

Impact Stabilization and Event Evaluation for Life Recovery among the 1995 Kobe Earthquake Survivors (The 1999, 2001, 2003 and 2005 Cross-sectional and Longitudinal Life Recovery Social Survey Findings)

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ABSTRACT

This paper summarizes major findings from the Hyogo Life Recovery Survey Project, a series of four consecutive cross-sectional social surveys conducted in years 1999, 2001, 2003 and 2005 as well as a 2001-2003-2005 longitudinal (panel) survey in order to study long-term life recovery processes among the 1995 Kobe earthquake survivors. The 1999 survey (N=915) that was conducted five years after the Kobe earthquake produced some key scales, including life recovery, physical and psychological stress, family relations and civic-mindedness. The questionnaires were standardized and then repeatedly administered to those who resided in the same three hundred and thirty impacted areas out of which ten subjects were randomly selected each time in the years 2001, 2003 and 2005. The 2001 study (N=1203) integrated the 1999 study findings with those from the 1999 grass roots assessment on life recovery, out of which the seven critical element model of life recovery was constructed. The effects of those seven critical elements on life recovery were empirically tested and validated by general linear model (GLM) analyses. The 2003 (N=1203) and 2005 (N=1028) studies focused not only on life recovery outcomes but also on intervening life recovery processes. Structural equation modeling (SEM) identified causal chains among recovery promoting factors, recovery processes such as event impact stabilization and event evaluation through community empowerment, and recovery outcomes. Event impact was a process through which impacts caused by earthquake damage, losses and/or stresses were alleviated by housing, livelihood and stress management. Through event evaluation, social ties and community rebuilding efforts facilitated the reframing of earthquake experiences into positive narratives. The 2001-2003-2005 longitudinal (panel) survey (N=289) further elaborated upon life recovery processes and confirmed that rich social ties facilitated life recovery even among the most disadvantaged population.

Keywords: *the 1995 Kobe earthquake, long-term life recovery, cross-sectional and longitudinal surveys*

INTRODUCTION

This paper summarizes major findings from the Hyogo Life Recovery Survey Project, a series of four consecutive cross-sectional social surveys as well as three time point longitudinal (panel) survey in order to study long-term life recovery processes among the 1995 Kobe earthquake survivors. The first survey was conducted in 1999, five years after the Kobe earthquake. The questionnaires were then repeatedly administered to those who resided in the same three hundred and thirty impacted areas out of which ten subjects were randomly selected each time in the years 2001, 2003 and 2005. During these three years, the additional panel survey was also conducted at the same areas.

The research framework for both cross-sectional and longitudinal studies evolved in three stages over the course of the project's seven-year period. The first stage was exploratory due to the fact that there was no preceding long-term life recovery model that would have applied to an urban mega-disaster (Kawata, 1995) in recent years either nationally or internationally. The first survey that was administered in March 1999 was therefore designed to develop several scales and measures that could be repeatedly employed in the following surveys. Among those scales and measures, one of the most important developments was that of life recovery, which was designed to quantify the dependent variable for the project. The 1999 survey also examined demographic, disaster impact and social characteristics of those who showed a higher level of life recovery

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(Tatsuki & Hayashi, 2000). The second stage integrated the findings from the 1999 study as well as those from the grass roots assessment workshop on life recovery conducted in the summer of 1999 (Tatsuki & Hayashi, 2001). Based on those findings, the seven critical element model of life recovery was constructed. The model guided research framework building for the 2001 Hyogo Life Recovery Survey. The third stage refined the research strategy that was then employed in the 2003 and 2005 surveys. Those two surveys paid attention not only to life recovery outcomes but also to intervening life recovery process variables. The 2003 survey resulted in the construction of the long-term life recovery process and outcome model from a mega-disaster (Tatsuki et al, 2004). The 2005 survey along side with the 2001-2003-2005 panel survey (Kuromiya, Tatsuki, Hayashi, Noda, Tamura, & Kimura, 2006) confirmed, in general, both internal and external validity of the final life recovery process and outcome model.

THE 1999 STUDY

The 1999 Hyogo Life Recovery Survey aimed to identify determinants of the changes of residence and life reconstruction among the 1995 Kobe earthquake victims (Tatsuki & Hayashi, 2000). Based on findings from the preceding ethnographic research (Aono, Tanaka, Hayashi, Shigekawa, & Miyano, 1998), the questionnaire was designed to inquire about residence location, source of help, sense of civic-mindedness and family relations at the 10th, 100th, and 1000th hour as well as at the six months point after the onset of the earthquake. These time points were considered to correspond with critical boundaries, which segmented phases of the disaster victims' behavior.

A. Method

The 1999 study was the first attempt to construct standardized measures of life recovery, physical and mental stress, civic-mindedness and family relations. Those scales were to be repeatedly used in the following three surveys. 2,500 In-Hyogo residents were sampled from 250 randomly selected points with a seismic intensity of 7 and/or with a more than two month cut-off from the city gas supply. For comparative purpose, 800 Out-of-Hyogo residents were randomly selected from the subscribers' list for a Hyogo Government newsletter aimed at Out-of-Hyogo residing earthquake victims. 3,300 questionnaires were mailed at the beginning of March 1999 and 993 (683 In-Hyogo and 313 Out-of-Hyogo) questionnaires were returned by the end of March. 915 responses (623 or 25.7 % from In-Hyogo and 292 or 37.1% from Out-of-Hyogo residents) were valid.

B. Results

1) *Standardized scales constructed:* Life recovery scale is a 14 item 5-point Likert scale. It asks subjective evaluations of life fulfillment compared with pre-earthquake days, life satisfaction and future prospects. Principal component analysis revealed that all 14 items loaded high on the first principal axis, suggesting that they constituted a unidimensional scale which could be repeatedly used for the following surveys.

Physical and psychological stress scale consists of six physical and six psychological stress items. They were selected from a total of 111 stress symptom items that were parts of the 1995 Japan Red Cross Stress Study (Hayashi, Nishio, Sugawara, Monma, Kohno, Makishima, Numata, & Nemoto, 1996). Factor analysis with a varimax rotation of these twelve items in the original Japan Red Cross Study data showed a clear two factor simplex structure. The 1999 study confirmed the same simplex structure, i.e., the mental stress items loaded high on the first factor and the physiological stress items on the second factor. These two stress scales were also supported for repeated use in the following studies.

In order to identify basic dimensions of civic-mindedness, twenty trichotomous questions were asked. A Dual Scaling analysis (Nishisato, 1980) was conducted to responses to these questions. The most dominant solution was a pattern of "cannot decide either" and the second and the third response patterns were used for further analyses. The second solution differentiated community solidarity/cooperation and non-cooperation orientations. Meanwhile, the third solution differentiated external/societal-criterion-based and self-governance valuations. Responses from the self-governance and community solidarity items were added and scores were obtained respectively.

2) *A rise of civic-mindedness:* Figure 1 indicates that both self-governance (left graph) and community solidarity (right graph) scores increased from pre- to post-earthquake time. The adaptive nature of their changed worldview on society was further elaborated in Figure 2, which shows that those who reported high civic-mindedness (a sum of the self-governance and community solidarity scores) at post-earthquake time tended to be better-recovered from the disaster (left graph) and less stressed (right graph) than those who reported low civic-mindedness. These findings suggest that the earthquake disaster experiences caused among many survivors a change in their internal value system, that they constructed a new civic-minded worldview as a result of adaptation to a new environment, and that these changes in civic-mindedness were responsible for elevating both their subjective evaluation of life recovery and their coping with the current life stressors (Tatsuki & Hayashi, 2000).

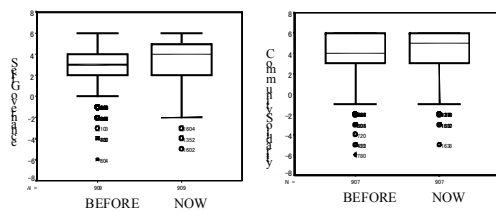


Figure 1: Changes in civic-mindedness pre- & post-earthquake: Results from the 1999 Hyogo life recovery survey (1) (N=993)

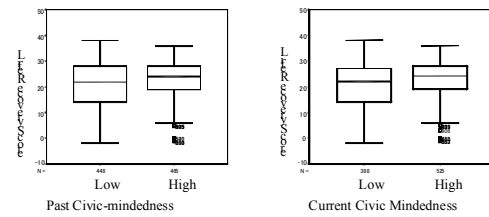


Figure 2: Level of civic-mindedness by degree of recovery: Results from the 1999 Hyogo life recovery survey (2)(n=993)

THE 2001 STUDY

The research frame development for the 2001 study was guided by the preceding 1999 study results and also by those findings that were obtained through a series of grass roots stakeholder assessment workshops on life recovery that were conducted during the summer of 1999 (Kobe City Research Committee on Disaster Recovery, 2000; Tatsuki and Hayashi, 2001). The aim of the assessment was to identify major factors that determine life recovery among those who experienced damages and losses during and after the 1995 Kobe earthquake. Residents from all of Kobe's nine wards and three special interest groups provided their assessments concerning life recovery at grass roots workshop sessions. This yielded 1,623 opinion cards which were taken back to the laboratory and conceptual clustering was attempted. In the end, seven mutually exclusive super-categories were formed. They were housing, social ties, community rebuilding, physical and mental health, preparedness, economic and financial situation, and relation to government. The 2001 study aimed to develop valid and reliable scales for the seven critical life recovery elements and to examine their impacts upon levels of life recovery.

A. Method

Table 1 summarizes both life recovery and seven critical element variables and corresponding scales that were included in the 2001 study questionnaire. 10 earthquake survivors over the age of 20 were randomly sampled from each of the same 250 research points as the 1999 study as well as from the 80 extra points in the Northern and Western wards of Kobe. Those two were not surveyed in the previous 1999 survey due to the less severe direct earthquake damage. In order to validate grass roots workshop results that were obtained from all 9 wards in Kobe, the remaining two wards were included in the 2001 study. Altogether, 3,300 questionnaires were sent by mail in January of 2001 and 1,203 valid responses were returned (36.5%).

Table 1. Overview of the independent and dependent variables scales	
Scale	Description
Housing	Relocation due to the earthquake
Social Ties	Self-Governance, Community Solidarity, Community Participation, Social Trust,
Community Rebuilding	Awareness of Urban Commons
Physical and Psychological Health	Physical and Mental Stress Symptom Checklist, General Health Practices Index
Preparedness	Awareness/Preparedness for the next major earthquake
Economic/Financial Situation	Increase/Decrease in Household Income, Expenditure, and Savings
Relation to Government	Paternalistic, Liberal, and Communitarian Views of Government, Willingness to Pay
Life Recovery	Life fulfillment, Life satisfaction, One year prospect
Social Desirability	MMPI Lie Scale

The predictor variables in the 2001 study included earthquake hazard, demographic variables and seven critical elements. Their effects on life recovery scores were examined. The 2001 study conducted a general linear model or GLM analysis to examine which variables or what combinations of variables best predicted the level of life recovery outcome among the impacted citizens. Table 2 shows the analysis results.

B. Results

As for the critical elements that were identified by the 1999 Kobe grass root assessment workshops, all components were entered into the GLM model. All of the seven critical components turned out to show significant main effects on life recovery. The effects of critical elements on life recovery were described in the following paragraphs.

1) *Housing*: Whether one experienced house relocation due to the earthquake was used as a measure for housing. House relocation showed a tendency ($F_{1, 1202}=4.242, p<.10$) that lowered life recovery scores.

2) *Social Ties*: Social ties component was measured by a) civic-mindedness scale, b) community participation scale, c) social trust scale and d) family functioning (i.e., adaptability and cohesion) scales. All variables designated to social ties showed moderate to strong effects on life recovery. Those include a sense of civic-mindedness that consists of self-governance ($F_{1, 1202}=4.117, p<.05$) and community solidarity ($F_{1, 1202}=5.439, p<.05$), the degree of actual community participation ($F_{1, 1202}=8.781, p<.01$) and social trust ($F_{1, 1202}=14.456, p<.01$). Family system as measured by family cohesion and adaptability was also found to facilitate life recovery. Those whose family cohesion was characterized by moderate levels of family cohesion ($F_{3, 1202}=8.195, p<.01$) and family adaptability ($F_{3, 1202}=4.199, p<.01$) reported a higher level of life recovery.

3) *Community rebuilding*: One cannot sense a recovery of everyday life in no man's land. It was hypothesized that recovery of everyday life was partly attributed to by an increased sense of stake-holdership to local urban commons. A sense of stake-holdership would increase people's involvement in community affairs and thus would help increase a sense of normalcy in community life. GLM analysis results supported this hypothesis and showed a tendency that the more one was aware of the urban commons, the better one was recovered ($F_{1,1202}=3.684, p<.10$).

Source of Variance	Type III SS	df	MS	F value	p	partial η^2
Corrected Model	702.311	293	2.397	4.360	***	0.584
Intercept	0.000	1	0.000	0.001	n.s.	0.000
Damage						
House Damage	0.955	3	0.318	0.579	n.s.	0.002
Furniture Damage	2.116	9	0.235	0.428	n.s.	0.004
Economic Damage	2.736	4	0.684	1.244	n.s.	0.005
Demography						
Locality	7.817	16	0.489	0.889	n.s.	0.015
Locality*Economic Damage	81.829	119	0.688	1.251	**	0.141
Sex	0.984	1	0.984	1.790	n.s.	0.002
Generation	15.848	2	7.924	14.415	***	0.031
Occupation	16.149	9	1.794	3.264	***	0.031
House Damage*Sex	4.222	3	1.407	2.560	*	0.008
House Damage*Generation*Occupation	69.058	86	0.803	1.461	***	0.121
①Housing						
Relocation Experience	2.332	1	2.332	4.242	*	0.005
②Social Ties						
Family Cohesion	13.515	3	4.505	8.195	***	0.026
Family Adaptability	6.925	3	2.308	4.199	***	0.014
Self Governance	2.263	1	2.263	4.117	**	0.005
Community Solidarity	2.990	1	2.990	5.439	**	0.006
Community Activity Participation	4.827	1	4.827	8.781	***	0.010
Social Trust	7.947	1	7.947	14.456	***	0.016
③Community Rebuilding						
Urban Common.s.	2.025	1	2.025	3.684	*	0.004
④Physical and Mental Stress						
Physical Stress	1.114	3	0.371	0.676	n.s.	0.002
Psychological Stress	57.008	3	19.003	34.568	***	0.102
Physical * Psychological Stress	17.631	8	2.204	4.009	***	0.034
General Health Practice	7.306	1	7.306	13.291	***	0.014
⑤Preparedness						
Future Earthquake Damage	3.581	1	3.581	6.515	***	0.007
⑥Economic/Financial Situation						
Income	17.437	3	5.812	10.573	***	0.034
Savings	2.473	3	0.824	1.499	n.s.	0.005
Expenditure	2.928	3	0.976	1.776	n.s.	0.006
⑦Relation to Government						
Communitarianism	1.420	1	1.420	2.584	n.s.	0.003
Willingness to Pay	4.291	1	4.291	7.806	***	0.009
Communitarianism*WTP	1.909	1	1.909	3.472	*	0.004
Social Desirability Bias	2.041	1	2.041	3.712	*	0.004
Error	501.598	910	0.551			
Total	1202	1203				

*** p<.01 ** p<.05 * p<.10 n.s. Not Significant

pessimistic expectation on the future disaster (the higher expectation of personal injuries, death of significant others, serious damages on housing, income and assets, the longer recovery time, and the wider damages on public facilities and community relations) was significantly associated with lower level of life recovery among the studied subjects ($F_{1,1202}=6.515, p<.01$).

6) *Economic and financial situation*: Subjects were asked to compare between the pre-earthquake and current levels of household income, expenditure and savings. Results showed that changes in income was a significant predictor of life recovery ($F_{3,1202}=10.573, p<.01$). The better off one was in terms of income, the better recovery he or she reported. Saving and expenditure, on the other hand, did not predict life recovery.

7) *Relation to government*: GLM analyses revealed that communitarian subscale had a only weak effect on life recovery ($F_{1,1202}=2.584, n.s., p=.105$). On the contrary, six item Willingness-to-Pay (WTP) Scale for community affairs (Cronbach's alpha was .899) was a significant predictor of life recovery. Those who are willing to pay more money and time for community affairs were found to be better recovered ($F_{1,1202}=7.806, p<.01$). Finally, a tendency of communitarianism and WTP interaction was found ($F_{1,1202}=3.472, p<.10$), suggesting those who were communitarians tended to be extraordinarily generous in offering time and money for community affairs.

THE 2003 AND 2005 STUDY

The 2003 and 2005 studies postulated life recovery as long-term, ongoing, and individual processes. Because of these postulations, the 2003 and 2005 studies separated three distinctively different types of variables. Firstly, those variables like seven critical elements that precipitated life recovery processes as well as the recovery outcomes were designated as independent variables. Secondly, recovery process variables were constructed as intervening variables that were influenced by independent variables on the one hand and also influenced the life recovery outcomes on the other. Thirdly, life recovery outcome measures were treated as dependent variables. The 2003 and 2005 studies employed a structural equation modeling (SEM) technique that explained causal chains among hazard and demographics, seven critical elements, life recovery processes and their outcomes as reported by the 1995 Kobe earthquake survivors (Tatsuki, Hayashi, Yamori, Noda, Tamura, & Kimura, 2004; Tatsuki, 2007).

A. Method

The population of the 2003 and 2005 studies was the same as the 2001 study, about 2.5 million people who resided in the areas that were hit hardest by the 1995 Kobe earthquake. This included residents in ten cities in the Kobe-Hanshin area as well as those on Awaji island. The identical 330 points were used. Two independent sets of ten residents over the age of twenty at each point, however, were randomly selected for each study. The 2003 and 2005 questionnaires were mailed in January of 2003 and 2005, respectively. The numbers of valid responses were 1,203 (36.5%) for the 2003 survey and 1,028 (31.2%) for the 2005 study.

Questionnaire items were divided into four categories, including socio-demographic and damage variables, seven critical life recovery element variables (Tatsuki and Hayashi, 2002), life recovery outcome variables, and life recovery process variables. The first three sets of variables were measured by the same scales as the 2001 study (see Table 1). Life recovery processes were measured from two perspectives, life recovery curve and life change appraisal perspectives. Life recovery curve perspective included such process variables as return to normalcy, struggle for meaning and retreat. Those for life change appraisal perspective were sense of life change and life change directions.

B. Results

Figures 3 and 5 show the results of structural equation modeling (or SEM) of the 2003 and 2005 study data respectively. The results are summarized as path diagrams that signify causal directions (arrows) and their magnitude (standardized coefficients) among damage, seven critical elements, life recovery processes (i.e., event impact and evaluation) and outcome variables. The variables in squares are designated as observed measures that were obtained from the data, while those in oval shapes are latent variables or postulated constructs (e.g. seven critical elements) that explain high correlations among measures of the same construct. Both 2003 and 2005 studies demonstrated high overall fit between the model and the data; GFI=.924, AGFI=.905, RMSEA=.05 for the 2003 study and GFI=.934, AGFI=.921, RMSEA=.041 for the 2005 study. The estimated parameters or coefficients in both models were all statistically significant at the pre-established $p < .05$ level.

Figures 4 and 6 present bird's-eye view summaries of the 2003 and 2005 study results respectively by means of illustrating major causal relations among latent variables. Both studies supported that two different processes, damage alleviation and community empowerment, influenced life recovery outcomes.

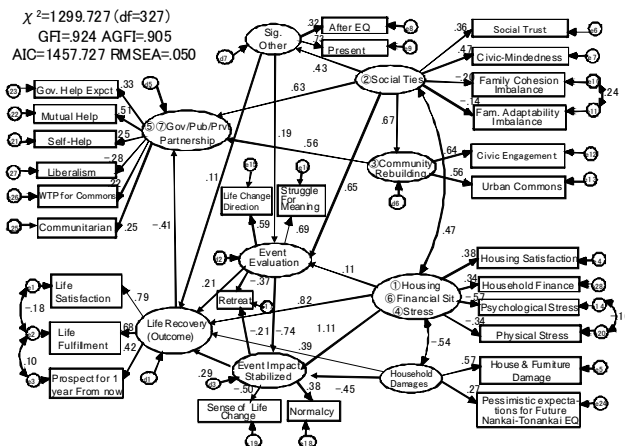


Figure 3: The final SEM life recovery model for the 2003 study data

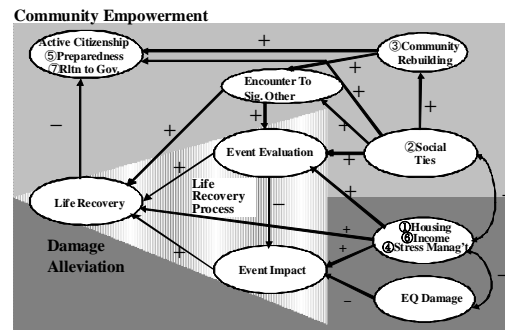


Figure 4: Bird's-eye view of life recovery process: The 2003 study results (N=1,203, Jan. 2003)

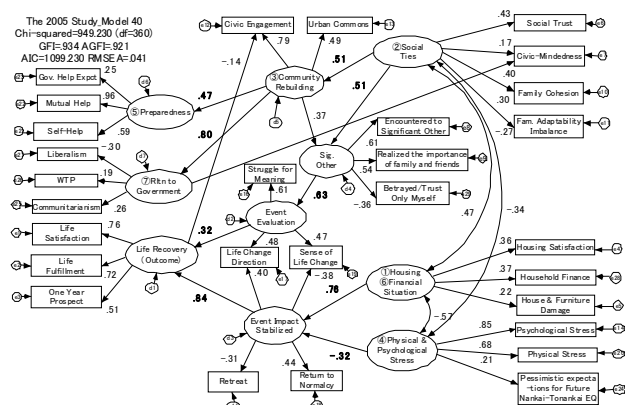


Figure 5: The final SEM life recovery model for the 2005 study data

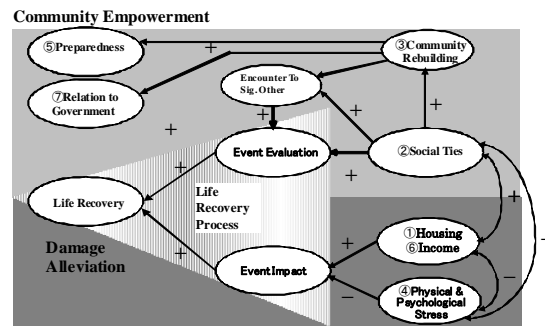


Figure 6: Bird's-eye view of life recovery process: The 2005 study results (N=1,028, Jan. 2005)

1) *Impact Stabilization:* Structural equation modeling postulated a latent variable, event impact, as an intermediary process to alleviate the impact of damage and stress upon life recovery. In this process, life recovery was directly caused by the degree to which the event impact was stabilized (see Figures 6 and 8). The event impact was measured by such life recovery process variables as a sense of life no longer in transition, a sense of normalcy, and no need for retreat (see Figures 3 and 5).

In the 2003 study (Figures 3 and 4), the event impact stabilization was negatively influenced by the magnitude of household earthquake damages and positively influenced by improvements in those three critical elements as housing, financial situation, physical and psychological stress. In other words, when the improvements outweighed the damages, the event impact was stabilized. The stabilization eventually led to a sense of life recovery. The 2005 study (Figures 5 and 6) repeatedly supported the above causal path in general. A slight but worth noting difference, however, was observed: The event impact stabilization was determined only by the housing and financial situations on one hand and physical and psychological stress on the other. This was due to the fact that the direct 1995 earthquake hazard effect as measured by house, furniture or economic damages disappeared in the 2005 study. People were not suffering because they were hit by the earthquake that occurred ten years ago. Rather, people were suffering from such secondary effects as a lack of housing/financial adjustment and/or long lasting physical and psychological stress.

In 2003 study, life recovery was also directly influenced by the housing-finance-stress critical element latent variable. It also exerted an influence on the event evaluation that will be discussed in the below. It should be noted, however, that these direct effects failed to be confirmed in the 2005 study, suggesting that these effects were temporary and considered to be idiosyncratic to the 2003 study data.

2) *Event Evaluation:* Both 2003 and 2005 studies demonstrated that event evaluation, another construct postulated by SEM analyses, played an important intervening role in community empowerment process. This was another path that led to life recovery (see Figures 3 and 5). The two studies identified a common community empowerment path where a sense of life recovery was achieved through positive event evaluation. This was measured by such attempts and feelings as struggle for meaning (e.g., "I feel strongly that living a life has a meaning"), life change toward a positive direction and low need for retreat (see path diagram in Figures 4 and 5 in more detail). Social ties, as evidenced by high social trust, civic-mindedness and balanced family relationships, exerted an influence in such a way that one's evaluation of the earthquake experiences was reframed into positive narratives. The influence paths were both direct and indirect. The indirect paths were through empowering community building efforts and/or increasing opportunities to encounter significant other who provided social and psychological support for re-socialization to and reconstruction of the post-earthquake reality (Berger & Luckman, 1966; Mead, 1963).

THE 2001, 2003 AND 2005 HYOGO LIFE RECOVERY PANEL SURVEY STUDY

Kuromiya, Tatsuki, Hayashi, Noda, Tamura, and Kimura (2006) reported the power of social capital upon life recovery using Hyogo Life Recovery Panel Survey Study data. The following section summarizes the major findings.

A. Method

297 subjects responded to the panel survey questionnaires at three different time points, in January of the years 2001, 2003 and 2005. The respondents resided in the area where a seismic intensity of seven on the Japanese scale was recorded and/or city gas service stopped for more than three months after the quake. In January of 2001, 3,300 residents who resided in the above-mentioned areas were randomly chosen. The questionnaires were mailed to them and 1,203 returned. They were the same subjects as reported in the 2001 Hyogo Recovery Survey Study. All were invited to participate in the panel survey and 486 subjects agreed. In January of 2003, along with the 2003 Hyogo Recovery Survey subjects, those 486 year 2001 panel survey participants were sent the 2003 survey questionnaires and 364 (66.1 %) responded. In January of 2005, the 2005 Survey questionnaires were also sent to the 364 panel study subjects and 297 (81.6%) responded. Those 297 subjects who responded to all three surveys (in years 2001, 2003, and 2005) formed the Panel Survey sample.

B. Results

1) *Four recovery patterns:* The 297 life recovery score transitions over three time points of 2001, 2003 and 2005 were inputted to a hierarchical cluster analysis (Ward method and square Euclidean distance) and four distinctive pattern clusters were obtained. Those were 1) ++ Type, 2) + Type, 3) – Type, and 4) – – Type (see Figure 8). Analyses of these patterns suggested that: 1) the ++ Type or those who scored very high on recovery in year 2001 continued and even increased their life recovery scores in the following two time points, 2) that those who scored moderately high (the + Type) or low (the – Type) on recovery maintained their respective scores in years 2003 and 2005, and 3) the – – Type or those who scored very low on recovery in year 2001 remained low in the following two time points.

2) *The -- Type characteristics:* Kuromiya et. al. (2006) summarized the characteristics of the 65 individuals who were categorized as being the --Type. Demographically, they tended to be males who experienced the earthquake in their 50's to early 60's. Physical injuries were commonly experienced by them or their family members. They also tended to report severe damage to household goods. With regard to the seven critical elements, they had more chance of dwelling in public housing units, showing low social ties/low awareness of local urban commons, being highly stressed both physically and mentally, engaging in small businesses, experiencing economic damage to business, and experiencing a decrease in income.

It should be noted that although the -- Type showed a significant decrease in their life recovery scores from year 2001 to 2003, there was no further significant change after 2003, suggesting that a time factor alone cannot explain the 2003-to-2005 within-subject variance and that other factors can be suspected to account for the variance. The Seven Critical Element Model variables were introduced as between-subject factors in the repeated measure ANOVA analyses for the 65 -- Type subjects. Within-subject contrast tests revealed moderate to significant time-by-factor interactions from the year 2003 to 2005 in three variables. Those were 1) number of relocations, 2) level of participation in community activities, and 3) community outlook where the respondents were residing.

3) *The power of social capital upon life recovery:* The effects of relocations upon repeated measure life recovery profiles were shown in Figure 7. The 2001-to-2003 profiles all indicate downward shift among five groups, i.e., those who moved none, once, twice, three times, and four times or more after the earthquake. In comparison, those who moved more than four times scored further and deeper decline from 2003 to 2005 while the other groups remained within the same range or even mildly bounced back in the year 2005. A within-subject contrast test from year 2003 to 2005 suggested a mild time-by-group interaction effect ($F_{4,60} = 1.981, p = .109$). This implied that those who were very transient and therefore considered being the least affiliated with locality were the least resilient ten years after the earthquake.

Secondly, the impact of community activity participation over a repeated measure life recovery score profiles was illustrated in Figure 8. Those who very often or sometimes participated in community activities showed a V-shape bounce-back of life recovery means while those who did not participate exhibited a steady decline in their life recovery scores. A within-subject contrast test from year 2003 to 2005 supported the significant time-by-group interaction ($F_{2,62} = 3.802, p < .05$).

Finally, as Figure 9 shows, a strong V-shape bounce-back of life recovery score from 2003 to 2005 was observed among those who reported that their neighborhoods were characterized as "everybody being sociable and being involved in neighborhood events." A mild bounce-back was also found among those who described their neighborhood being "neighbors greeting to each other." In comparison, 2003 to 2005 declines of life recovery score were found among those who reported their neighborhood being "no daily interaction among neighbors", or "only neighborhood leaders being actively involved." A significant time-by-group interaction effect ($F_{3,61} = 3.489, p < .05$) was also evidenced by a within-subject contrast test from year 2003 to 2005.

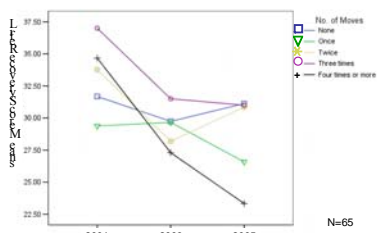


Figure 7: Number of relocations and changes in life recovery scores among "--" type respondents

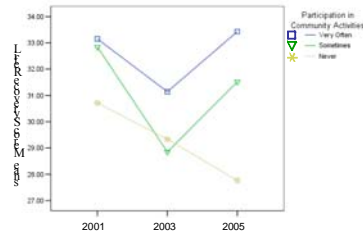


Figure 8: Participation in community activities & changes in life recovery scores among "--" type respondents

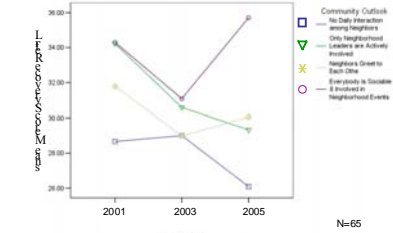


Figure 9: Community outlook & changes in life recovery scores among "--" type respondents

CONCLUSION

The current paper aimed to examine what constituted "life recovery", what facilitated it and how on a long-term basis. The study resulted in a grass roots-assessment-based working model (the seven critical element model of life recovery), which was then tested, validated and further refined by a series of empirical studies. The life recovery process and outcome model, the final product of these research endeavors, provided a framework for life recovery assistance programs and policies for future urban mega-disaster victims/survivors.

At an earlier course of life recovery (i.e., within five years), housing, income as well as physical and psychological health management issues should be addressed in order to alleviate the event impact. This leads to a sense of normalcy and stability in everyday life. Policies and programs geared toward this objective include provisions of many different types of temporal and permanent housing units, grants and low interest loans, and other housing related programs, monetary compensations and grants for livelihood assistance, public health care services including stress management programs.

Apart from damage alleviation, another and possibly longer-term life recovery process, event evaluation, was identified. This process was found directly facilitated by social ties by which disaster experiences were reframed into complete, coherent and meaningful narratives. Social ties also exerted indirect influences on event evaluation through empowering community rebuilding efforts and/or through enriching opportunities to encounter significant others who assisted re-socialization to and reconstruction of the post-earthquake realities. The policies and programs toward event evaluation, therefore, should include family and community enrichment/empowerment activities as well as those to commemorate and transcend the experiences to the next generations.

The 2001-2003-2005 longitudinal (panel) survey further elaborated upon life recovery processes and confirmed that rich social ties, as evidenced by fewer relocation experiences, more community activity participations and higher degree of neighbor interactions, facilitated life recovery even among the most disadvantaged population.

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