Cost-Benefit Analysis of the e-Ambulance Project in Depopulated Areas in Japan

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Med-e-Tel2014, Luxembourg, April 9-11, 2014
Outline

➢ Background of the project
➢ How to measure benefits
➢ Cost/benefit analysis
➢ Conclusion
Background of the project
Regional Imbalance of Medical Resources

Clinics moved to populated areas

Declining of emergency hospitals in the region

Declining medical staff for acute medicine
e-ambulance Project in Aki City and Muroto City, Kochi Prefecture

**Aki City**
- 18,657 residents and 8,055 households
- elderly ratio 29.14%
- 42 clinics

**Muroto City**
- Population 17,490 and 7,598 households
- elderly ratio 32.94%
- 23 clinics
Change in medical Doctors

2010

Ehime Pref. +75

KagaPref. +148

Tokushima Pref. +102

Kochi +1

Aki City

Muroto City

Increase

Decrease

10

1
Tertiary Emergency Hospitals are located in prefectural capital in Kochi City.

It takes one hour from those cities.

This is backgrounds of e-ambulance.
e-Ambulance Project
Image Transmission System

Ambulance
- Camera
- Tablet PC
- Image database server
- Identification server

Transmit
- Image data
- Voice data

3G mobile network

Hospital
- Database
- View
- Doctor
- Image data
- Voice data
Stationary camera (ambulance interior)

① Video transmission PC (Real-time video)
  Shows the patient inside the ambulance

② Video transmission PC (wearable type)
  Shows emergency scenes or monitor screens, etc., inside the ambulance

③ Galaxy Tab
  Entered inside the ambulance
  Sends patient information and GPS location information
Pictures Viewed at the Hospital
How to Measure Benefits of e-Ambulance
Benefits of e-Ambulance

Residents
- Saving life, shorter recovery
- Philological effect: satisfaction
- Reduce medical expenditure, shorter treatment days

Medical institutions
- Saving time and man power
- Promoting efficiency

Local government
- Reducing burden of public medical insurance
Method to measure benefit

CVM (Contingent valuation method)

Measure benefits of non-market goods and services such as environment, sightseeing sites, public services such as education, medical, bridges and so on.

WTP (Willingness to pay)

Ask the money which residents want to pay for receiving the service.
WTP

Issues related to WTP

Reply to the amount of WTP contains various biases. These biases have to be removed.

The three-stages dichotomous choice method was employed, which can obtain “true values” of the services revealed by despondences.
Tree structure of questions

1,500?
  Yes---2,500?
    Yes---3,000?
      Yes---How much? [more than 3,000]
      No---[2,500 yen: determined]
    No---2,000?
      Yes---[2,000 yen: determined]
      No---[1,500 yen: determined]
  No---500?
    Yes---1,000?
      Yes---[1,000 yen: determine]
      No---[500 yen: determined]
    No---250?
      Yes---[250 yen or less: determined]
      No---How much? [less than 250]
## Distribution of Replied WTP

<table>
<thead>
<tr>
<th>WTP (JPY)</th>
<th>3,000+</th>
<th>2,500-2,999</th>
<th>2,000-2,499</th>
<th>1,500-1,999</th>
<th>1,000-1,499</th>
<th>500-999</th>
<th>250-499</th>
<th>1-249</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>10</td>
<td>18</td>
<td>30</td>
<td>36</td>
<td>11</td>
</tr>
</tbody>
</table>

**USD**

- 30.00
- 25-29
- 20-24
- 15-19
- 10-14
- 5.00-9.00
- 2.50-4.99
- 1.00-2.49
- 0.00
WTP: 1,747 yen (US$175)

Probability of acceptance

\[ = 1 - \frac{1}{1 + \exp(-\alpha - \beta \log \text{WTP})}. \]
Total Benefit

The population
18,657 in Aki City and 17,490 in Muroto City as of January 1, 2014, and total is 36,147 (as of January 1, 2014).

Total benefit:

36,147x JPY 1,747=
JPY 63,148,089 (US$631,000).
## Total Cost (single year)

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Cost (JPY)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Initial cost</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hardware (equipment)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-A Equipment</td>
<td></td>
<td>8,144,662</td>
</tr>
<tr>
<td>Ambulance</td>
<td></td>
<td>36,000,000</td>
</tr>
<tr>
<td>Software</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-C Software development</td>
<td></td>
<td>19,341,000</td>
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<tr>
<td>1-D Software</td>
<td></td>
<td>4,114,803</td>
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<tr>
<td>Installment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-E Installment cost</td>
<td></td>
<td>2,706,784</td>
</tr>
<tr>
<td>Training</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-F Initial training</td>
<td></td>
<td>1,680,000</td>
</tr>
<tr>
<td><strong>subtotal</strong></td>
<td></td>
<td>71,987,249</td>
</tr>
<tr>
<td><strong>2. Operational Cost</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salaries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-A Salaries of ambulance crew</td>
<td></td>
<td>50,572,080</td>
</tr>
<tr>
<td>Maintenance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-B Software maintenance</td>
<td></td>
<td>893,928</td>
</tr>
<tr>
<td>2-C Hardware maintenance</td>
<td></td>
<td>654,360</td>
</tr>
<tr>
<td>Fuel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-D Gasoline</td>
<td></td>
<td>2,400,000</td>
</tr>
<tr>
<td>Communication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-E Communication fees</td>
<td></td>
<td>1,200,000</td>
</tr>
<tr>
<td><strong>subtotal</strong></td>
<td></td>
<td>55,720,368</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td>127,707,617</td>
</tr>
</tbody>
</table>
Cost/Benefit: 3 years

<table>
<thead>
<tr>
<th>Item</th>
<th>JPY</th>
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<tbody>
<tr>
<td>Total benefit B3</td>
<td>175,243,694</td>
</tr>
<tr>
<td>Initial cost IC3</td>
<td>231,459,775</td>
</tr>
<tr>
<td>Operating cost OC3</td>
<td>150,332,453</td>
</tr>
<tr>
<td>Total Cost TC3</td>
<td>381,792,228</td>
</tr>
</tbody>
</table>

\[
\frac{B3}{TC3} = 0.459 \\
\frac{B3}{OC3} = 1.166
\]
## Cost/Benefit: 5 years

<table>
<thead>
<tr>
<th>Description</th>
<th>JPY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total benefit B5</td>
<td>281,127,278</td>
</tr>
<tr>
<td>Initial cist IC5</td>
<td>231,459,775</td>
</tr>
<tr>
<td>Operating cost OC5</td>
<td>241,164,475</td>
</tr>
<tr>
<td>Total Cost TC5</td>
<td>472,624,250</td>
</tr>
<tr>
<td>B5/TC5</td>
<td>0.595</td>
</tr>
<tr>
<td>B5/OC5</td>
<td>1.166</td>
</tr>
</tbody>
</table>
conclusions
Evaluation of the Project

The project does not cover the costs.

But, from the standpoint of town it is worthy to implement.

Therefore, more financial foundation is required,
Thank you for listening.