Egocentric Network Characteristics and Disaster Preparedness in Rural Japan

Shigeki Toyama *

s-toyama@kochi-u.ac.jp

Keywords: Egocentric Network, Social Network Analysis, Rural Community,

Disaster Preparedness, Japan

Abstract

In Japan, after the 2011 Tōhoku earthquake and tsunami, the preventive actions toward a natural disaster become a serious issue both individuals and communities of a rural area where contiguous to nature.   This study uses social network analysis to examine the predictors of the disaster preparedness.

The dataset for this study was derived from the survey conducted at Kuroshio town of Kochi Prefecture in Japan, with a population of 11,846, and elders (over 65) took 35% of its people.   The social survey had been carried out as a drop-off/pick-up method survey - self-administered questionnaire in Japanese between November and December in 2013.   A systematic sample of 533 individuals, who ages between twenty to seventy-nine years old, were chosen from the electoral roll of the town of 10,541.   Numbers of valid responses were 209.   In the survey, the social network data (three types of social network; close relation network, a network of retrieve local information, and a network of consulting disaster prevention) and demographic attributes, as well as media usage data, were asked.

By reviewing the previous study (Heller et al. 2005; Sattler et al. 2000; Hurlbert

* Kochi Univeristy / Visiting Scholar of SONIC at Northwestern University

et al. 2000), the author hypothesized the predictor variables for the disaster preparedness with egocentric network measures, demographic characteristics, and communication behaviors (see Table1).   In egocentric network configurations, the author hypothesized that individual who is embedded in a larger and more cohesive social network would take more preventive actions than who is embedded in a smaller and disperse network.   The other hypotheses are presented as that the older individuals with higher education and higher income, living with their family members tend to be more prepared for a disaster than the others who are younger and only attain a lower education and revenue.   As the additional hypotheses, individuals who are high interest in local communication will access more knowledge on risks of natural hazard and will be more prepared.

Egocentric network measures and hierarchical multiple regression were calculated on the predictors of disaster preparedness.   Table 2 showed the results of regression models.   Based on theory and previous research, the predictor variables were entered in three blocks. In the Model 4, significant predictor variables were IQV (β=2.059, S.E.=.860), Average age of Alters (β=2.043, S.E.=.017), Proportion of men in Alters (β=2.702, S.E.=.986), Density without Ego (β=-2.088, S.E.=1.639), Age (β=3.276, S.E.=.026), Income [3M =< 5M Yen](β=2.197, S.E.=1.042), Living with family (β=2.727, S.E.=.908), Radio (β=2.280, S.E.=.639), Cellular phone (β=2.844, S.E.=.680), Publicity paper (β=4.369, S.E.=.649) (see Figure 1).

In the relation to egocentric network features, an individual who has higher IQV tend to be more prepared.   It is because persons who had ties with a mixture of strong and weak ties may have better access to new information and resources (Granovetter, 1973). Also, only variable negatively associated with preparedness was Density without Ego, and

this tells us that persons who embedded in the sparser network will take more preventive action than others.   The inference that weak ties have more impact on disaster preparedness can be drawn from the results of the analysis.   Whether respondents are male or female, a proportion of men in Alters were positively associated with disaster preparedness.   The result supported the hypothesis of the previous study (Hurlbert et al.,2000).

In the relation to demographic characteristics and media usage, in contradiction to H8 (Heller et al. 2005), Age was positively associated with disaster preparedness.   Even persons who reached the 70s still be high in disaster preparedness score.   Individuals who live with his/her family were more to take preventive behavior toward natural hazards.   A radio and cellular phone are taken as the essential items during a disaster event, and their possession became reliable predictors.   A publicity paper is the most significant source of local information including risk management plan of the town.   It was inferred that residents with a strong attachment to the community may be cultivated a reading habit of publicity paper, and this practice may lead them to be more prepared.

Comparison between First Quartile ("Vulnerable") and Fourth Quartile ("Well-Prepared") with the observed data showed clear differences (Figure 2).   Those predictors will contribute the local town government and the community leaders by offering them clear indicator to specify well-prepared community members as well as vulnerable, and make them capable of reaching out appropriate individuals when they create and implement the risk management plan.

Acknowledgement

References

Granovetter, M.S. (1973) The Strength of Weak Ties, American Journal of Sociology, Vol.78, No.6,pp.1360-1380.

Heller, K., Alexander, D.B., Gatz, M., Knight, B.G., and Rose, T. (2005) Social and Personal Factors as Predictors of Earthquake Preparation: The Role of Support Provision, Network Discussion, Negative Affect, Age, and Education, Journal of Applied Social Psychology, Vol.35, No.2, pp.399-422.

Hurlbert, J.S., Haines, V.A, and Beggs, J.J. (2000) Core Network and Tie Activation: What Kinds of Routine Networks Allocate Resources in Nonroutine Situations?, American Sociological Review, Vol.65, pp.598-618.

For more information, please see following links;

http://souls.cc.kochi-u.ac.jp/?&rf=5327

Table 1. Hypotheses Statements

Hypotheses	
BLOCK1: Ego Network Measures	
H1	A person who embedded in a larger social network is more prepared than who does not.
H2	A person who embedded in a social network with more diversity (or dispersion) is more prepared than who does not.
H3	A person who embedded in a social network with higher average age is more prepared than who does not.
H4	A person who embedded in a social network with a higher proportion of men is more prepared than who does not.
H5	A person who embedded in a social network with more same-sex is more prepared than who does not.
H6	A person who embedded in a social network with a higher proportion of Kin is more prepared than who does not.
H7	A person who embedded in a denser social network is more prepared than who does not.
BLOCK2: Demographic Characteristics	
H8	An older person is less likely to engage in disaster preparation activities than a younger one.
H9	A person with a higher education is more prepared than who is not.
H10	A person with a higher income is more prepared than who is not.
H11	A person who lives with his/her family is more prepared than who lives alone.
BLOCK3: Media Usage	
H12	A person who owns a television is more prepared than who is not.
H13	A person who owns a radio is more prepared than who is not.
H14	A person who owns a cellular phone (including a smartphone) is more prepared than who is not.
H15	A person who subscribes a local newspaper is more prepared than who is not.
H16	A person who subscribes CATV is more prepared than who is not.
H17	A person who habitually read a publicity paper of the town is more prepared than who is not.
H18	A person who uses any Internet services is more prepared than who is not.
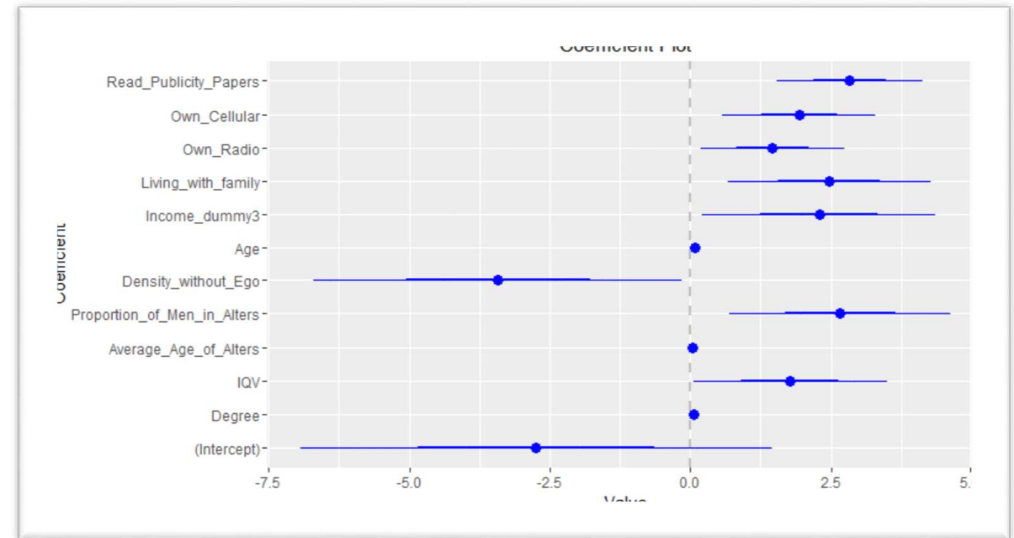
Figure 1. Coefficient Plot of Model 4
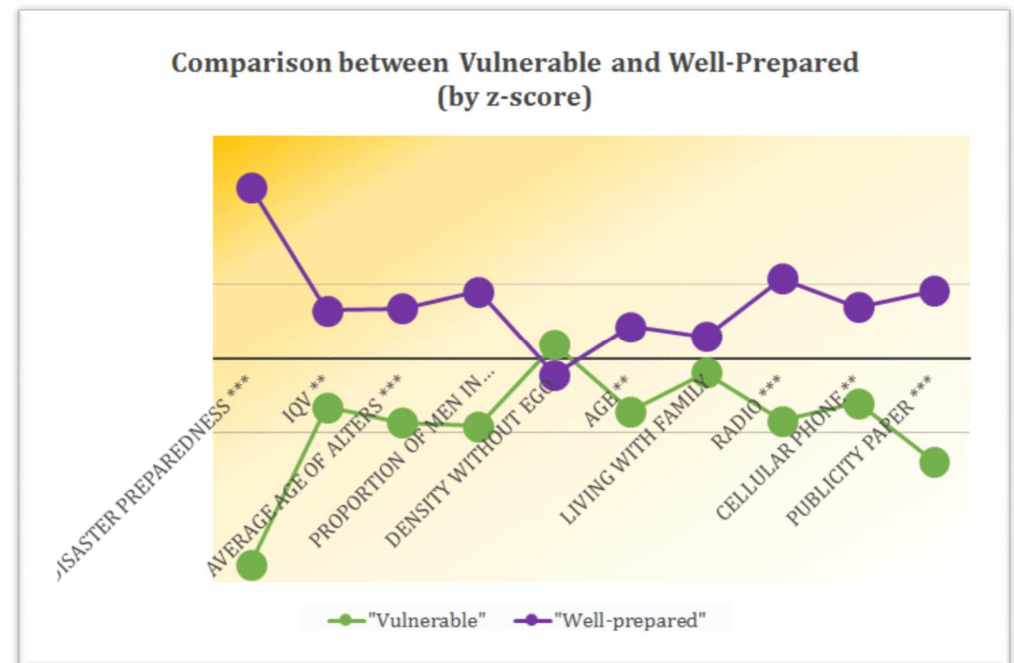
Figure 2. Comparison between "Vulnerable" and "Well-prepared"

Table 2. Regression Table

Predictors of Preparedness by Network Structure, Demographics, and Media Usages

Predictor variable	Model 1 Coef.	(S.E.)	β	95%CI	Model 2 Coef.	(S.E.)	β	95%CI	Model 3 Coef.	(S.E.)	β	95%CI	Model 4 Coef.	(S.E.)	β	95%CI
Intercept	5.675	1.196	4.746 ***	3.316 - 8.034	-2.286	2.504	-.913	-7.227 - 2.655	-3.613	2.294	-1.575	-8.140 - .913	-2.745	2.100	-1.307	-6.889 - 1.400
Block 1: Ego Network Structure																
Network size	.077	.039	2.012 *	.001 - .153	.113	.038	2.983 **	.038 - .187	.058	.035	1.648	-.011 - .127	.064	.034	1.844 +	-.004 - .131
IQV	2.625	.972	2.702 **	.708 - 4.542	2.426	.951	2.552 *	.550 - 4.303	1.739	.879	1.979 *	.005 - 3.473	1.771	.860	2.059 *	.074 - 3.469
Average Age of Alters	.063	.018	3.561 ***	.028 - .097	.042	.020	2.125 *	.003 - .082	.034	.017	1.975 *	.000 - .068	.035	.017	2.043 *	.001 - .069
Proportion of men in Alters	3.851	1.078	3.573 ***	1.725 - 5.978	4.402	1.248	3.527 ***	1.939 - 6.865	2.378	1.012	2.350 *	.381 - 4.375	2.665	.986	2.702 **	.719 - 4.611
EI Index of Sex	.195	.798	.245	-1.379 - 1.769												
EI Index of Kin	.715	.710	1.008	-.685 - 2.115												
Network Density without Ego	-4.170	1.885	-2.212 *	-7.889 - -.451	-3.955	1.869	-2.115 *	-7.644 - -.265	-3.028	1.706	-1.775 +	-6.394 - .338	-3.422	1.639	-2.088 *	-6.655 - -.189
Block 2: Demographic Characteristics																
Age					.097	.029	3.334 **	.040 - .155	.091	.028	3.246 **	.036 - .146	.084	.026	3.276 **	.034 - .135
Sex (0=Female, 1=Male)					-.348	.857	-.406	-2.039 - 1.343								
Education - Middle School (Reference)																
Education - High School (dummy1)					-.299	.916	-.326	-2.107 - 1.509								
Education - Junior College (dummy2)					2.332	1.424	1.638	-.478 - 5.142								
Education - Vocational College (dummy3)					.541	1.299	.417	-2.021 - 3.104								
Education - University or Higher (dummy4)					.477	1.370	.348	-2.227 - 3.180								
Income - None (Reference)																
Income - > 1 million yen (dummy1)					.140	.922	.152	-1.679 - 1.959								
Income - 1million => 3 million yen (dummy2)					.183	.951	.193	-1.693 - 2.059								
Income - 3million => 5 million yen (dummy3)					2.984	1.361	2.193 *	.298 - 5.669	2.365	1.058	2.235 *	.277 - 4.454	2.289	1.042	2.197 *	.233 - 4.344
Income - 5million => 7 million yen (dummy4)					-1.039	1.840	-.565	-4.671 - 2.593								
Income - =< 7 million yen (dummy5)					-2.100	2.453	-.856	-6.941 - 2.742								
Living with Family (0=Alone, 1=Yes)					2.832	1.018	2.782 **	.823 - 4.840	2.489	.926	2.687 **	.661 - 4.317	2.475	.908	2.727 **	.684 - 4.265
Block 3: Media Usages																
TV possession (0=No, 1=Yes)									.087	.810	.108	-1.510 - 1.685				
Radio possession (0=No, 1=Yes)									1.339	.652	2.053 *	.052 - 2.626	1.457	.639	2.280 *	.196 - 2.718
Cellular phone possession (includes smart phone) (0=No, 1=Yes)									1.530	.782	1.958 +	-.012 - 3.072	1.935	.680	2.844 **	.593 - 3.277
Local newspaper subscription (0=No, 1=Yes)									.752	.727	1.035	-.682 - 2.186				
Local CATV subscription (0=No, 1=Yes)									.111	.243	.458	-.368 - .590				
Habit of reading a publicity paper of town government (0=No, 1=Yes)									2.669	.680	3.926 ***	1.327 - 4.011	2.834	.649	4.369 ***	1.554 - 4.114
Internet usage (0=No, 1=Yes)									.831	.736	1.130	-.620 - 2.282				
R			*.260*				*.345*				*.449*				*.442*	
R2			*.232*				*.282*				*.403*				*.408*	
F			*9.339*				*5.456*				*9.685*				*13.110*	
df			*7, 186*				*17, 176*				*15, 178*				*11, 182*	
AIC			*1156.634*				*1152.946*				*1115.300*				*1109.894*	
BIC			*1186.044*				*1215.035*				*1170.853*				*1152.377*	

Note. Numbers in parentheses are standard errors; *N* =194
+ *p* < .1. * *p* < .05. ** *p* < .01. *** *p* < .001.