

**SMALL AREA ANALYSIS TO EVALUATE ACCESSIBILITY OF  
HEALTHCARE RESOURCES IN THE TOKAMACHI  
CITY, NIIGATA PREFECTURE, JAPAN**

By Theo Ndatimana, MPH  
Environmental and Occupation Health  
Loma Linda University, School of Public Health  
Loma Linda, California

OCTOBER 18, 2010



# Location Background

---

- Tokamachi City, Niigata Prefecture, Japan
- Area: 589.9km<sup>2</sup>
- Population: 60,826 as of end Oct. 2009
- Average Population per household: 3.04
- Rice Production
- Kimono and manufacture of textile
- Heavy Snow



ESRI, Redlands, CA

Robinson Projection  
Central Meridian: 100.00





# Problem Overview

---

- Rationalization/Centralization of health services
- An ongoing campaign by the government of Japan to consolidate small municipalities and reduce administrative costs.
- 2005, Tokamachi city merges with the surrounding Kawanishi Town, Nakasato Village, Matsudai Town, and Matsunoyama Town
- The city gets 2 prefectural hospitals
- Niigata prefecture has a hard time maintaining both hospitals
- **Solution: Close one hospital**



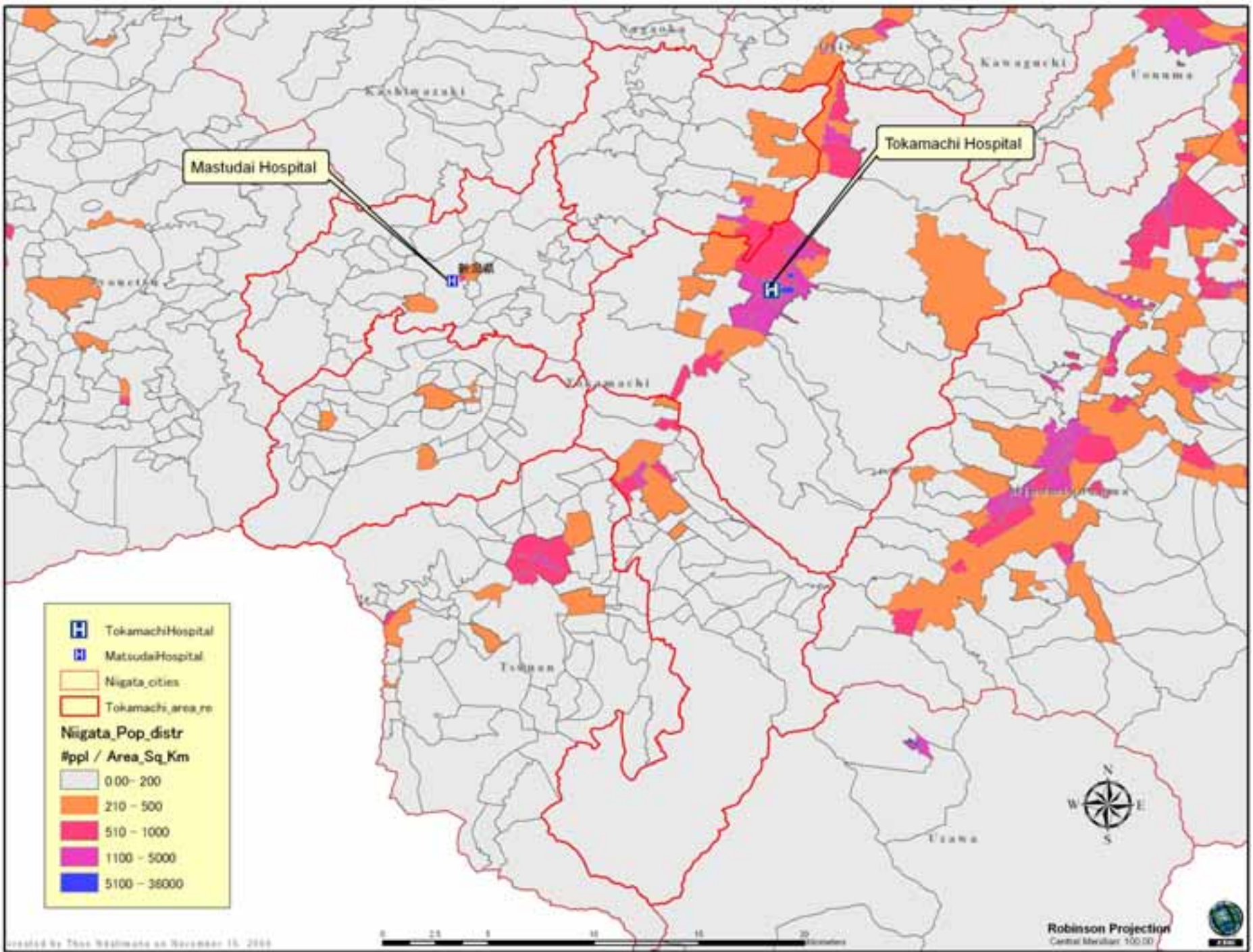
# APPROACH OVERVIEW

---

- Look at population vs. Hospital distribution
- Hospital Capacity
- Hospital Catchments areas (service areas)
- External Factors
- Which hospital has less effect on services?
- How to efficiently use the remaining hospital

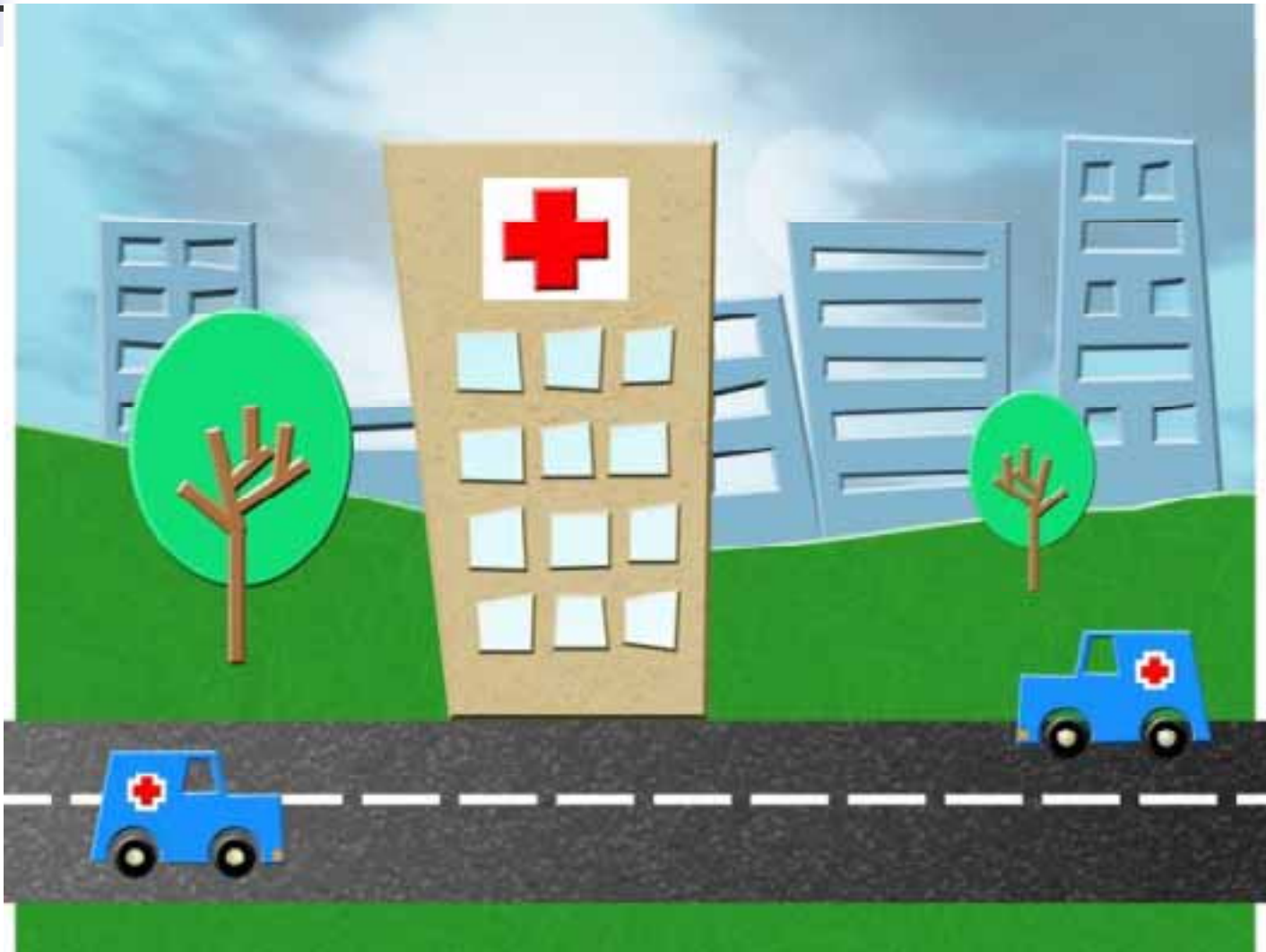
# Population Distribution

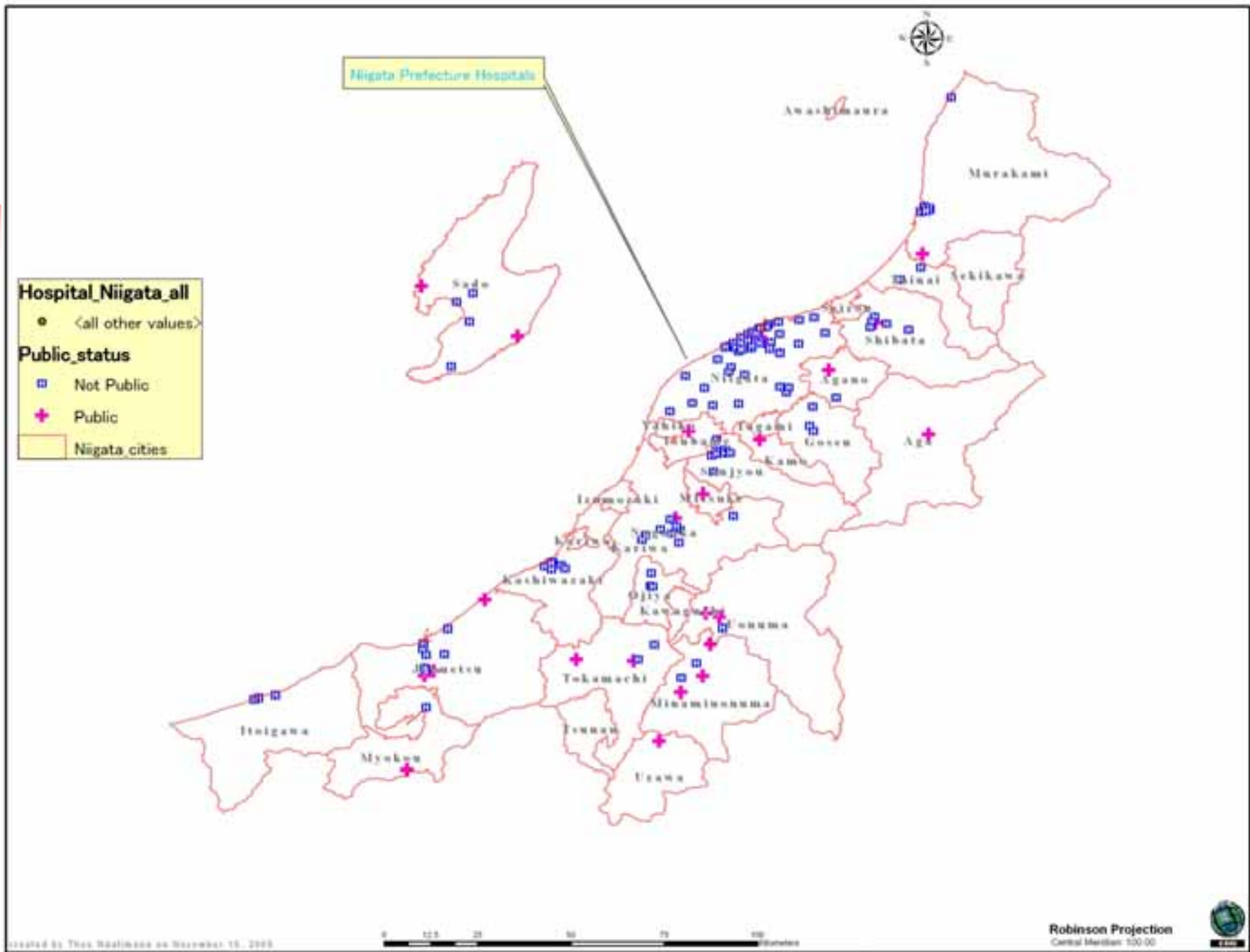






# Hospital Distribution





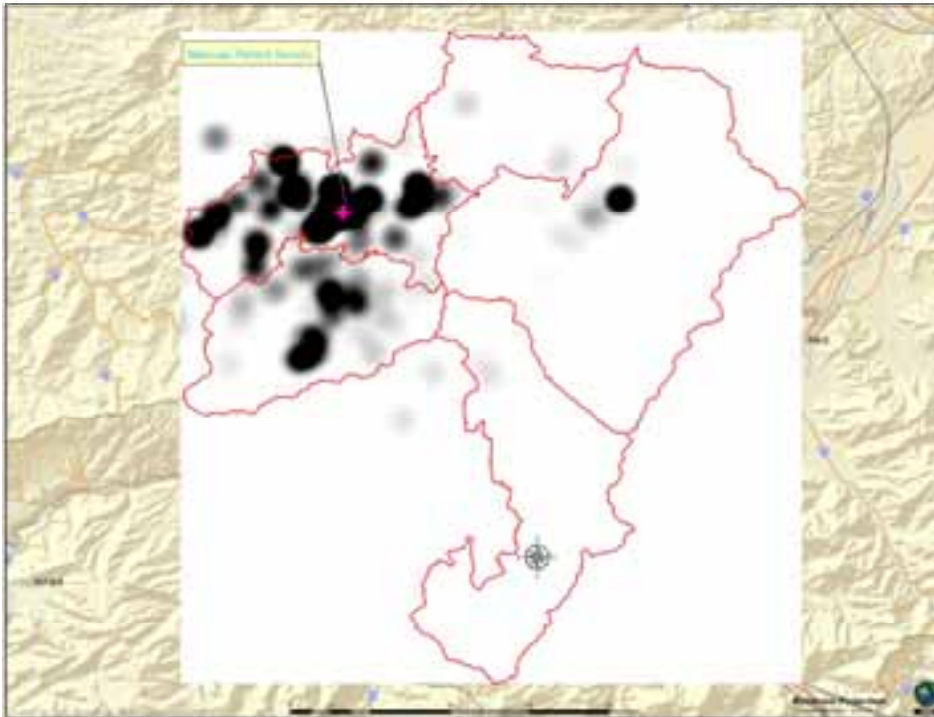
# Service Accessibility & Delivery Analysis



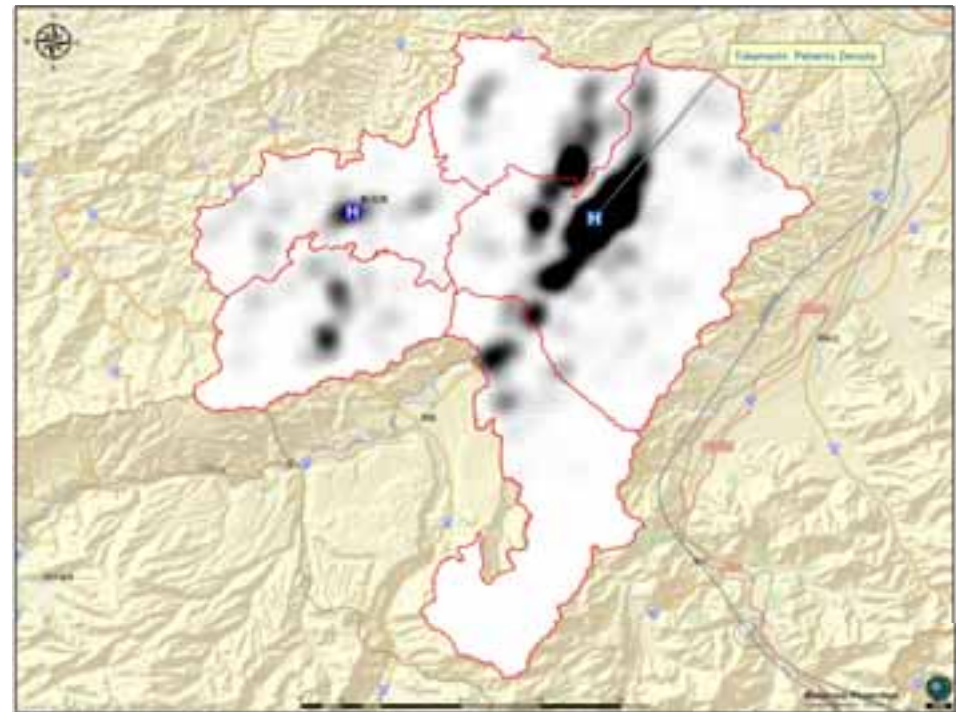
# Sample Patient distribution

Overall, patients tend to use hospital closer to them

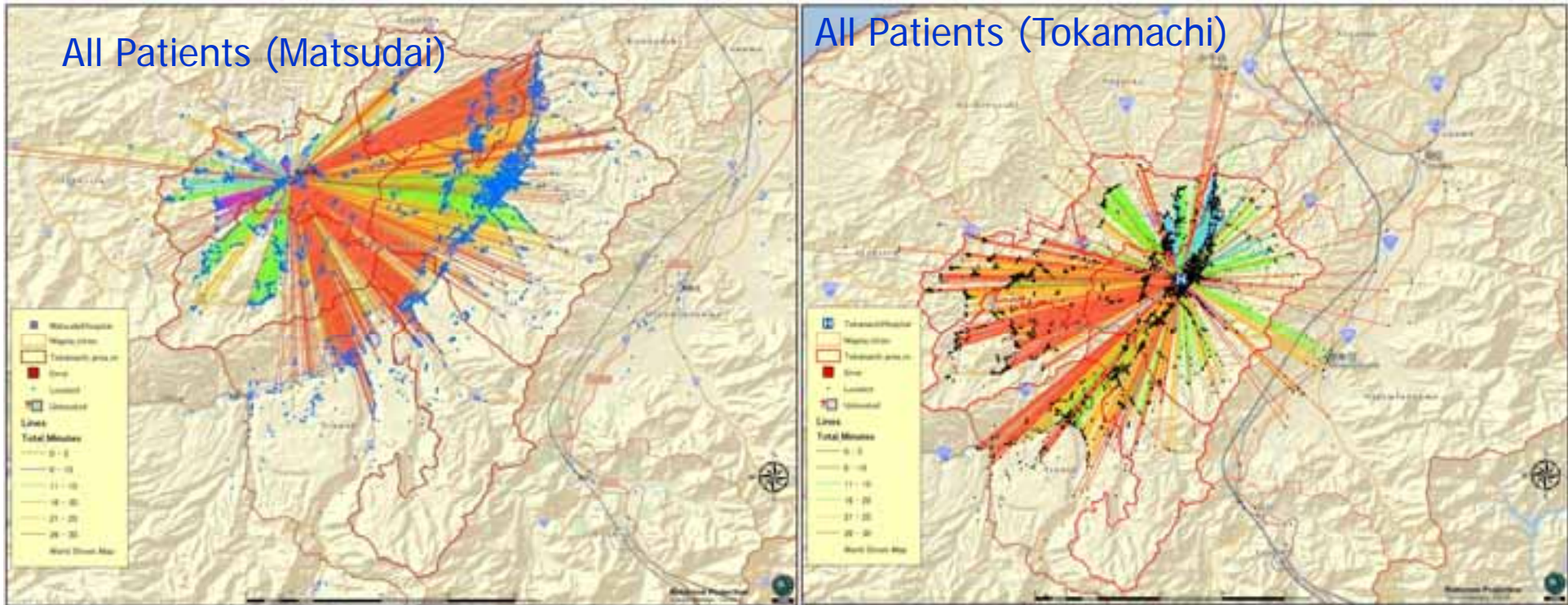
Matsudai



Tokamachi



8744 Patients who visited either hospital in the month of January 2006



Total number of patients: 8744  
 8197 live within 30 mins of Matsudai  
 8416 live within 30 mins of Tokamachi

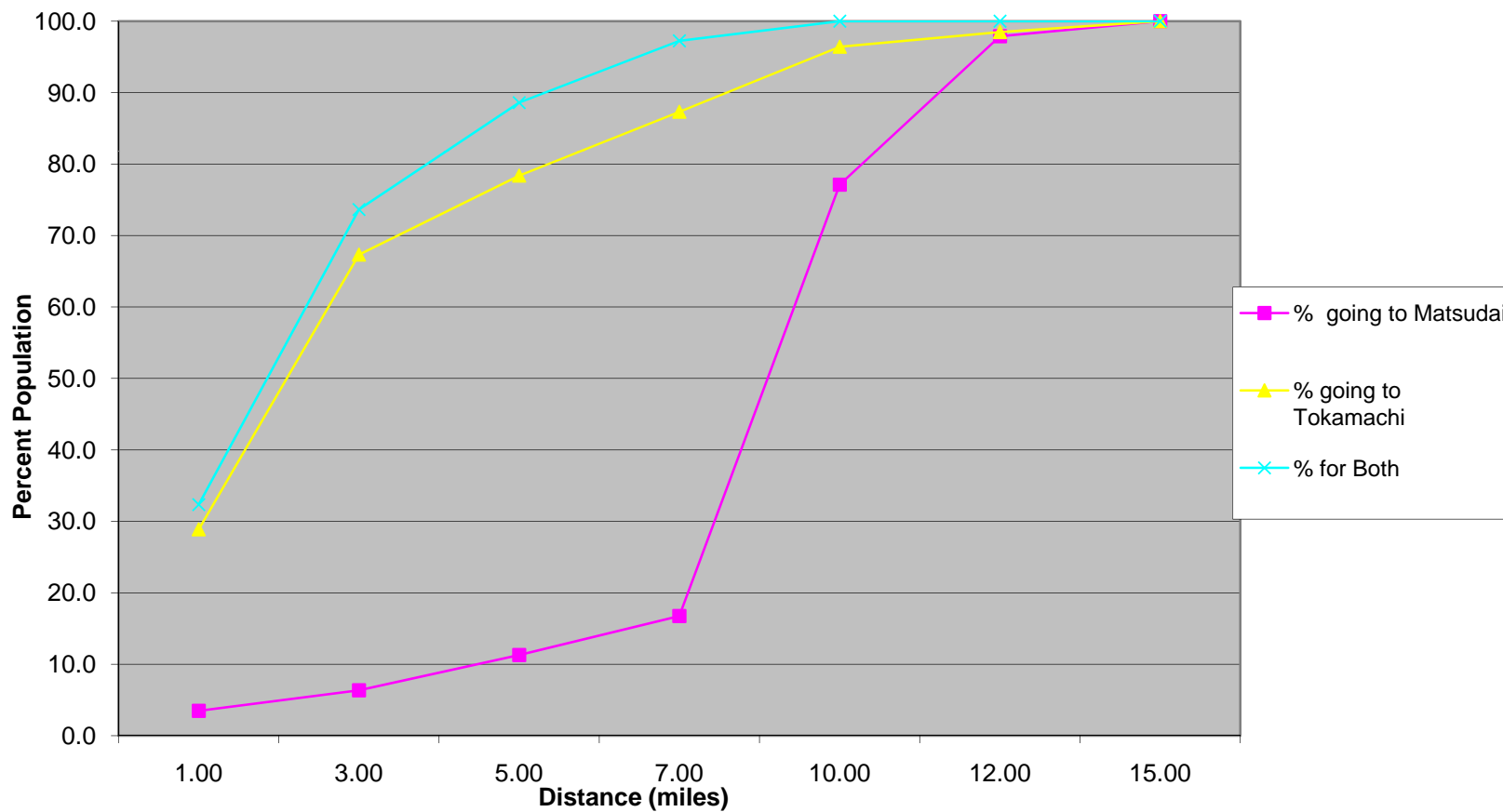


# Distance vs. %Population

---

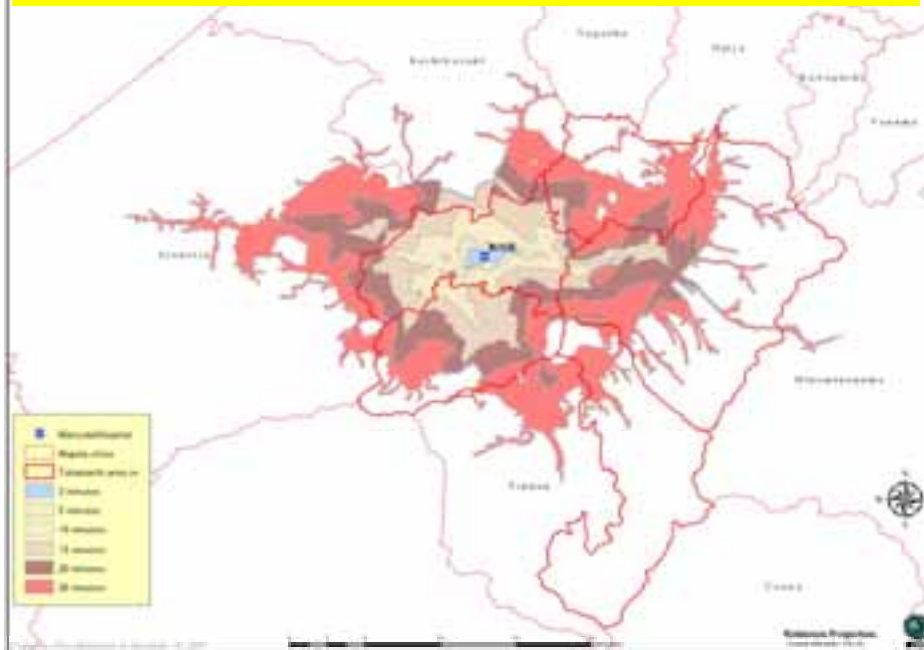
Distance (miles)	% going to Matsudai	% going to Tokamachi	% for Both
1.00	3.47	28.88	32.35
3.00	6.34	67.32	73.66
5.00	11.28	78.38	88.61
7.00	16.74	87.33	97.25
10.00	77.13	96.43	100.00
12.00	97.90	98.48	100.00
15.00	100.00	100.00	100.00

# % of population that lives within a given distance to hospital

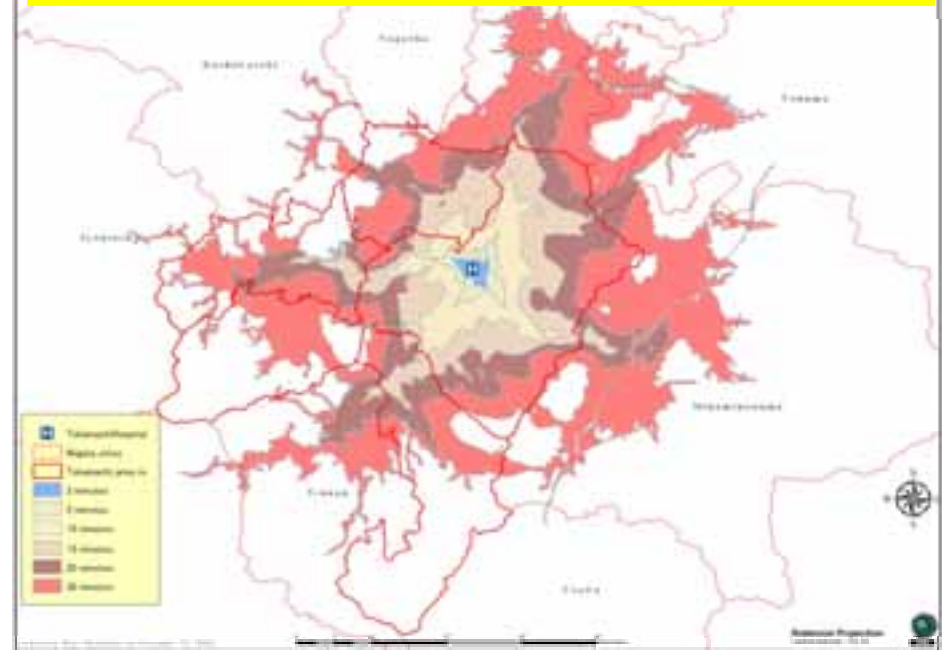


# Service Areas Comparison

Matsudai Hospital 30 minutes Service Area



Tokamachi Hospital 30 minutes Service Area







# Summary (previous table and figure)

---

- By using isochrones and average distance to the nearest hospital,
- Tokamachi would pick up **96.25%** compared to **93.74%** of Tokamachi city population within a 30 minutes time limit
- **18.83** minutes or **14.53** kilometers for a patient to get to Tokamachi
- **20.45** minutes or **15.90** kilometers for a patient to get to Matsudai

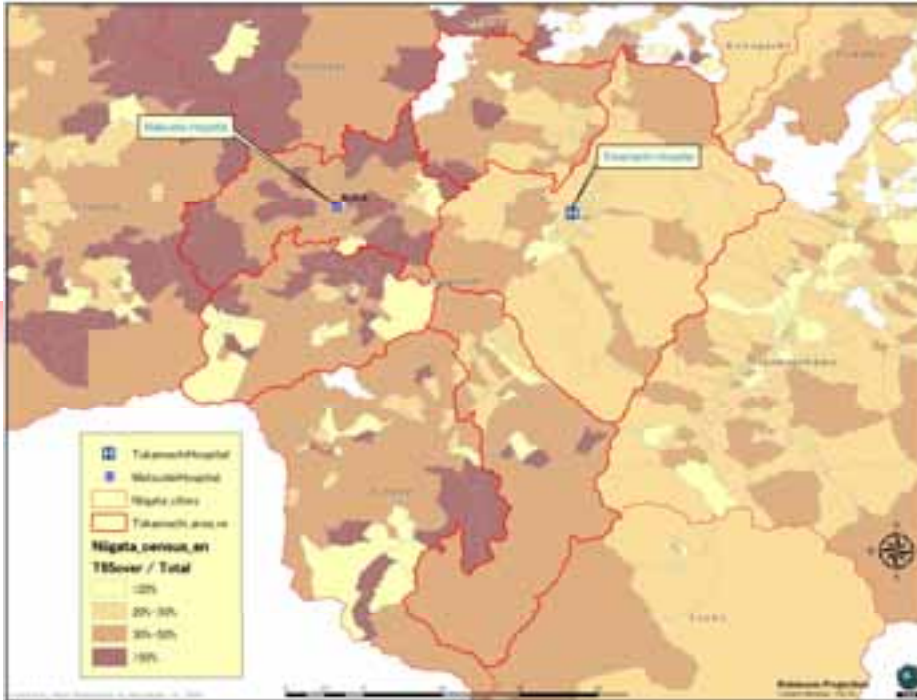
This was found using the feature-to-point tool of ArcGIS 9.3



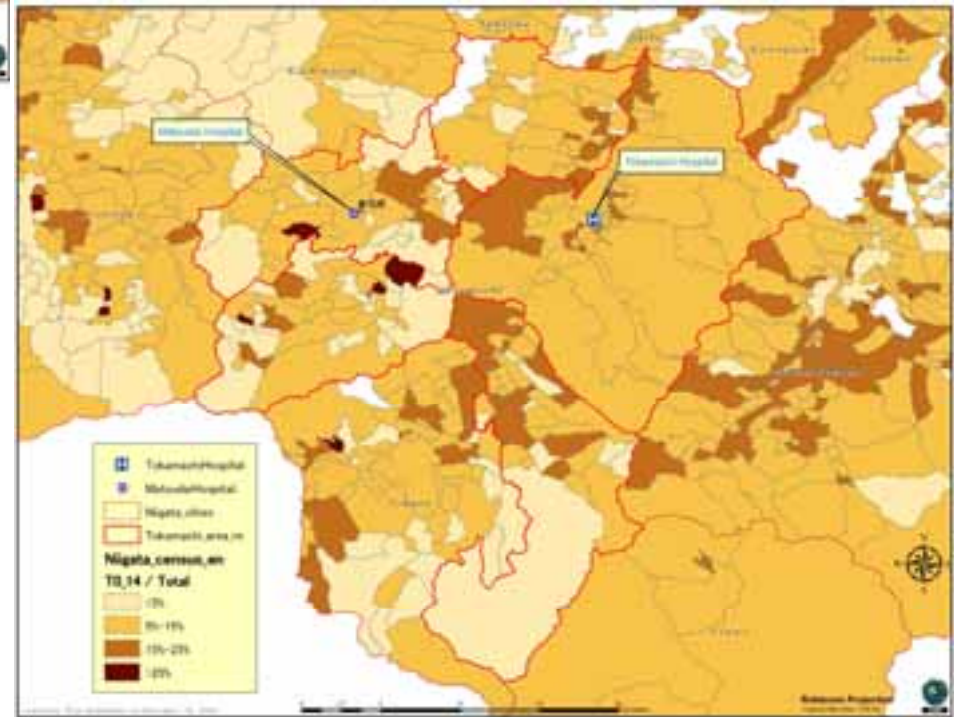
# External Factors

---

- Rural population distribution
- Vulnerable populations
- Hospital capacity

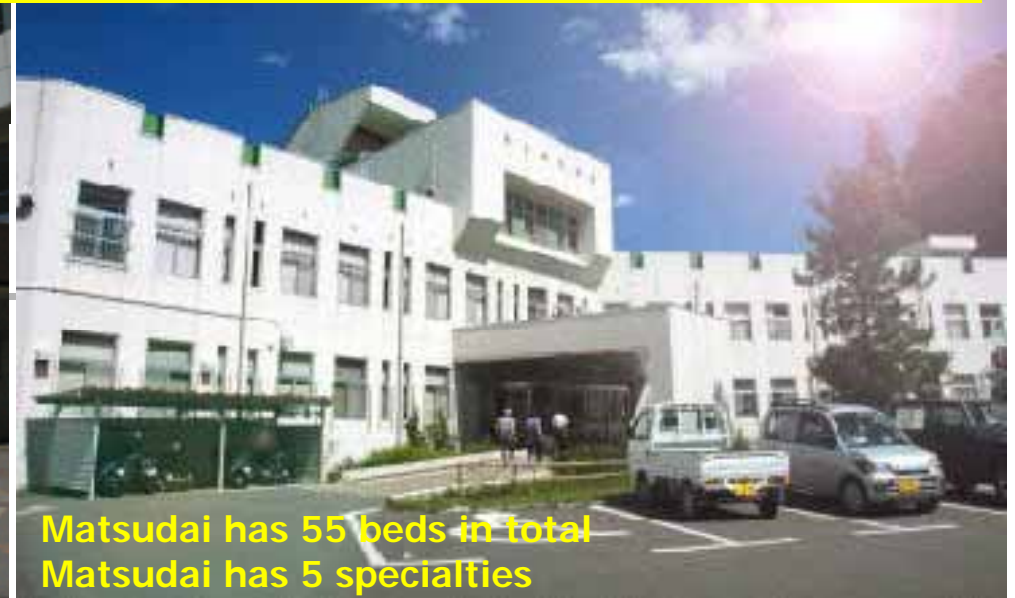


Eldery (>65) Population Distribution



Children (0-14) Population Distribution

# Hospital size, capacity, and services offered



		Matsudai (08:30- 11:00, 13:00- 15:00)									
		Monday		Tuesday		Wednesday		Thursday		Friday	
		Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
General Medicine		✓	✓	✓		✓	✓	✓	✓	✓	
<b>Psychiatry</b>						✓					
Orthopedics			✓								
Ophthalmology						✓			✓		
Urology											✓

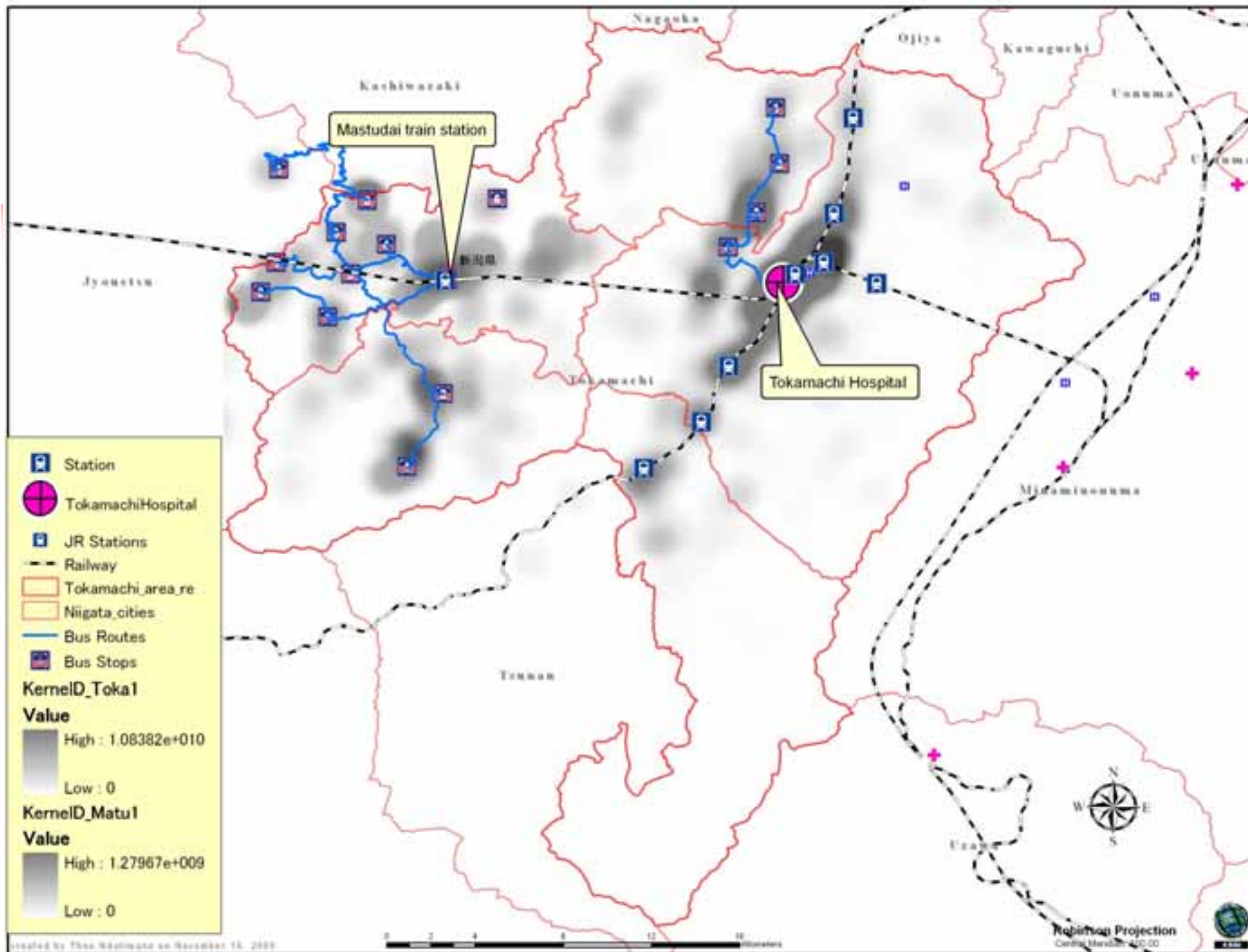
		Tokamachi (08:30- 11:00)									
		Monday		Tuesday		Wednesday		Thursday		Friday	
		Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon	Morning	Afternoon
General Medicine		✓		✓		✓		✓		✓	
Surgery		✓		✓		✓		✓		✓	
Orthopedics		✓		✓		✓		✓		✓	
Gynecology		✓		✓		✓		✓		✓	
Pediatrics		✓		✓		✓		✓		✓	
Neurosurgery		✓		✓		✓		✓		✓	
Ophthalmology		✓		✓		✓		✓		✓	
Urology		✓		✓		✓		✓		✓	
Otorhinolaryngology		✓		✓		✓		✓		✓	
Nerology		✓		✓		✓		✓		✓	



# CONCLUSION

---

- Conclude that 'Matsudai' hospital has less effect on the health services compared to Tokamachi
- In the best case scenario, keep both hospitals open
- However, if budgets constraint then close Matsudai
- Add **Psychiatry** department on Tokamachi
- **Introduce Focused service** delivery
- Increase operation hours on some days
- See proposed alternative shuttle bus routes (next)





# Challenges/Limitations & Future work

---

- **Challenges and limitations**

- Hospital choice is more complex than simple distance estimation
- Patient privacy
- Network construction has limitations
- Rural areas population distribution is different

- **Future analysis**

- Service usage by department (started)
- Environmental factors (future)



# References

---

- ESRI Online Maps 2009 (<http://www.esri.com>)
- Harden, Blaine. **Health Care in Japan: Low-Cost, for Now. Aging Population Could Strain System.** *Washington Post Foreign Service.* Monday, September 7, 2009
- Tokamachi City Website (<http://www.city.tokamachi.niigata.jp/>)
- Japan Ministry of Internal Affairs and Communication (Statistics Bureau).
- Ryuichi Kaneko, Akira Ishikawa, Futoshi Ishii, Tsukasa Sasai, Miho Iwasawa, Fusami Mita, and Rie Moriizumi. **Population Projections for Japan: 2006-2055 Outline of Results, Methods, and Assumptions.** *The Japanese Journal of Population*, Vol.6, No.1 (March 2008).
- Niigata University School of Medicine and Dental Sciences