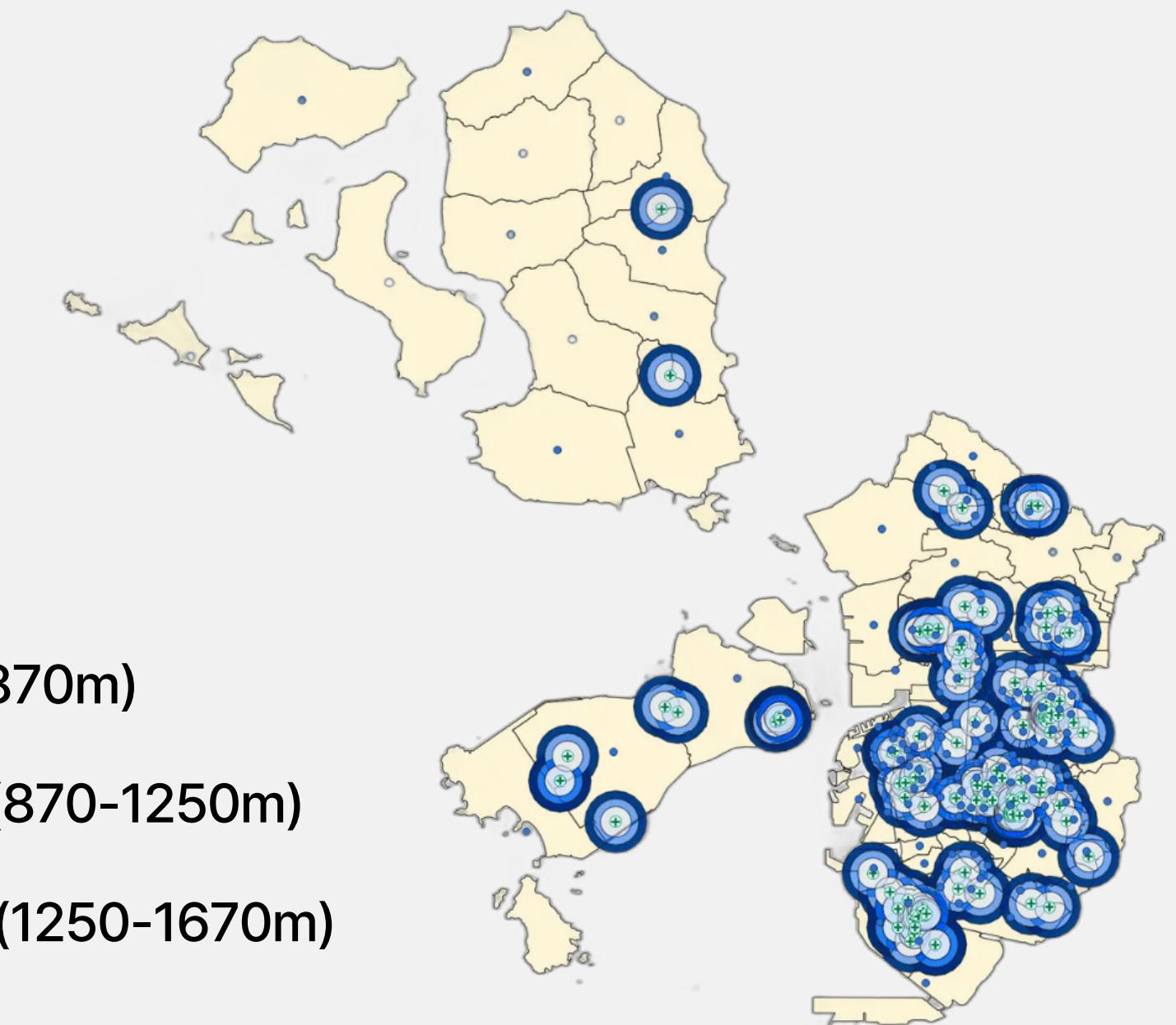
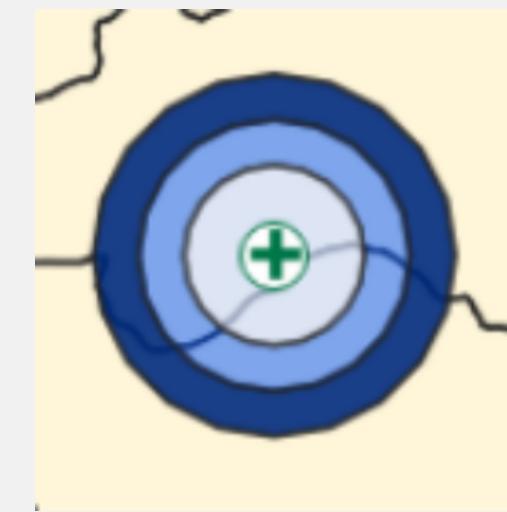
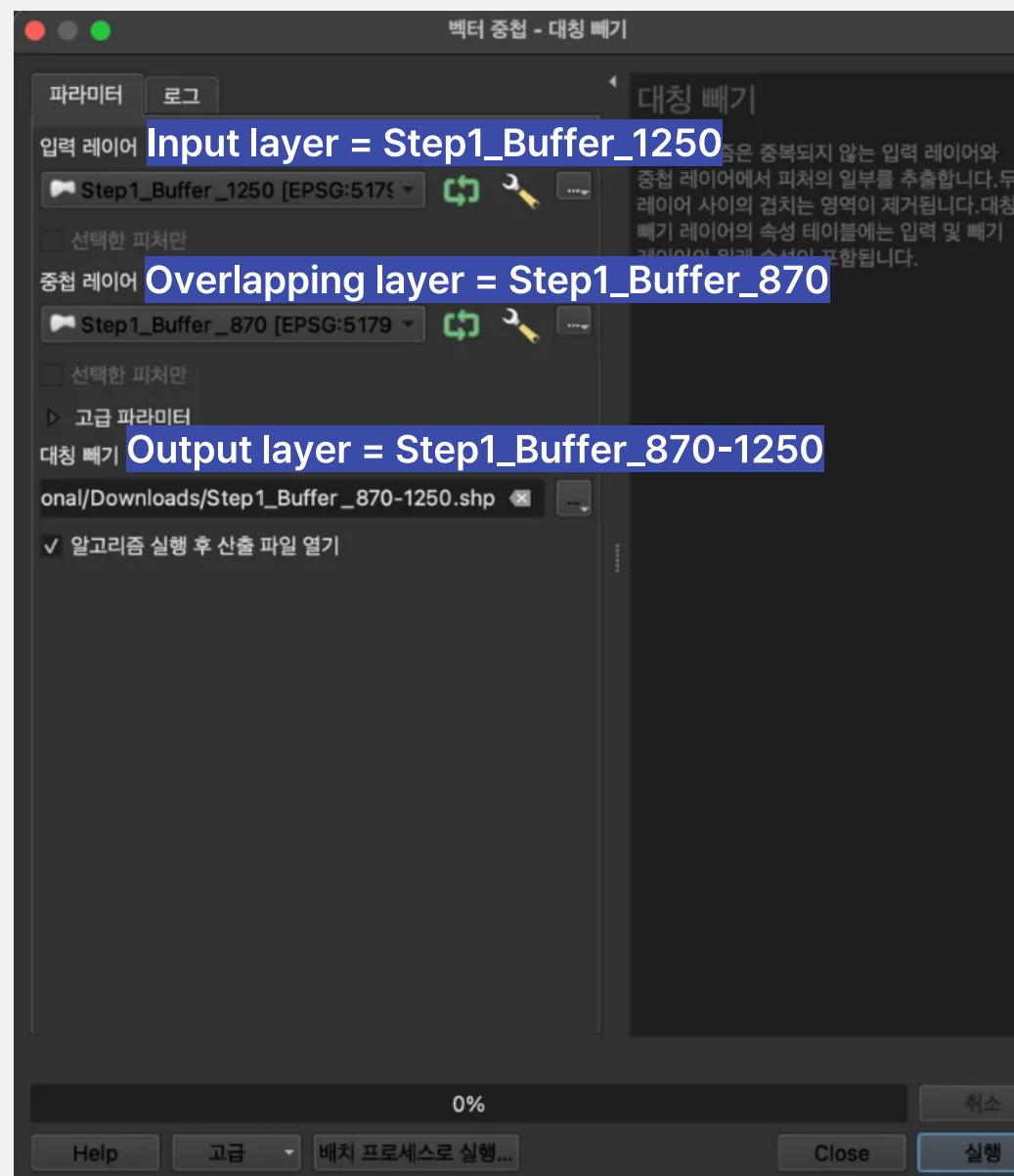


15-20min walk (1670m)

4. Measuring Spatial Accessibility to the Hospitals to Foreigners Using E2SFCA

E2SFCA Step1_Creating donut-shaped buffers

Remove overlapping parts to make donut-shaped buffers in areas 0-870m, 870m-1250m, 1250m-1670m



4. Measuring Spatial Accessibility to the Hospitals to Foreigners Using E2SFCA

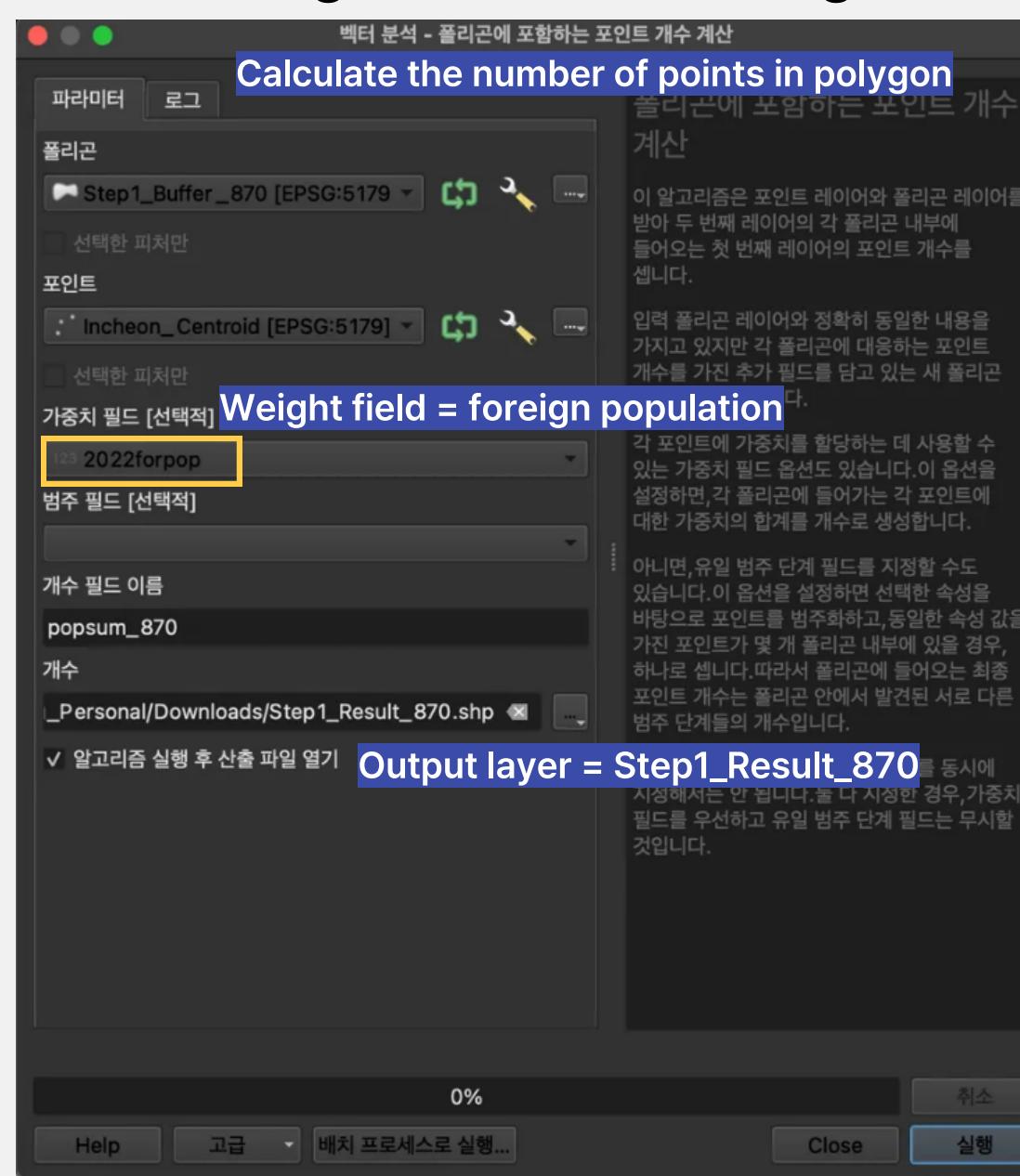
E2SFCA Step1_Multiplying weight 1, 0.68, 0.22

Now count the number of points in three buffers to calculate the PPR(physical to population ratio) for each hospital.

"popsum" = Count the number of points in each buffer (weight = Foreign population)

Then multiply each of the three "pop sum" columns by the corresponding weights 1, 0.68, and 0.22

→ Creating "(buffer size) weight" column!



The screenshot shows a software interface for creating a new field. The top section has a checked checkbox labeled "새로운 필드 생성" (New Field Creation). Below it, another checkbox is unchecked, labeled "가상 필드 생성" (Virtual Field Creation). A yellow box highlights the "산출 필드 이름" (Output Field Name) input field, which contains "1670weight". To the right of this input is a dropdown menu showing "1.2 십진수 (실수)" (1.2 Decimal (Real Number)). Below this are fields for "산출 필드 길이" (Output Field Length) set to 10, "정확도" (Precision) set to 3, and "표현식" (Expression) and "함수 편집기" (Function Editor) buttons. Below these buttons are five small icons: a file, a clipboard, a pencil, a trash can, a download arrow, and an upload arrow. A yellow box highlights the expression field, which contains the text "`"popsum_167" *0.22`". At the bottom, a large blue box contains the text "Weight for zone that takes 15 to 20 minutes on foot = 0.22". The top right corner of the screen has a partial view of the letter "p".

| popsum_1670 | 1670weight |
|----------------|------------|
| 0 | 0 |
| 0 | 0 |
| 1084.000000... | 238.480 |
| 0 | 0 |
| 0 | 0 |
| 610.000000... | 134.200 |
| 4870.000000... | 1071.400 |
| 0 | 0 |
| 0 | 0 |
| 469.000000... | 103.180 |
| 691.000000... | 152.020 |
| 0 | 0 |
| 0 | 0 |
| 514.0000000... | 113.080 |
| 0 | 0 |
| 514.0000000... | 113.080 |
| 1117.000000... | 245.740 |
| 0 | 0 |
| 0 | 0 |
| 0 | 0 |
| 0 | 0 |
| 294.000000... | 64.680 |
| 0 | 0 |
| 0 | 0 |

4. Measuring Spatial Accessibility to the Hospitals to Foreigners Using E2SFCA

E2SFCA Step1_Table join, Calculate PPR

Step1_Result_870 Layer property table (+ Step1_Result_870-1250 "1250weight" column join +Step1_Result_1250-1670 "1670weight" column join)

After that, the supply amount is divided by the sum of the demand for the 3 buffers
 → to calculate the supply capacity of each hospital = PPR

Join property table

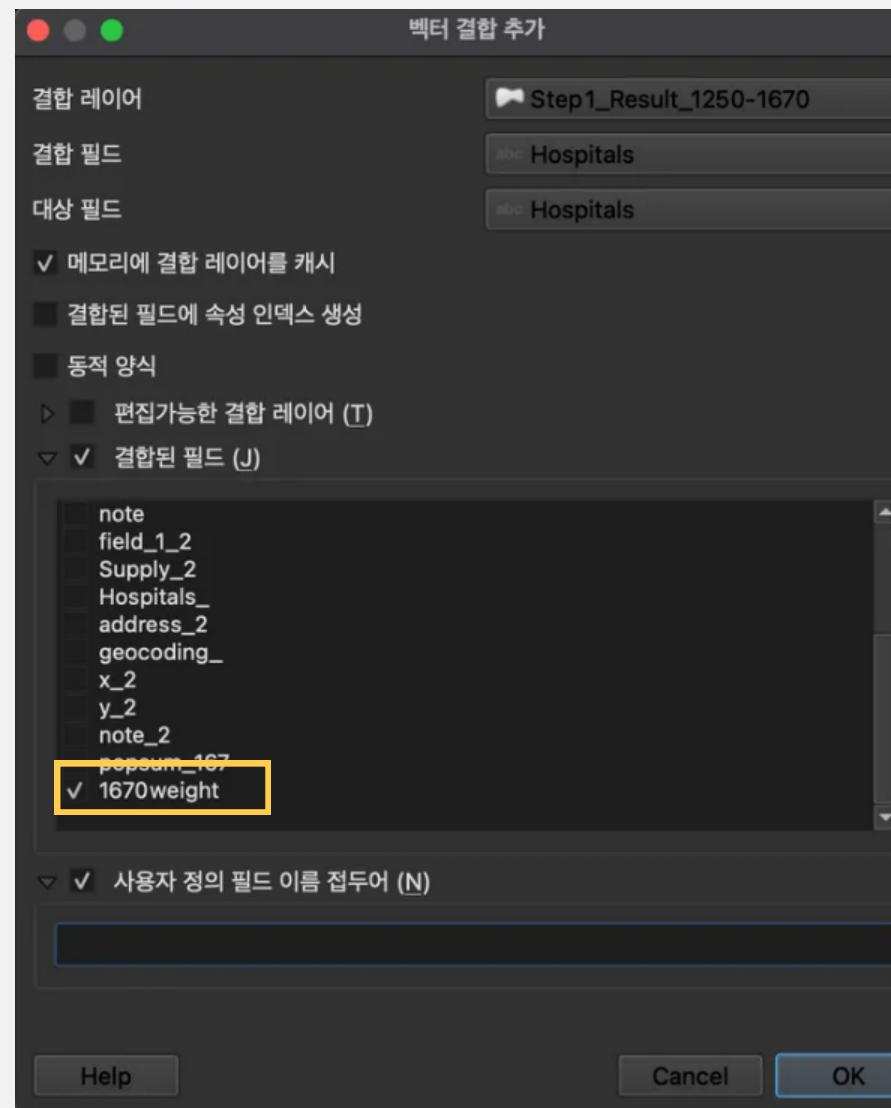
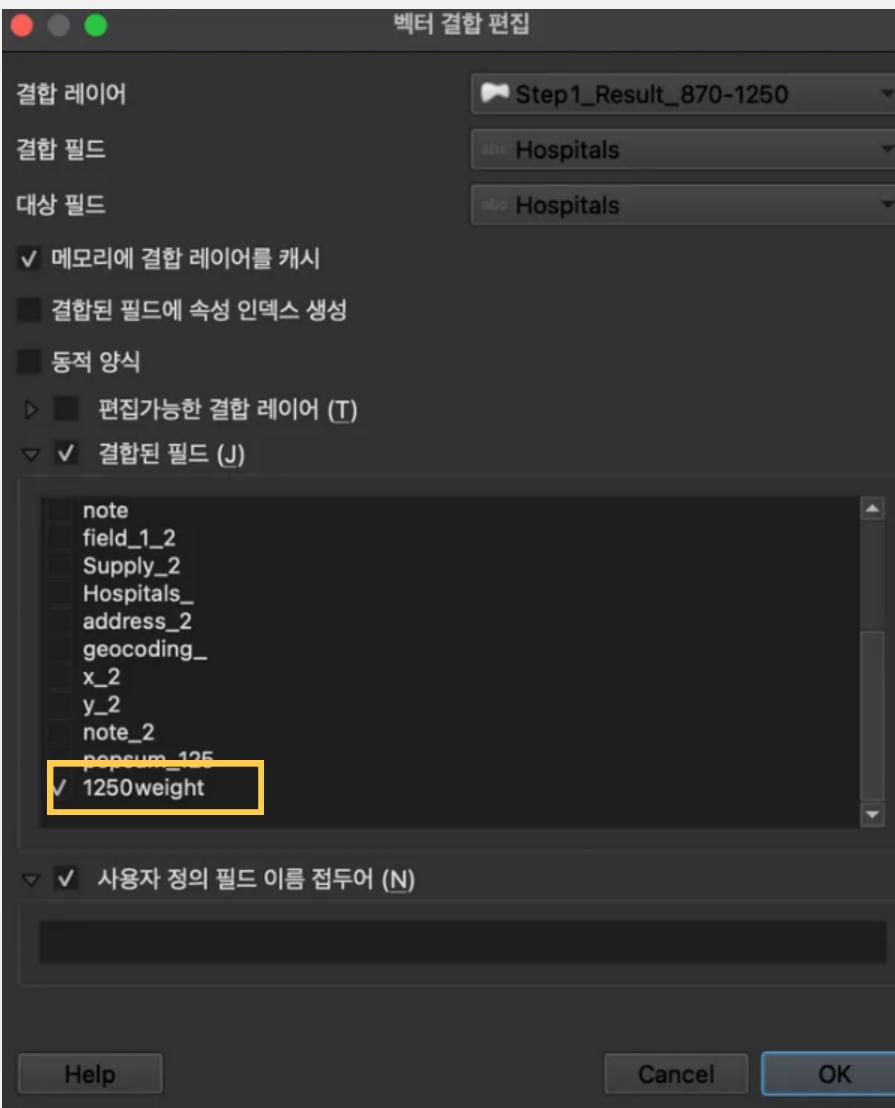


Table join result

| popsum_870 | 1670weight | 1250weight |
|----------------|------------|------------|
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 1578.000000... | 0 | 0 |
| 1578.000000... | 0 | 0 |
| 1578.000000... | 0 | 0 |
| 1578.000000... | 0 | 0 |
| 1578.000000... | 0 | 0 |
| 1578.000000... | 0 | 0 |
| 1133.000000... | 0 | 0 |
| 0 | 0 | 0 |
| 1200.000000... | 64.020 | 427.720 |
| 1200.000000... | 64.020 | 564.400 |

Calculate PPR

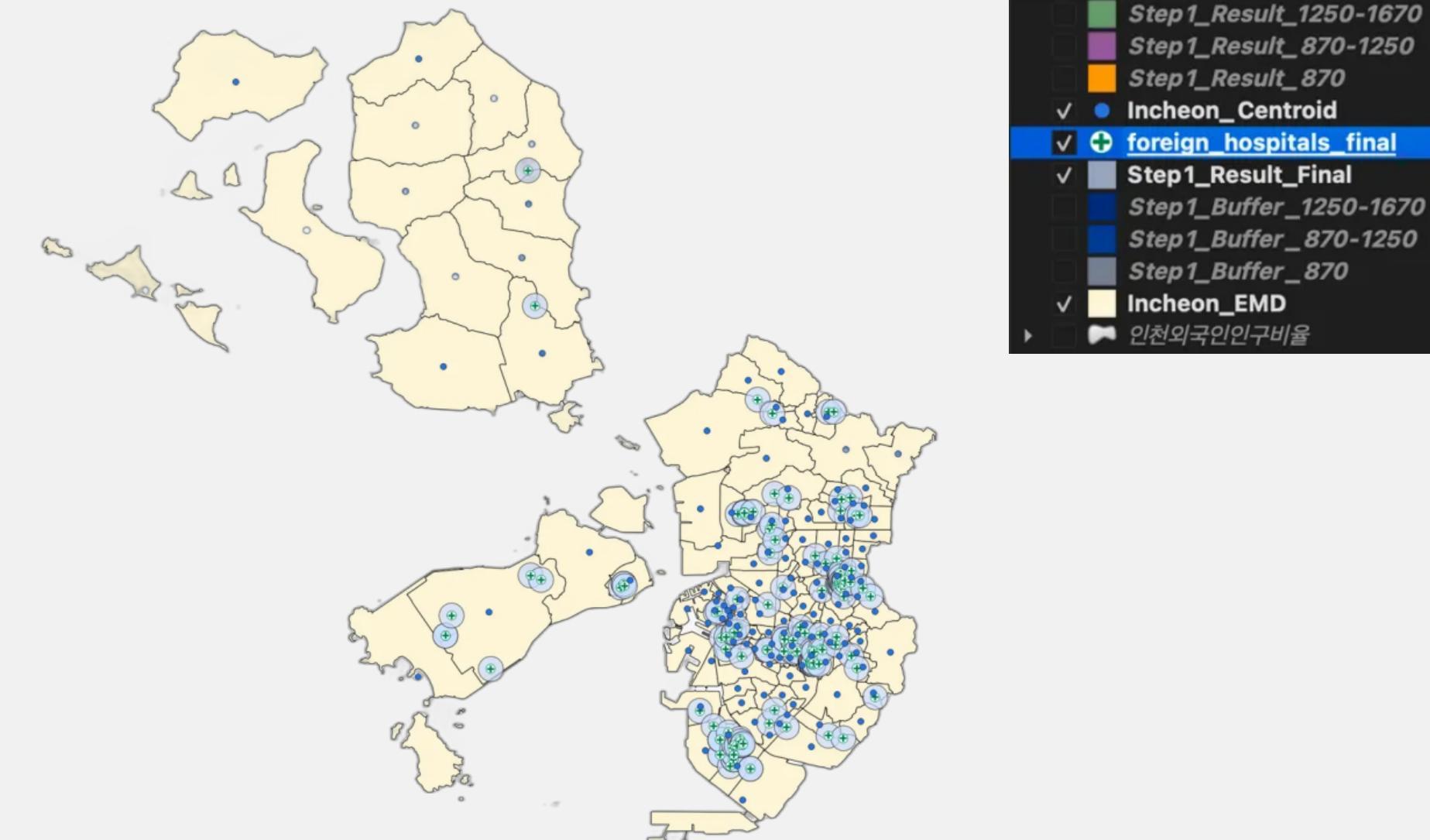
$$PPR = \frac{Supply}{Demand}$$

(foreign pop sum in 3buffers)

4. Measuring Spatial Accessibility to the Hospitals to Foreigners Using E2SFCA

E2SFCA Step1_Final Result

| Supply | Hospitals | PPR |
|--------|-------------|-------------|
| 283 | 인하대학교의과... | 0.582304526 |
| 334 | 의료법인 길의료... | 0.138992925 |
| 150 | 가톨릭관동대학... | 0.128755364 |
| 60 | 나사렛국제병원 | 0.074242724 |
| 88 | 의료법인 인성의... | 0.07188133 |
| 98 | 인천세종병원 | 0.059426353 |
| 248 | 가톨릭대학교 인... | 0.050131392 |
| 59 | 검단탑병원 | 0.049579831 |
| 86 | 의료법인루가의... | 0.044834165 |
| 13 | 플러스정형외과... | 0.038082962 |
| 25 | 청라여성병원 | 0.03805175 |
| 26 | 인천백병원 | 0.035546319 |
| 7 | 모두병원 | 0.028485391 |
| 46 | 인천광역시의료원 | 0.022194559 |
| 89 | 의료법인 아인의... | 0.018986099 |
| 36 | 뉴성민병원 | 0.018255207 |
| 44 | 현대유비스병원 | 0.014191534 |
| 42 | 인천힘찬종합병원 | 0.013699345 |
| 18 | 더블유여성병원 | 0.012625377 |
| 8 | 청라국제병원 | 0.01217656 |



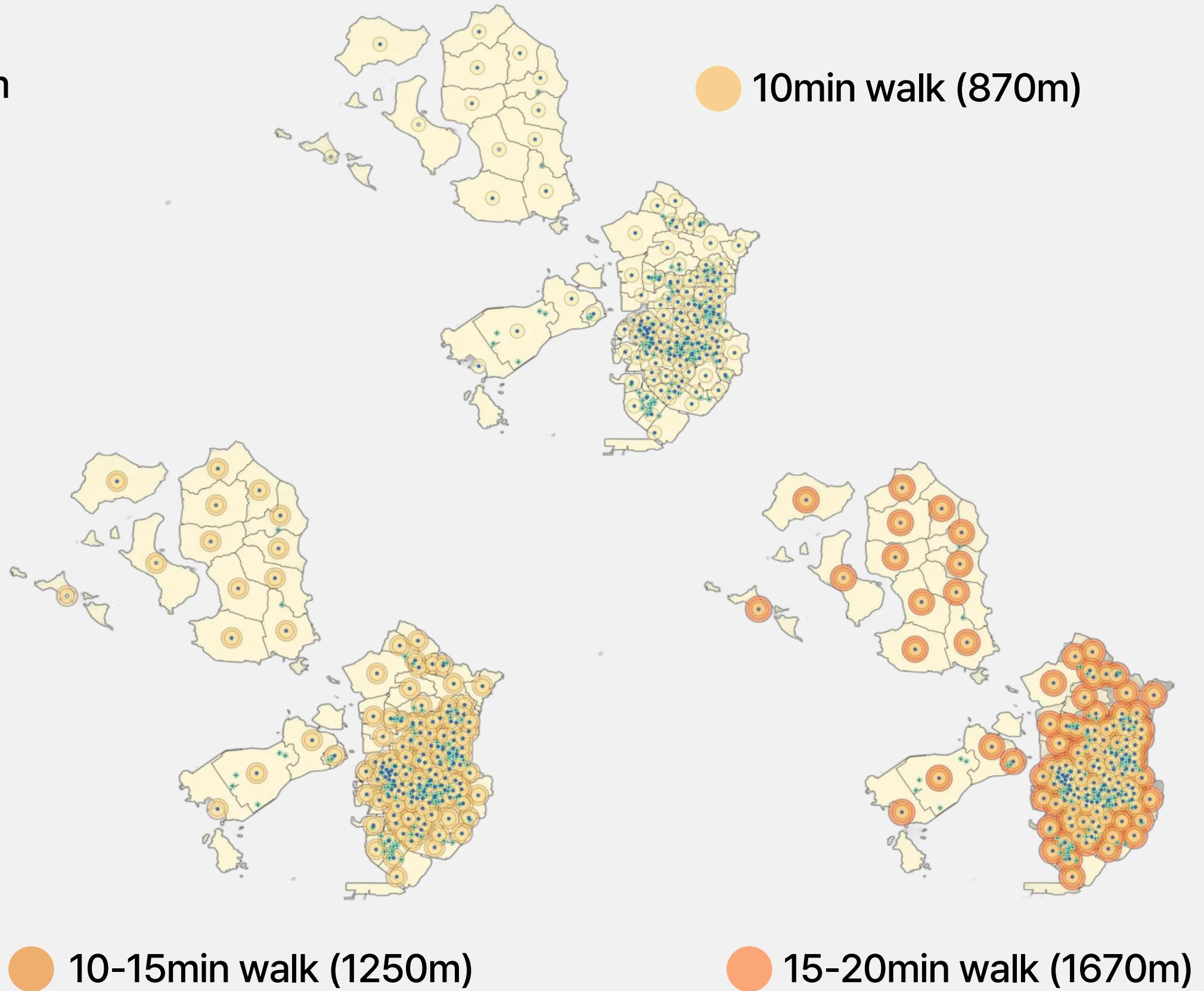
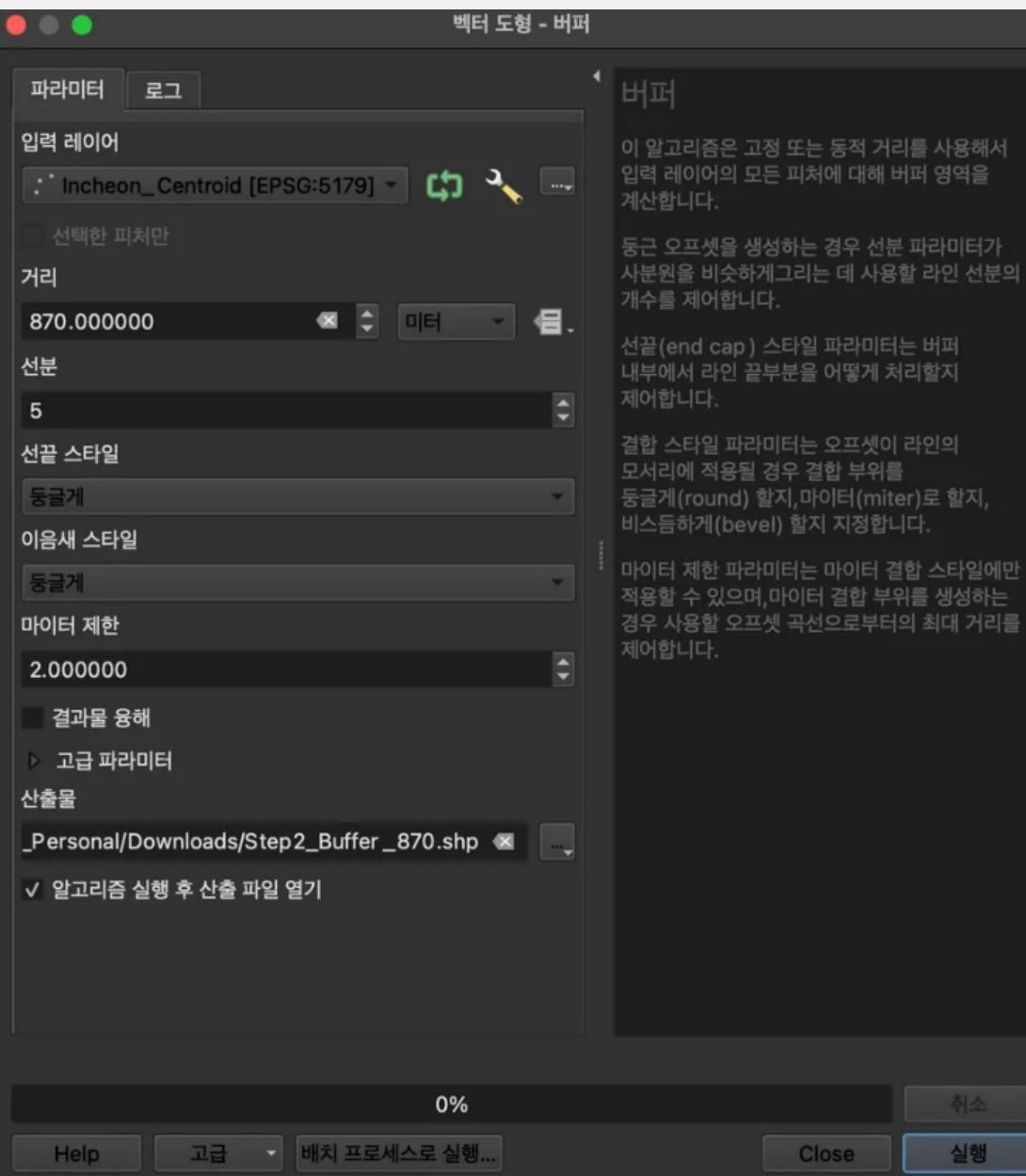
Final Result of E2SFCA Step1

We got the supply capacity of each hospitals which have foreign medical services in Incheon

4. Measuring Spatial Accessibility to the Hospitals to Foreigners Using E2SFCA

E2SFCA Step2_Creating buffers from centroid

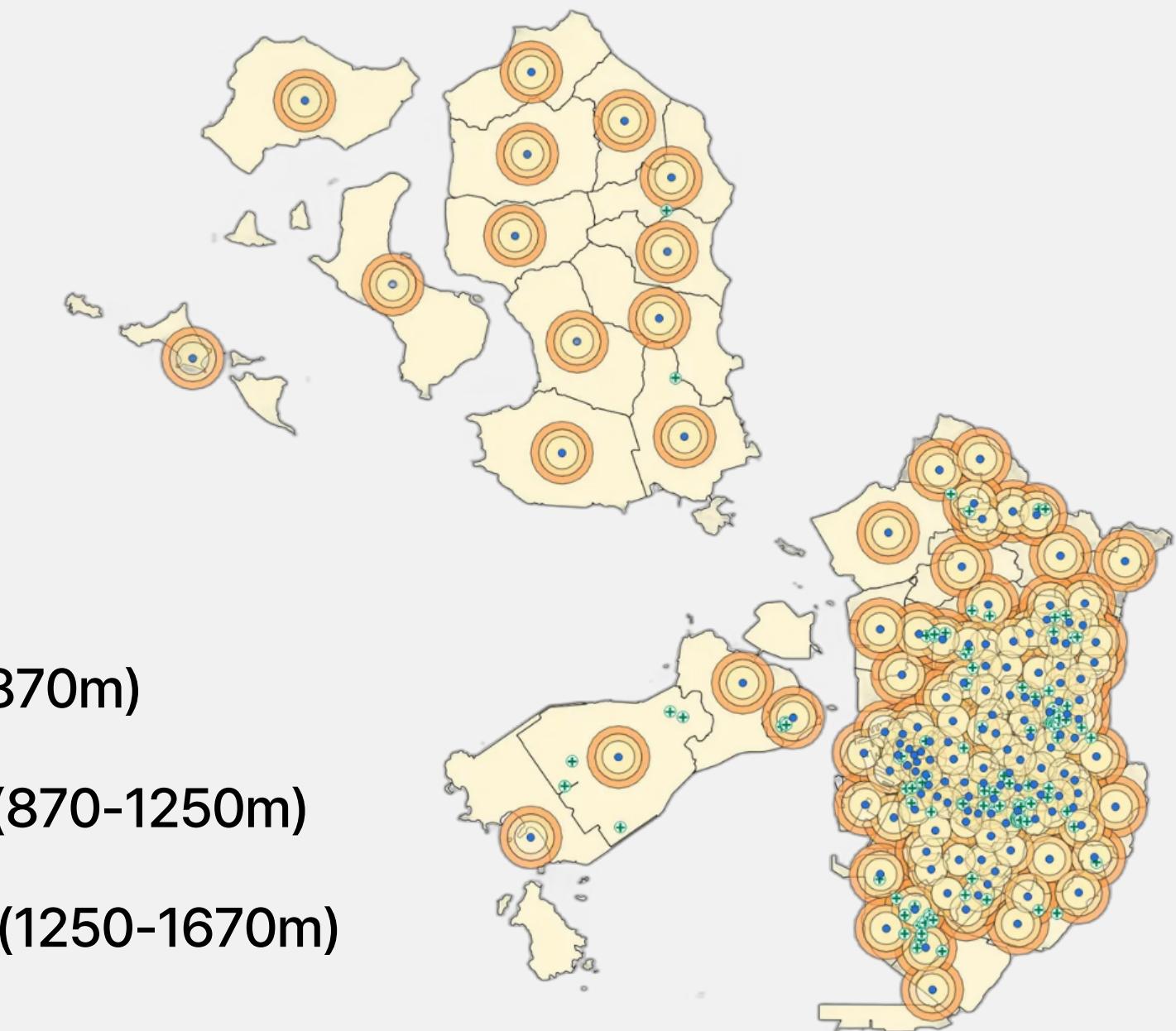
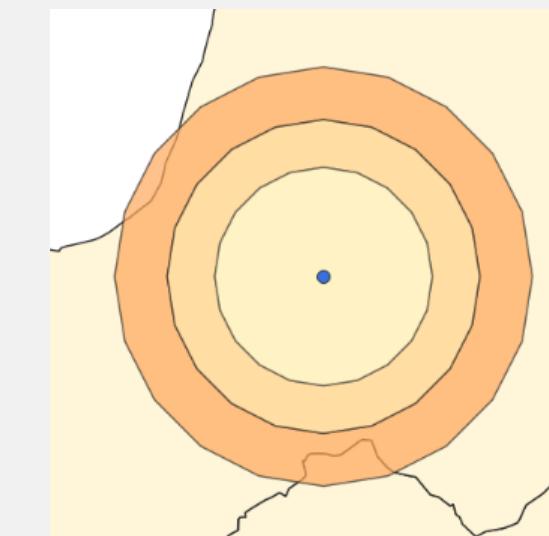
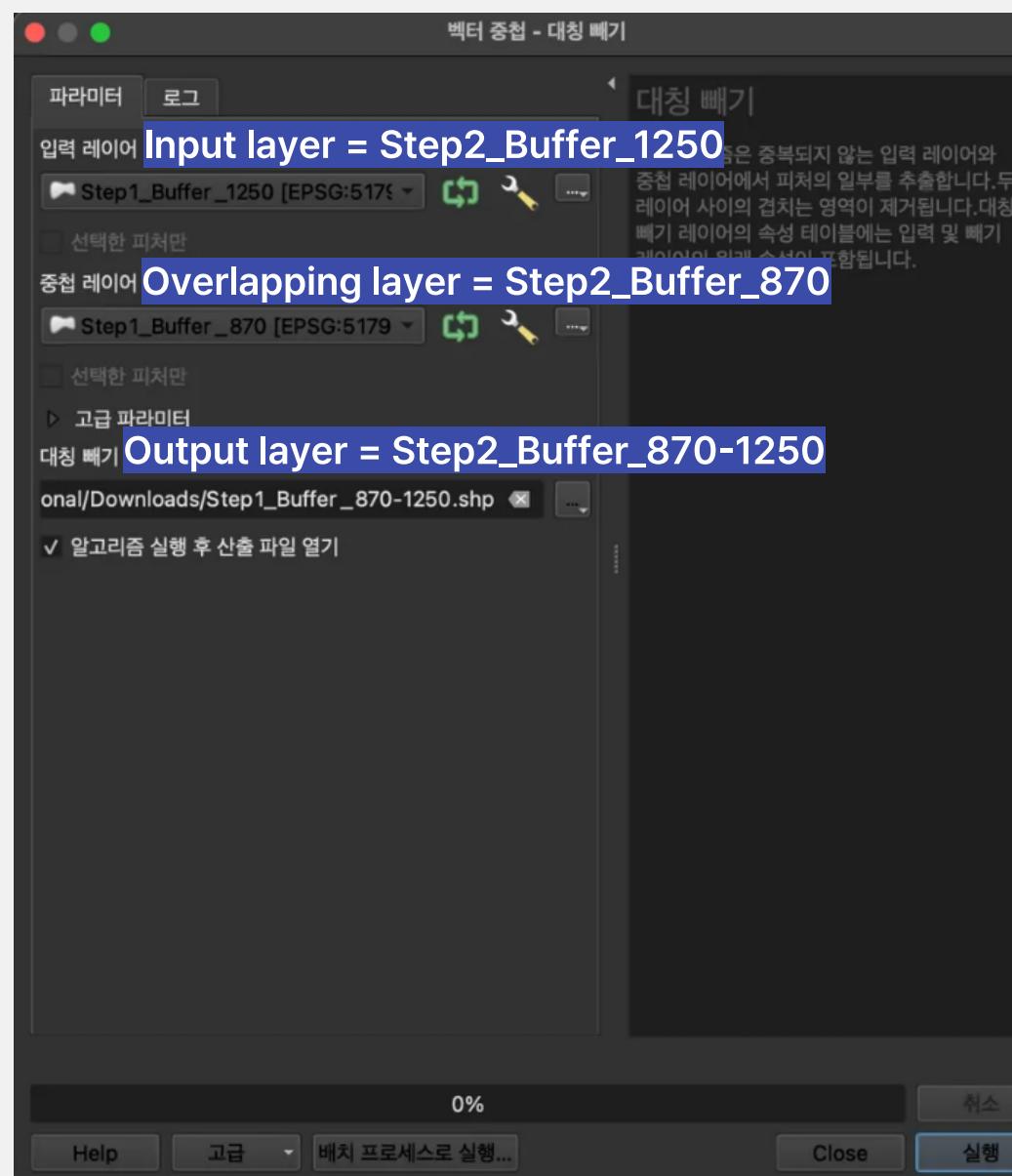
Create 870m, 1250m, and 1670m buffers from centroid of each town(Eup-Myeon-Dong)



E2SFCA Step2_Creating donut-shaped buffers

Remove overlapping parts to make donut-shaped buffers in areas 0-870m, 870m-1250m, 1250m-1670m

Same as step one!



- within a 10min walk (0-870m)
- within a 10-15min walk (870-1250m)
- within a 15-20min walk (1250-1670m)

4. Measuring Spatial Accessibility to the Hospitals to Foreigners Using E2SFCA

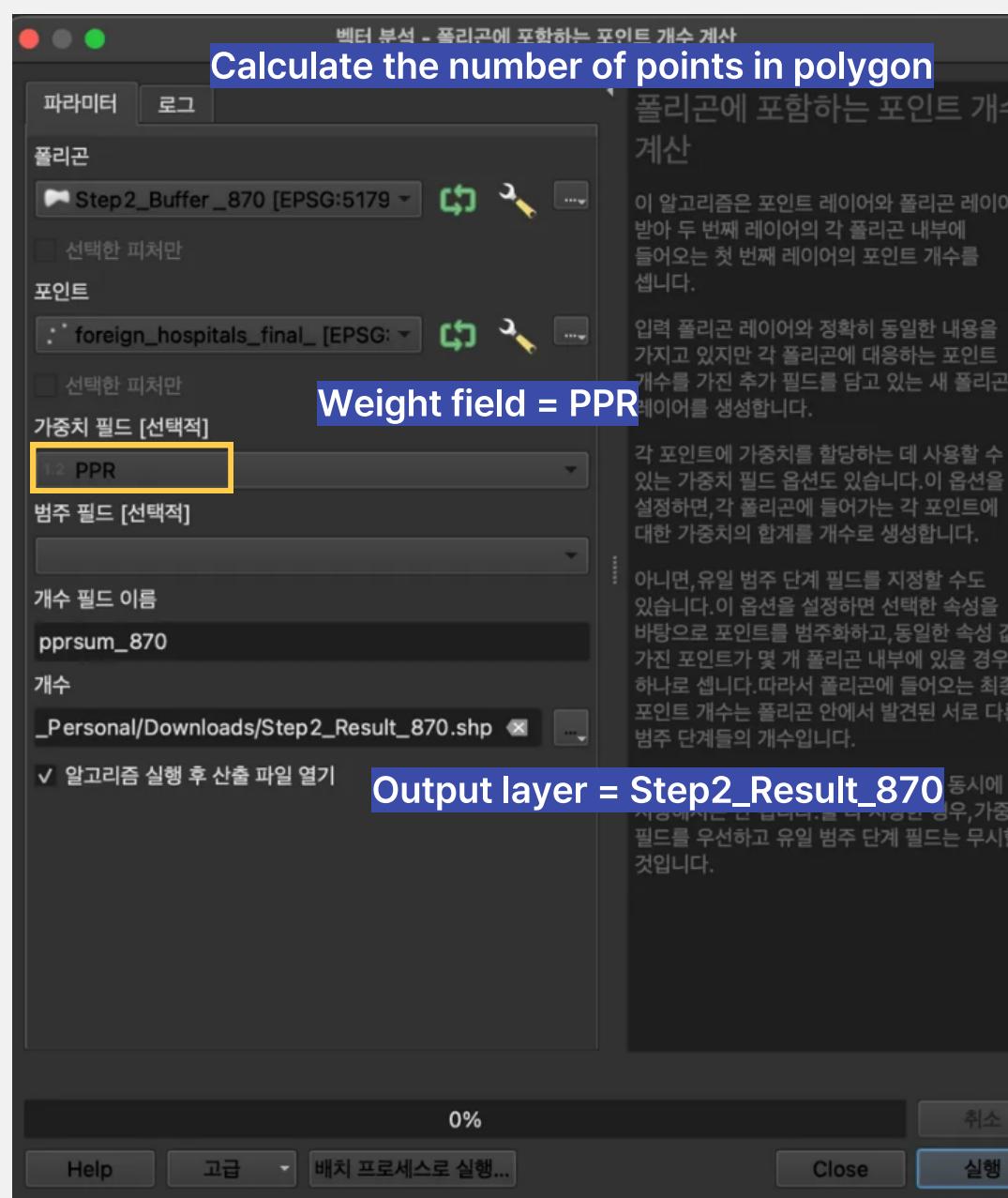
E2SFCA Step2_Multiplying weight 1, 0.68, 0.22

Now count the number of points in three buffers to calculate the hospitals accessibility for Eup-Myeon-Dong

"PPRsum" = Count the number of points in each buffer (weight = PPR)

Then multiply each of the three "PPR sum" columns by the corresponding weights 1, 0.68, and 0.22

→ Creating "(buffer size) weight" column!



The screenshot shows a dialog box for creating a new field. The title bar says "✓ 새로운 필드 생성" (New Field Creation). Below it, "가상 필드 생성" (Virtual Field Creation) is selected. The "산출 필드 이름" (Output Field Name) is set to "1250weight". The "산출 필드 유형" (Output Field Type) is "실진수 (실수)" (Real Number (Double)) with a scale of 1.2. The "산출 필드 길이" (Output Field Length) is 15. There are buttons for "표현식" (Expression) and "함수 편집기" (Function Editor), and icons for file operations like copy, paste, and save. The expression entered is "`"pprsum_125" *0.68`". Below the expression, a large blue box contains the text "Weight for zone that takes 10 to 15 minutes on foot = 0.68".

✓ 새로운 필드 생성

4. Measuring Spatial Accessibility to the Hospitals to Foreigners Using E2SFCA

E2SFCA Step2_Table join, Calculate accessibility

Step2_Result_870 Layer property table (+ Step2_Result_870-1250 "1250weight" column join +Step2_Result_1250-1670 "1670weight" column join)

After that, the supply amount is divided by the sum of the demand for the 3 buffers
 → to calculate the supply capacity of each hospital = PPR

Join property table

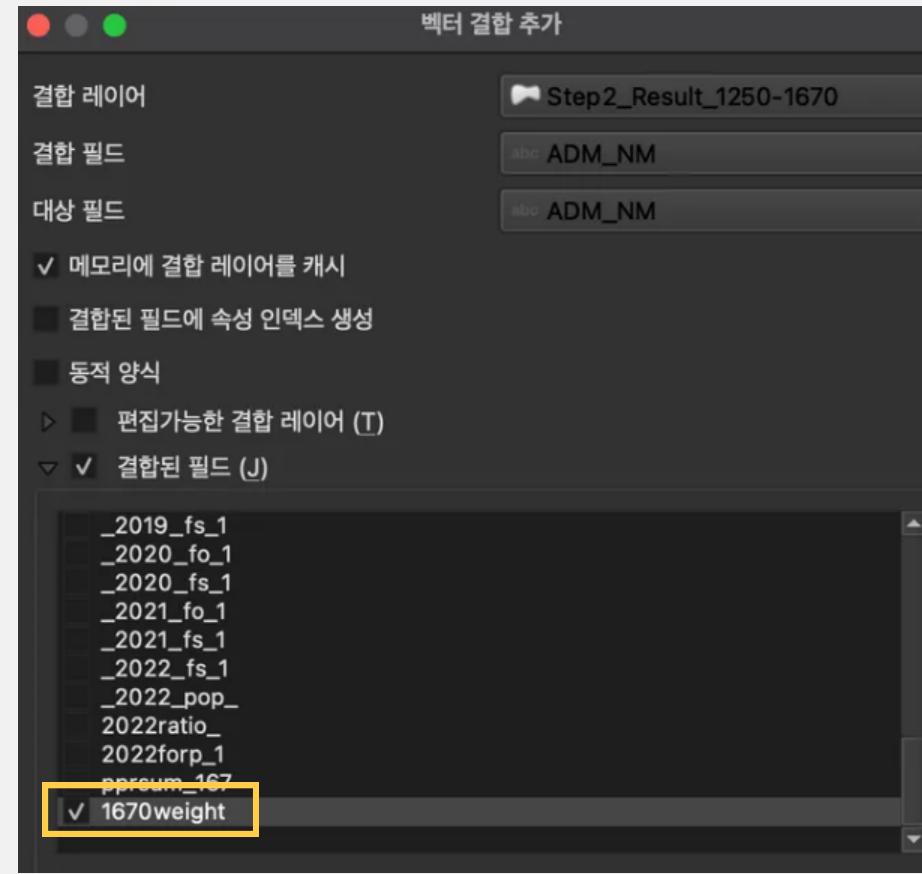
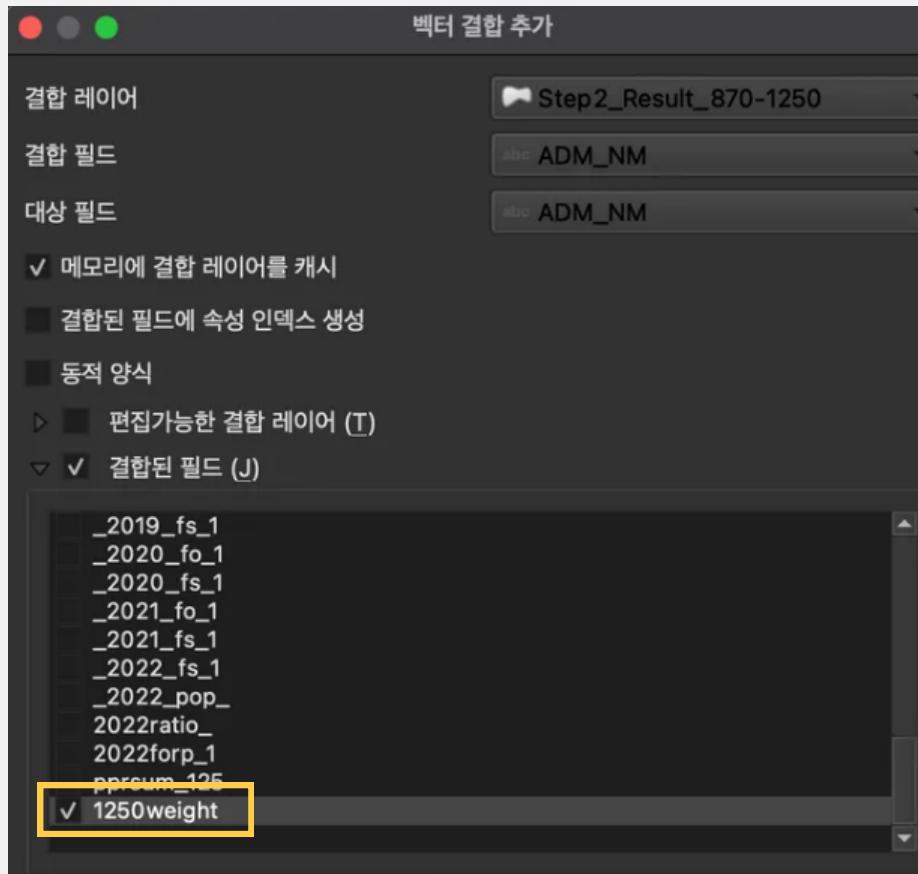


Table join result

| popsum_870 | 1670weight | 1250weight |
|----------------|------------|------------|
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 1578.00000... | 0 | 0 |
| 1578.00000... | 0 | 0 |
| 1578.00000... | 0 | 0 |
| 1578.00000... | 0 | 0 |
| 1578.00000... | 0 | 0 |
| 1578.00000... | 0 | 0 |
| 1133.000000... | 0 | 0 |
| 0 | 0 | 0 |
| 1200.00000... | 64.020 | 427.720 |
| 1200.00000... | 64.020 | 564.400 |

Calculate Accessibility

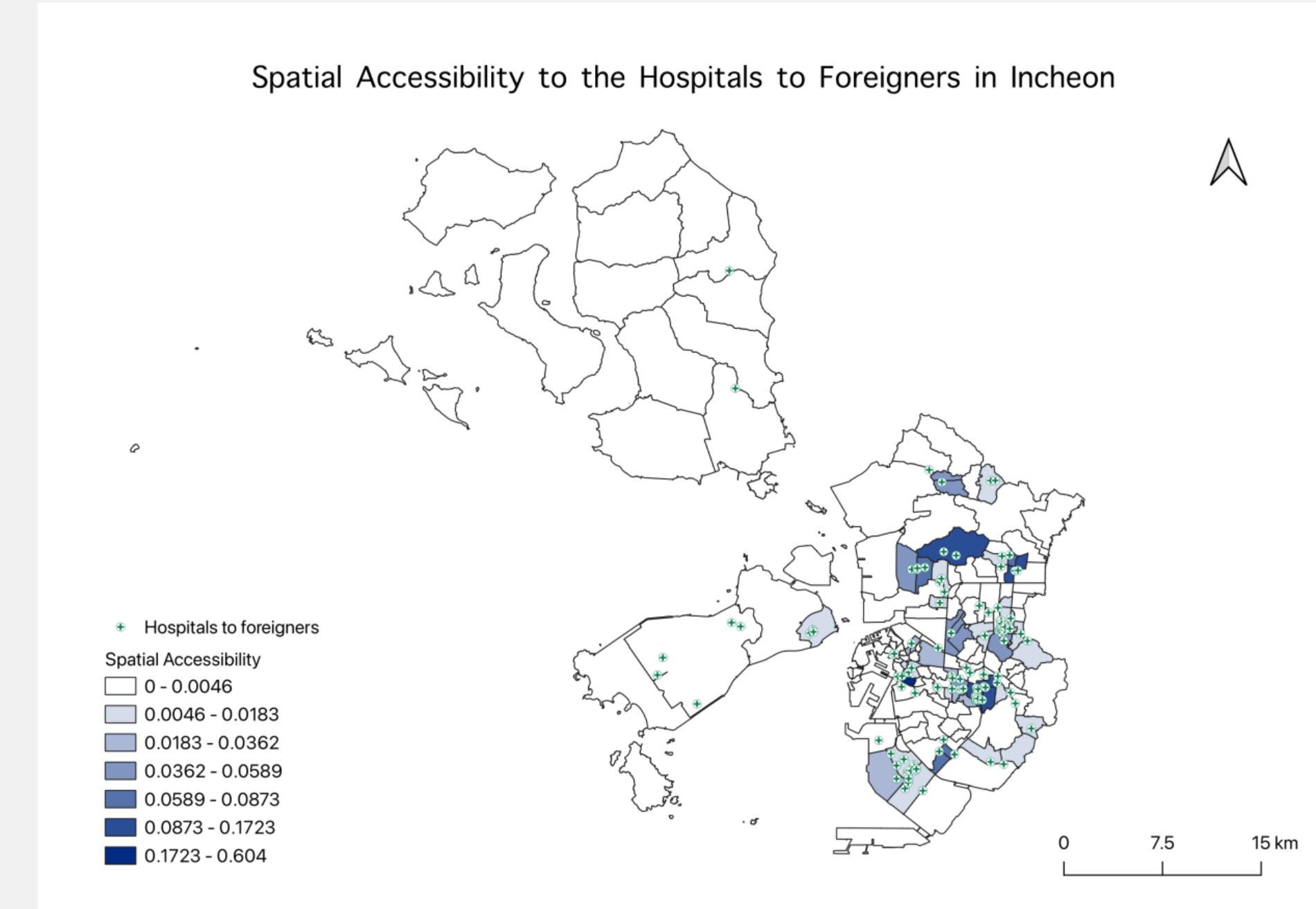


Hospitals Accessibility
 = Sum of PPR

4. Measuring Spatial Accessibility to the Hospitals to Foreigners Using E2SFCA

E2SFCA Step2_Final Result

| SGG | EMD | ACC |
|------|--------|---------------|
| _SGG | ADM_NM | ACC_SUM |
| 미추홀구 | 용현2동 | 0.60401683516 |
| 남동구 | 구월3동 | 0.172252546 |
| 남동구 | 구월1동 | 0.148140836 |
| 남동구 | 구월2동 | 0.141566604 |
| 계양구 | 계산4동 | 0.131307683 |
| 계양구 | 작전1동 | 0.131307683 |
| 서구 | 연희동 | 0.128755364 |
| 계양구 | 계산3동 | 0.087286592 |
| 연수구 | 동춘3동 | 0.07721761748 |
| 연수구 | 동춘2동 | 0.074242724 |
| 서구 | 청라1동 | 0.06697108 |
| 미추홀구 | 주안4동 | 0.058915218 |
| 서구 | 청라2동 | 0.055843837 |
| 부평구 | 부평6동 | 0.055045087 |
| 서구 | 마전동 | 0.0519664658 |
| 부평구 | 부평2동 | 0.050131392 |
| 서구 | 당하동 | 0.049579831 |
| 서구 | 가좌2동 | 0.044834165 |
| 서구 | 가좌3동 | 0.044834165 |
| 서구 | 가좌4동 | 0.044834165 |
| 미추홀구 | 주안8동 | 0.036205107 |
| 동구 | 송림2동 | 0.035546319 |
| 동구 | 송림6동 | 0.035546319 |
| 미추홀구 | 관교동 | 0.032891704 |
| 연수구 | 송도4동 | 0.02589641416 |
| 미추홀구 | 주안1동 | 0.022710111 |

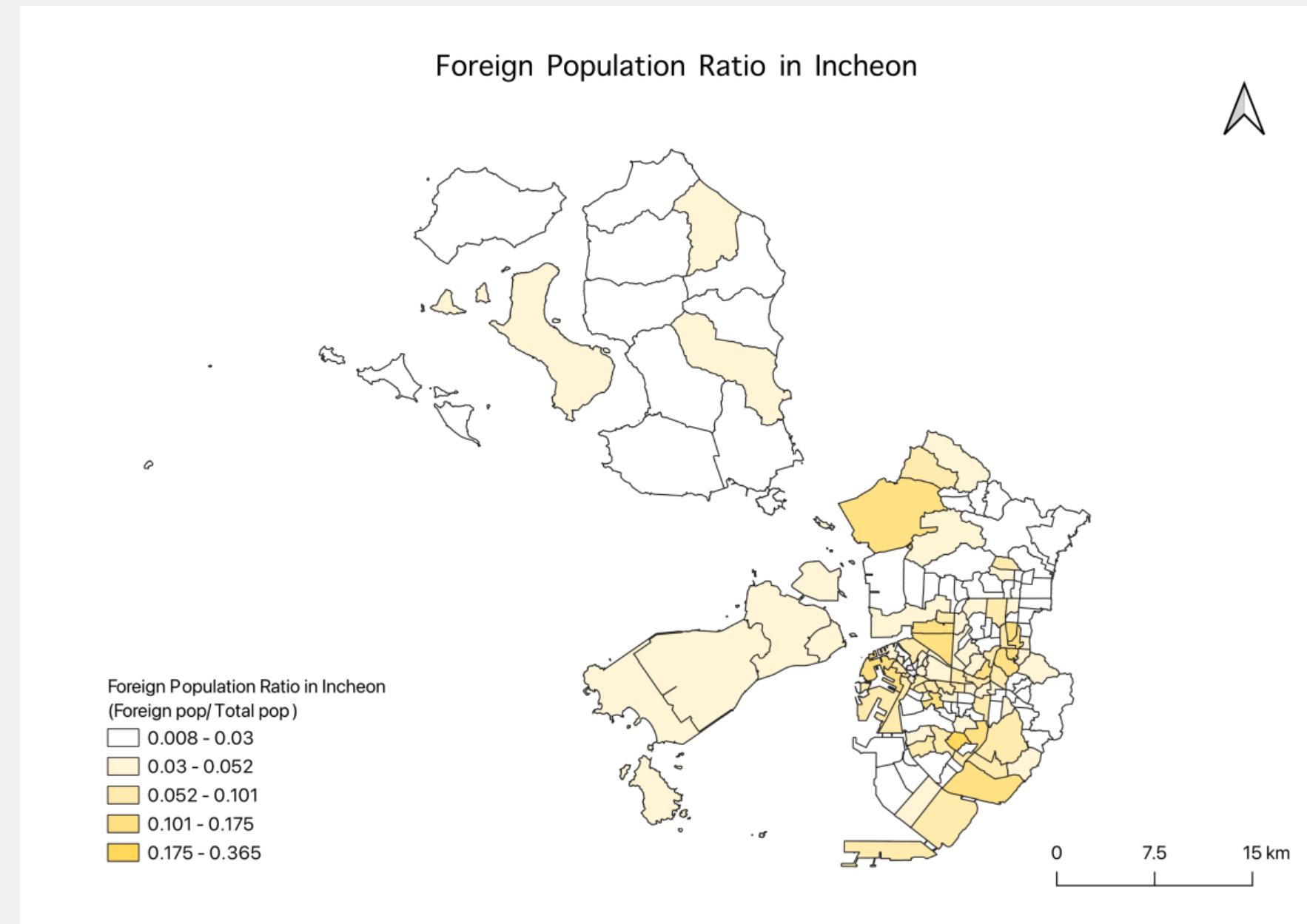


Final Result of E2SFCA Step2
 We got the hospitals accessibility to foreigners in each town(Eup-Myeon-Dong)
 which have foreign medical services in Incheon

Conclusion

Among 148 towns in Incheon, 66 towns showed "0" accessibility to hospitals to foreigners.
It is not clear to select areas where foreign medical services are needed.

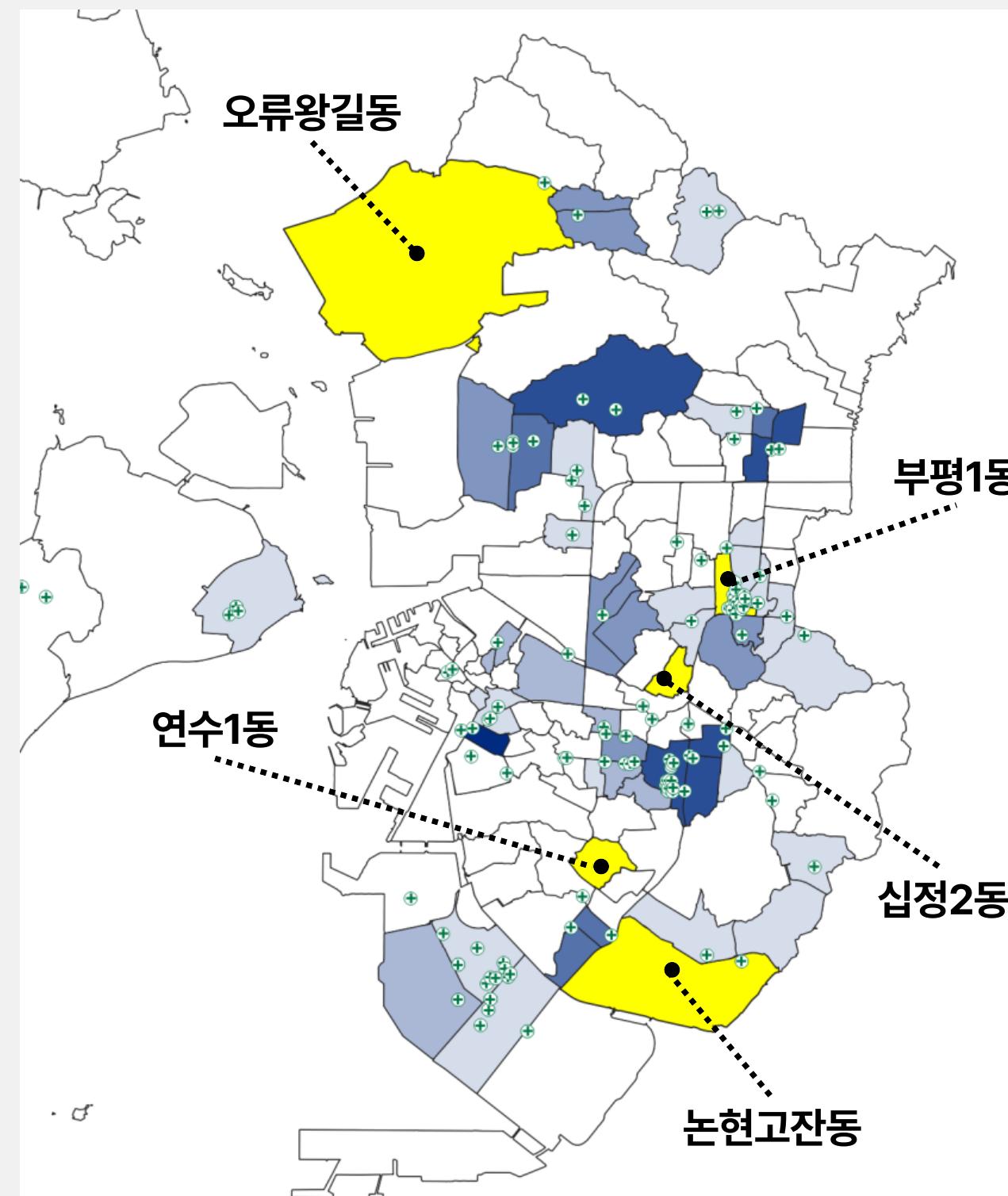
So we found towns with large foreign population ratio and large foreign population
and compared their accessibility to hospitals!



Top 20 town in Incheon
for both foreign population ratio
and the foreign population

| | |
|--------|---------------------|
| 연수1동 | Yeonsu 1-dong |
| 부평5동 | Bupyeong 5-dong |
| 부평2동 | Bupyeong 2-dong |
| 부평6동 | Bupyeong 6-dong |
| 부평4동 | Bupyeong 4-dong |
| 용현1·4동 | Yonghyeon 1·4 dong |
| 십정2동 | Sipjeong 2-dong |
| 오류왕길동 | Oryuwanggil-dong |
| 논현고잔동 | Nonhyeon Gojan-dong |
| 부평1동 | Bupyeong 1-dong |
| 주안1동 | Juan 1-dong |
| 논현2동 | Nonhyeon 2-dong |

Conclusion



Towns where more foreign medical services are needed

| Town name (Eup-Myeon-Dong) | Accessibility to hospitals to foreigners | Foreign Population Foreign Population Ratio Ranking |
|--------------------------------|---|---|
| 연수1동 (Yeonsu 1-dong) | 0.00032050848 (82/148) | 1/148 1/148 |
| 십정2동 (Sipjeong 2-dong) | 0 (148/148) | 8/148 8/148 |
| 오류왕길동 (Oryuwanggil-dong) | 0 (82/148) | 6/148 11/148 |
| 논현고잔동 (Nonhyeon Gojan-dong) | 0 (148/148) | 4/148 12/148 |
| 부평1동 (Bupyeong 1-dong) | 0.000941501 (148/148) | 5/148 15/148 |

Provide Solutions

First solution : Expansion of foreign medical services in towns that need more foreign medical services based on the previous E2SFCA analysis.

However, not only physical accessibility,

but also ways to increase socio-cultural and psychological accessibility are needed !



Basis

Minding the Gaps:

Health Care Access for Foreign-born People in the U.S.: An Integrative Review

Shade Adigun, PhD, APN, CCNS, FNP-BC — (bio), Cristina Barroso, DrPH — (bio), Sandy Mixer, PhD, RN, CTN-A — (bio), Carole Myers, PhD, RN — (bio), and Joel Anderson, PhD, CHTP, FGSA — (bio)

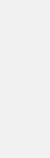
"Regardless of country of origin, **factors (e.g. possession of health insurance, income level, having a usual source of care) influence access to the health systems** and utilization of health services."

Provide Solutions

Aspects of socio-cultural and psychological access to healthcare

Requirements for foreigners

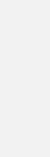
Mandating foreigners to purchase a small healthcare package upon entering



act as a safety net incase they do need medical services unexpectedly

ease tensions concerning trust with medical staff concerning payment

(When they leave they can have the deposit returned as long as there was no need to go to a medical facility)



This initial deposit can be used for the first payments for the national health insurance
for those with extended visas like students

5. Conclusion & Provide Solutions

Provide Solutions

Aspects of socio-cultural and psychological access to healthcare

1

Giving medical workers additional benefits if bilingual
+

Offering to pay for classes to further diversify their
forms of communication



Help hospitals overcome language barriers and foster an
environment that promotes being foreigner friendly

3

By limiting the amount of doctors going into
cosmetic industries



There will more of a proper balance between
cosmetic and necessity medical services.

2

There is also hiring doctors from abroad

[Limit]

1. required to have a high proficiency of Korean
2. if the work environment is not found to be welcoming
it can cause these foreign doctors to leave.



So solution 1 can be much more institutionalized,
guaranteeing language resources.

4

Hospitals could also enlist the aid of translators
not only required to be able to speak multiple languages
but also be able to explain cultural differences
that could cause conflict between patient and medical staff.

Reference

1. Census Use for 2023. Administrative Area Boundary (Province/City).
2. Census Use for 2023. Administrative Area Boundary (Town/Village).
3. KOSIS. Status of Foreign Residents by Province/City.
4. KOSIS. Foreign Resident Trends by Town/Village and Area.
5. KOSIS. Population and Population Density by Gender and Age.
6. Administrative Areas: Land Use Status by National Territory (City/District, 2022 by Province Level).
7. Incheon Metropolitan City. Registration Status of Medical Institutions for Foreign Patients.
8. Incheon Metropolitan City. Current Status of Medical Institutions.
9. Health Insurance Review & Assessment Service. Hospital Information (Number of Doctors).
10. Incheon Metropolitan City. Population and Area Statistics by District (Population and Area of Towns/Villages in Incheon).
11. Kang, J. Y., & Park, J. W. (2023). Measuring Spatial Accessibility to COVID-19 Testing Sites: A Case Study of Seoul.
12. Migration Research & Training Centre. Promoting Health and Health Rights of Migrants.
13. KHIDI. (2022). Report of Foreign Patients Satisfaction and Experience of Korean Medical Service in 2022
14. Sol Lim. (2013, Jul 31st), Inducement for Foreign Patient Should Be Regenerated by Recognizing Problems. Medical Observer.
15. JH Lee. Why did Sok Haeng Who Paid 120K WON for Medical Insurance Pass Away. The Hankyoreh.
16. TH Lee. (2010, Feb 15th), Major Hospitals Overcharge Foreigners. The Korea Times.
17. Marianne Chang. (2023, Jan 18th), Are Big 5 hospitals in Korea foreigner-friendly?. Korea Biomedical Review.
18. Sataporn Julchoo et al. (2021). Health Status and Barriers to Healthcare Access among "Son-in-Law Westerners": A Qualitative Case Study in the Northeast of Thailand. MDPI.
19. Uršula Lipovec Čebron. (2021). Language as a Trigger for Racism: Language Barriers at Healthcare Institutions in Slovenia. MDPI.
20. Shade Adigun et al. (2021). Minding the Gaps: Health Care Access for Foreign-born People in the U.S.: An Integrative Review.
21. Shade Adigun. (2023). Toward an emerging model of healthcare access: A theoretical framework. ICN.
22. Shaoyao Zhang, Xueqian Song & Jie Zhou. (2021). An equity and efficiency integrated grid-to-level 2SFCA approach: spatial accessibility of multilevel healthcare. BMC.
23. Valentina Antonipillai et al. (2017). Impacts of the Interim Federal Health Program reforms: A stakeholder analysis of barriers to health care access and provision for refugees. NIH.



Thank you!