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

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Location Background

- Tokamachi City, Niigata Prefecture, Japan
- Area: 589.9km²
- Population: 60,826 as of end Oct. 2009
- Average Population per household: 3.04
- Rice Production
- Kimono and manufacture of textile
- Heavy Snow
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

Note: Roads and other transportation data such as speed limits, stops, etc...were obtained from Increment P. Corporation
## Distance vs. %Population

<table>
<thead>
<tr>
<th>Distance (miles)</th>
<th>% going to Matsudai</th>
<th>% going to Tokamachi</th>
<th>% for Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>3.47</td>
<td>28.88</td>
<td>32.35</td>
</tr>
<tr>
<td>3.00</td>
<td>6.34</td>
<td>67.32</td>
<td>73.66</td>
</tr>
<tr>
<td>5.00</td>
<td>11.28</td>
<td>78.38</td>
<td>88.61</td>
</tr>
<tr>
<td>7.00</td>
<td>16.74</td>
<td>87.33</td>
<td>97.25</td>
</tr>
<tr>
<td>10.00</td>
<td>77.13</td>
<td>96.43</td>
<td>100.00</td>
</tr>
<tr>
<td>12.00</td>
<td>97.90</td>
<td>98.48</td>
<td>100.00</td>
</tr>
<tr>
<td>15.00</td>
<td>100.00</td>
<td>100.00</td>
<td>100.00</td>
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</tbody>
</table>
% 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
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
**Hospital size, capacity, and services offered**

Tokamachi has 275 beds in total
Tokamachi has 10 specialties

Matsudai has 55 beds in total
Matsudai has 5 specialties

**Matsudai (08:30-11:00, 13:00-15:00)**

<table>
<thead>
<tr>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morning</td>
<td>Afternoon</td>
<td>Morning</td>
<td>Afternoon</td>
<td>Morning</td>
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<td></td>
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<td>Afternoon</td>
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</tbody>
</table>
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://ww.esri.com)
- Tokamachi City Website (http://www.city.tokamachi.niigata.jp/)
- Japan Ministry of Internal Affairs and Communication (Statistics Bureau).
- Niigata University School of Medicine and Dental Sciences