

Model construction and testing of psychological recovery processes from the Kobe earthquake disaster experiences I: Life recovery process scale construction using the 2002 public restoration housing residents population survey data

Shigeo Tatsuki¹⁾, Haruo Hayashi²⁾, Katsuya Yamori²⁾, Takashi Noda³⁾, Keiko Tamura²⁾, Kenji Koshiyama⁴⁾

1 Department of Sociology, Doshisha University, Kyoto, Japan

2 Disaster Prevention Research Institute, Kyoto University, Kyoto, Japan

3 Faculty of Human Life and Environment, Nara Women's University, Nara, Japan

4 Disaster Reduction Institution for Human Renovation, Kobe, Japan

Abstract

The current study aimed to develop and test a model of recovery that emphasizes ongoing and long-term processes. Based on reviews of recovery-related literature from the Kobe earthquake studies, US natural hazard research school studies, and general sociological/psychological studies concerning the social construction of everyday life after disasters, the current paper attempted to reconstruct three distinctively different recovery processes; "return to normalcy", "struggle for meaning" and "retreat." Population social survey data (N=17,079) from restoration public housing residents conducted in 2002 were used to examine the postulated recovery process typology. Eight items were prepared and factor analysis of these items showed a clearly expected three factor simplex structure. Using the factor loadings, factor scores were obtained for each of the corresponding three factors. Based on the maximum factor score recorded among the three factors, 17,079 respondents were classified into one of the three groups. A third of the restoration public housing residents were judged to be in the "return to normalcy" group while the other two-thirds were considered to be in either the "struggle for meaning (27.9%)" or "retreat (38.8%)" group. ANOVA's that treated the recovery process typology as a factor on life re-adjustment, life satisfaction, physical and mental stress measures all showed significant differences among the three groups. The recovery process typology and corresponding scale that was developed will be utilized in the forthcoming 2003 general panel survey of the Kobe earthquake victims.

1. INTRODUCTION

1.1 Background of the study

In January 2002 at the second workshop for Comparative Study for Urban Earthquake Disaster Mitigation, Tatsuki and Hayashi (2002) presented their study results on the seven critical element model of life recovery using the 2001 life recovery panel survey results collected from the 1995 Kobe earthquake survivors. The seven elements included housing, social ties, townscape, physical/mental health, preparedness, economic/financial situation, and relation to government. Seven respective indicators were prepared and entered into a GLM equation along with house/economic damages, demography and their interaction terms. This model accounted for 59.3% of the total variance in the life recovery scales. The presentation stimulated several questions from the audience and one particular question raised by an old gentleman was fundamental in its nature and off-balanced the current author. He asked "So, please tell me to what degree are we, Kobe citizens as a whole, in a process of psychological recovery?" After a discussion with the gentleman, it became clear that our study focused linearly on the outcome of life recovery (i.e., a sense of readjustment and that of life satisfaction) and has not paid enough attention to recovery process per se. Unless we had a tool to estimate each individual's psychological recovery processes, we were not able to

answer what percentage of Kobe earthquake survivors were in what recovery process categories. This discussion along with the similar question raised concerning the 2001 Kobe panel survey results on life recovery (Tamura, Hayashi, Tatsuki, & Kimura, 2001) at the annual conference of the Institute of Social Safety Science in 2001 led a new project to construct a model of psychosocial recovery process from a severe natural hazard experience such as the 1995 Kobe earthquake.

1.2 Preceding studies on recovery process among the Kobe earthquake victims

Based on ethnographic interviews with the Kobe earthquake victims in Nishinomiya city (cf., Shigekawa & Hayashi, 1997), Aono, Tanaka, Hayashi, Shigekawa and Miyano (1998) found in the existence of three distinctive time phases in the victims' disaster response behaviors. These phases are namely, disorientation (up to ten hours after the event), development of a "disaster utopian society" (from ten to one hundred hours) and maintenance of a "disaster utopian society" (from one hundred to one thousand hours). After surviving to the one-thousandth hour, people began "returning to normalcy" (Tanaka, Aono & Hayashi, 1998; Tanaka, Hayashi & Shigekawa, 1999).

These preceding ethnographic studies of disaster process prepared a framework that guided us to look for particular parameters in the following quantitative survey analyses.

Employing the suggested disaster process framework, Takashima and Hayashi (1999) constructed a quantitative research methodology which allows researchers to empirically examine spacio-temporal patterns of the recovery process from antecedent normalcy to a disaster period and to a gradual incline back to another level or return beyond the previous level of normalcy. Their methodology was applied to regional power consumption statistics before, during and after the Kobe earthquake. They showed normalcy-to-disaster-to-recovery patterns in those statistics recorded at different branch office service areas within Hanshin-Awaji regions. Using the same conceptual framework of disaster process, Karatani, Hayashi and Kawata (2000) examined Kobe city monthly reports on household and socio-economic activity statistics and identified six different patterns in the "socioeconomic rehabilitation" process.

Despite their methodological innovations, the above quantitative studies are based on aggregate measures and thus provide less insight on the on-going individual recovery process.

1.3 Preceding studies on long-term recovery from major natural hazards in the US

Webb, Tierney and Dahlhamer (2000) summarized results from four cross-sectional post-event large sample surveys on short- and long-term business recovery after major disasters such as the Loma Prieta earthquake in 1989, Hurricane Andrew in 1992, Midwest floods in 1993, and the Northridge Earthquake in 1994. Those surveys focused on recovery either in the short term, i.e., one to one and a half year after the event (Midwest flood and Northridge earthquake, respectively) or in the long term, i.e., six to eight years after the incident (Hurricane Andrew and Loma Prieta earthquake, respectively) Although they found that most businesses returned to or exceeded pre-disaster levels both on the short- and long-term, differential impacts upon business recovery were observed due to disaster severity, business size, the degree of operational problems such as disruptions in supply and employee-related problems, and damage to the surrounding areas that provide the business customer base.

Based on longitudinal/ethnographic interviews with disaster hit small business owners and NGO leaders whose disaster experiences were as old as the Hurricane Andrew (1992) and as new as the Los Alamos Fire (2000), Alesch (2001) pointed out the five most critical variables for long term recovery: the disaster's impact on the organization's clientele; the availability of convenient substitute goods or services; pre-disaster major trends in the organization's industry, and the individual organization's position in relation to those trends; the extent of financial resources lost by the organization; and the owner/operator's ability to adapt to the new business environment. These points seem to correspond closely with those reported by Webb et al. (2000). Alesch (2001) also noted common narratives being repeatedly told to the interviewers across different disaster sites. Those include misplaced confidence, an illusion of

security, a feeling of helplessness to change the outcome, the continuing nightmare, self-imposed limits in recovery efforts, imprudent use of financial resources, failure to discern changes in customer base, an assumption that circumstances will revert to normal, special impact on retirement age people, and lack of short term help. Those common narratives seemed to reflect the victims' view of reality and outside world, which in return might have strong influence upon what they do or do not do.

Although the above mentioned studies seem to reflect the current state of arts on studies of long term recovery in the US, they do not seem to have fully responded to and/or solved some of the research issues raised at the 1996 Boulder workshop session titled "What is known and trends for improving recovery and reconstruction following disasters," in which Joanne Nigg, Trish Bolton, Claire Rubin, and Phil Berke participated as panelists. Dennis Wenger who moderated the session summarized some of the discussion points as follows: a) there exists a "need to shift the conceptualization of recovery from linear and outcome based to seeing it as an ongoing and long-term process"; b) antecedent recovery studies tend to be "overly descriptive, fragmented, and short-term oriented"; c) not much attention has been paid to link a disaster response phase to a recovery phase; and d) more research is needed in order to understand the long-term effects of disaster recovery (Wenger, Rubin, Nigg, Berke & Bolton, 1996).

The 1996 Boulder workshop session participants seemed to have agreed upon future research directions on recovery studies: An attempt should be made to overcome "overly descriptive, fragmented, and short-term oriented" studies by incorporating a large systematically sampled surveys. The following studies at their best (e.g., Webb, Tierney & Dahlhamer, 2000; Tatsuki & Hayashi, 2002), are cross-sectional, linear and outcome-based, thus not fully paying attention to ongoing recovery processes. In comparison, long-term, longitudinal, and ethnographic studies on disaster victims provided rich insights about recurring themes shared among various victims (e.g., Shigekawa & Hayashi, 1997; Aono, Tanaka, Hayashi, Shigekawa & Miyano, 1998; Alesch, 2001), their insights have not yet fully verified by either long-term large sample surveys or by those based on individual as opposed to aggregate data source.

1.4 Preceding general studies treating recovery as ongoing, long-term and individual processes

The above brief comparisons of recovery studies in Japan and US consensually revealed a need to understand recovery as long-term, ongoing, individual processes by incorporating systematic and longitudinal methodology. Two sources of general literature were sought in order to build a working conceptual model of long-term, ongoing and individual recovery, which was defined in the current study as obtaining a sense of new normalcy or stable reality of everyday life that may not necessary be the same as before. One is a sociological view of how reality of everyday life is constructed in transactions in a social

context (Berger & Luckman, 1966). The other come from works by such psychologists and psychiatrists that worked with holocaust survivors, *hibakusha*, Vietnam veterans, and dying patients (Frankl, 1959, Lifton, 1968, 1976; Kubler-Ross, 1969).

According to Berger and Luckman (1966), reality of everyday life is socially constructed and maintained socially. First, everyday life depends on a form of inter-subjectivity. One way for individuals to understand each other in this inter-subjective world is to pay attention to repetitive patterns or typification in daily transactions. When an individual actor tries to understand the other, he/she then starts mobilizing typificatory schema. If the corresponding actor employs the same schema, the reliance on typification becomes reciprocal. Second, when typification becomes more reciprocal, stable and universal, it then becomes habituated and routinized. As the mutual/reciprocal typification chain enlarges, it further goes beyond repetitive habits and is eventually socially institutionalized. What emerges is a sense of an external, objective and legitimate outside world, an image of society as an objective reality. Finally, externalized or objectified world is in turn internalized through primary socialization in such small groups as families and through secondary socialization. This sense of objective reality is thereafter constantly maintained by means of coherency, which comes from daily conversations with significant others, from seeing and being surrounded by insignificant/ordinary others and accustomed environment. Disasters upset not only objective but also subjective reality that people were accustomed to and force them to re-activate the above mentioned process of typification, habituation, institutionalization, externalization, internalization and maintenance of new reality.

The psychologists and psychiatrists who worked with holocaust survivors, *hibakusha*, Vietnam veterans and dying patients (Frankl, 1959, Lifton, 1967, 1987; Kubler-Ross, 1969) provided a related but more psychosocially-oriented view of process in which human being accept new reality and regain a sense of normalcy. For example, after intensive interviews with those survivors of holocaust, atomic bomb, Vietnam combat and natural disasters, Lifton (1967, 1987) observed five common themes; death imprint, death guilt, psychic numbing, suspicion of counterfeit nurturance, and struggle for meaning. Lifton's last theme is also echoed by a holocaust survivor/psychiatrist, Victor Frankl, who also taught that the final step toward the reconciliation with traumatic experiences comes from a search for meaning of life, which requires a Copernican revolution of a way one searches the meaning of life (Frankl, 1959, 121-122).

What was really needed was a fundamental change in our attitude toward life. We had to learn ourselves and, furthermore, we had to teach the despairing men, that it did not really matter what we expected from life, but rather what life expected from us. We needed to stop asking about the meaning of life, and instead to think of ourselves as those who were being questioned by life - daily and hourly. Life ultimately means taking the

responsibility to find the right answer to its problems and to fulfill the tasks it constantly sets for each individual.

Although death and dying is not itself directly related to natural disaster, stages of dying or grief that terminal patients go through quite remarkably resembles those of disaster survivors in the recovery process. According to Kübler-Ross' (1969) model, a dying person goes through five stages when being told that he/she has a terminal illness. These five stages are denial, anger, bargaining, depression, and acceptance. This model has been widely adopted and applied to many other situations where humans suffer a loss or change in social identity.

Based on the above preceding literature in disaster research in both Japan and US as well as in general studies on human recovery and reconciliation with an altered reality, a new conceptual model of recovery process was proposed for the current paper (See Figure 1).

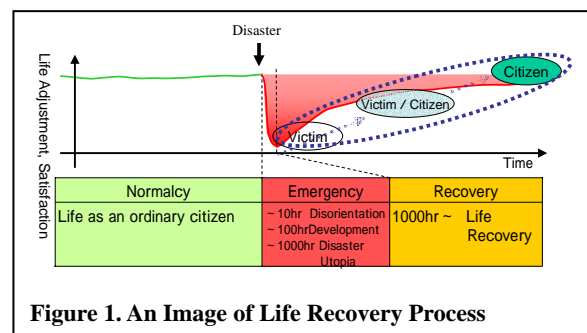


Figure 1. An Image of Life Recovery Process

The purpose of the current paper is to construct a recovery process scale that is based on the above conceptual framework and examine its internal as well as criterion-related validity with recovery outcome variables.

2. STUDY METHODOLOGY

2.1 Study Subjects and Survey Strategy

For the purpose of recovery process model building and corresponding factor analytic item analysis, the current study used the data collected by the 2002 restoration public housing resident survey. Residents of all of the 263 newly constructed public restoration housing complexes as well as the 60 preexisting public housing complexes where a proportionally large number of earthquake survivors resided constituted the study population of the current study. 26,349 questionnaires were distributed to this population, i.e., surveyors visited every housing unit and they left an envelope that contained a questionnaire in every door mail slot. Eventually, 17,079 (or 64.8%) questionnaires were returned by mail. The time of survey was from September of 2002 to mid March of 2003. Although the restoration public housing resident survey has explored far wider range of possible explanatory variables that were considered to facilitate or hinder resident community activities and thus to influence a sense of recovery, the current study mainly focuses on the findings concerning those recovery process variables that were outlined in the preceding sections and their details are explained below.

2.2 Instruments

A sense of return to normalcy is based on Berger and Luckman's (1966) discussion about the internalization and maintenance of new reality. After examining content validity of candidate items, the following four items were chosen for the current study:

- I have a certain prospect on how I will live my life in this house (この家で、どのように暮らしていけば良いのか、そのめどは立った).
- I have come to feel that everyday life consists of repetitive routines (毎日の生活は、震災前と同じように、決まったことのくり返しに感じられるようになった).
- Although they used to say that material appetites have decreased right after the earthquake, now is not much different from the pre-earthquake days (震災直後は物欲が減ったという人が多かったが、今はもう震災前と変わらない).
- I feel I am living in a "normal" everyday life (現在が、「ふつう」のくらしに感じられる).

After careful reading of Frankl (1959), Lifton (1967, 1976), and Kübler-Ross(1969), a bi-polar set of item pools were prepared in order to reflect the concepts of "struggle for meaning/acceptance" as opposed to "retreat/denial." After another careful content validity examination, the following four items were selected for the study (items with asterisks show retreat/withdrawal items):

- During the earthquake, I have experienced something unusual which I cannot get in everyday life (震災での体験は、日常生活では得られない得がたい経験だった).
- What I experienced during the earthquake is something that I would like to erase from my past (震災での体験は、私の過去から消し去ってしまいたい経験だった).
- I no longer talk about the earthquake in these days (今ではもう震災を話題にすることもなくなった).
- I began thinking about what mission my life has given to me (「自分に与えられた人生の使命とは何か」を考えるようになった).

3. STUDY FINDING

3.1 Characteristics of Subjects

Among those 17,079 respondents, 40.4% were men and female were 56.5 % (3.1% unknown). Those who were older than an age of 65 consisted of 54.6 % of the respondents. Mode household size was one-person (37.4%), followed by two-person (32.0%). The most typical family members in non-single-person families (N=8,963) were spouse (67.5%) followed by child (46.7%).

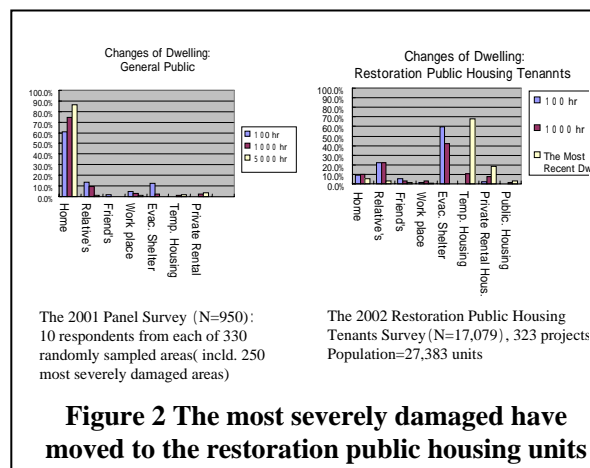


Figure 2 The most severely damaged have moved to the restoration public housing units

The most striking characteristics of the studied subjects are shown in figure 2. The graph on the left in figure 2 shows the pattern of changes in dwellings, 100, 1,000 and 5,000 hours after the 1995 Kobe earthquake. This is obtained by the 2001 general population panel survey (Kimura1, Hayashi, Tatsuki & Tamura, 2001). The left graph indicates that nearly nine out of ten answered that they returned to their own original houses by 5,000 hours after the earthquake. In comparison, those who currently residing in public restoration housing projects (the graph on the right in figure 2) answered that nearly two out of three evacuated to nearby evacuation center 100 hours after the event and two out of five still remained at the evacuation center 1,000 after the earthquake. More than 60% of those who are currently residing in the restoration public housing complexes answered that their most previous dwelling was temporary housing. This is due to fact that the 1995 earthquake destroyed their old homes and forced them to live in alternative shelters, temporary housing, and finally newly constructed eventually restoration public housing projects or preexisting public housing units. In sum, the current study subjects represent the most severely damaged among those who experienced the 1995 Kobe earthquake.

3.2 Factor Analysis Results of Items

Responses for the above mentioned eight items from 17,079 subjects were factor-analyzed (principal component analysis followed by varimax rotation method). Three principal components showed corresponding eigenvalues that were larger than 1 and they accounted for 58.49 % of the total variance. These three axes were then rotated in order to interpret the factor structure (see table 1).

Table 1.
Factor Analysis Results of Eight Items

Items	Factor 1	Factor 2	Factor 3	Communitativity
	Return to Normalcy	Struggle for Meaning	Retreat	
I feel I am living in a "normal" everyday life	0.792	0.060	0.010	0.631
I have come to feel that everyday life consists of repetitive routines	0.734	0.014	0.078	0.545
I have a certain prospect on how I will live my life in this house	0.698	0.125	-0.109	0.515
Although they used to say that material appetites decreased right after the earthquake, now is not much different from the pre-earthquake days	0.687	0.039	0.081	0.479
I began thinking about what mission my life has given to me	0.004	0.799	0.123	0.654
During the earthquake, I have experienced something unusual which I cannot get in everyday life	0.172	0.756	-0.070	0.606
I no longer talk about the earthquake in these days	0.190	-0.159	0.761	0.640
What I experienced during the earthquake is something that I would like to erase from my past	-0.133	0.230	0.735	0.610
Variance accounted for after rotation	27.59%	16.37%	14.54%	

Note1: Factor extraction method: Principal component analysis

Note2: Factor rotation method: Varimax rotation

The results showed a clear three factor simplex structure as expected from the model construction. All of the four “return to normalcy” items were loaded high on factor 1, the next two “struggle for meaning” items were loaded high on factor 2 and the remaining two “retreat/withdrawal” items were loaded high on factor 3. Communalities for all eight items ranged from .479 and to .654 and they seemed to be acceptable indices for the targeted construct.

3.3 Recovery Process Typology of the Subjects

Using the above factor analysis results, three factor scores, i.e., “return to normalcy”(factor 1), “struggle for meaning” (factor 2), and “retreat” (factor 3), were obtained for each subject. Based on the largest positive score among them, each subject was classified into one of the three recovery process types. In usual factor score calculations, factor loadings were treated as regression weights and a linear combination of weighted responses are obtained. For the purpose of inter-factor comparisons, weighted scores are standardized by dividing raw factor scores with a square root of corresponding eigenvalue, which is a measure of how much variance a given factor accounted for (VAF). As a result, this procedure shrinks variances of scores on more dominant (i.e., larger VAF) factors and at the same time expands variances of those scores on less contributing (i.e., smaller VAF) factors. Because the present study was mainly interested in finding which raw factor scores were the largest among the three, the SPSS factor score outputs were unstandardized by multiplying a square root of the VAF estimate, the corresponding eigenvalue.

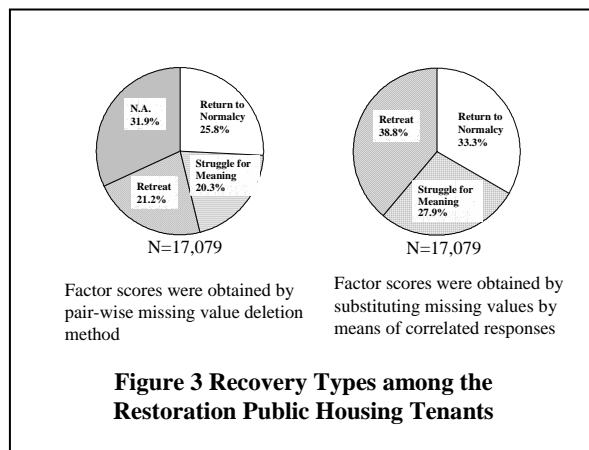


Figure 3 Recovery Types among the Restoration Public Housing Tenants

The left graph in figure 3 shows a distribution of three recovery process types and that of those who did not complete the eight recover process items. 25.8% of the studied subjects were classified as “return to normalcy”, 20.3 % as “struggle for meaning” and “retreat” as 21.2%. The largest category, however, was that of those who did not complete the eight items designated to measure recovery process. They consisted of 31.9 % or 5448 subjects out of 17,079. In order to estimate recovery process scores for those who did not complete the questionnaire items, a missing response was replaced with an average of a given item. The right pie graph in figure 3 is the result. Based on this estimation, “return to normalcy” was 33.3 %,

“struggle for meaning” was 27.9 %, and “retreat” was 38.8%. In other words, 7.5% of those who were originally categorized as “N.A.” were added to “return to normalcy”, 7.6 % of them were added to “struggle for meaning” and 17.6% or about more than twice as many “N.A.” were added to “retreat.”

The above results show that the restoration public housing residents were almost equally divided into three groups seven years after the Kobe earthquake. Among them, the two-thirds felt that their everyday life had not yet returned to normalcy. Within these two-thirds, about 1.4 times more people were in a state of “retreat/withdrawal” (38.8%) as opposed to “struggle for meaning” (27.9%).

3.4 Recovery Process Typology and Recovery Outcome Variables

The three recovery process typologies and their relationship to recovery outcome variables, life re-adjustment and life satisfaction were examined by several ANOVA’s (figures 4 and 5). In terms of life re-adjustment, “return to normalcy” showed high positive mean, “struggle for meaning” a slightly negative mean and “retreat” showed the largest negative mean (the left graph in figure 4). In terms of life satisfaction, similar patterns emerged. “Return to normalcy” showed high positive mean while the other two categories, “struggle for meaning” and “retreat” were negative, with “retreat” slightly more negative than “struggle for meaning.”

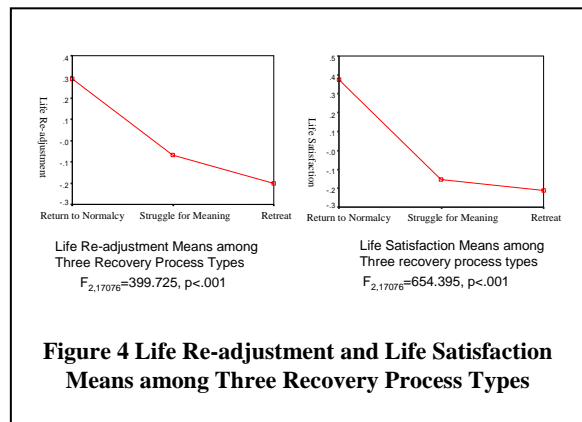


Figure 4 Life Re-adjustment and Life Satisfaction Means among Three Recovery Process Types

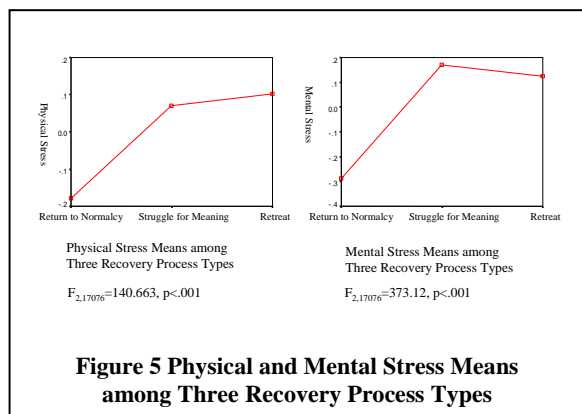


Figure 5 Physical and Mental Stress Means among Three Recovery Process Types

Recovery process types also showed expected relations with other recovery outcome variables, physical and mental

stress (see figure 5). Those who were categorized as “return to normalcy” reported less physical and mental stress. Both “struggle for meaning” and “retreat” showed more physical and mental stress. However, an interesting reversal was observed in these two groups. “Retreat” reported slightly higher stress in physical but their mental stress was slightly lower than “struggle for meaning.” It seems that “retreat” withdraw from the environment and attempts to lessen mental stress, while “struggle for meaning” are ready to face up the reality and feel more mental stress.

4. CONCLUSION

The current study aimed to shift the conceptualization of recovery from linear and outcome based to one that emphasizes ongoing and long-term process. Based on reviews of recovery-related literature from the Kobe earthquake studies, within and outside US natural hazard research school studies, it attempted to reconstruct three distinctively different ongoing and long-term recovery processes. Those are “return to normalcy”, “struggle for meaning” and “retreat.” Population social survey data from restoration public housing residents were used to examine the above postulated recovery process typology model. Eight items were prepared for the recovery process typology. Factor analysis of the items showed clearly expected three factor simplex structure and they accounted for nearly sixty percent of the total variance. Using the factor loadings, factor scores were obtained for each of the corresponding three factors. Based on the maximum factor score recorded among the three factors, 17,079 respondents were classified into one of the three groups. A third of the restoration public housing residents were judged to be in the “return to normalcy” group while the other two-thirds were considered to be in either the “struggle for meaning (27.9%)” or “retreat (38.8%)” group. ANOVA’s that treated recovery process typology as a factor on life re-adjustment, life satisfaction, physical and mental stress measures all showed significant differences among the three groups. The recovery process typology and corresponding scale that was developed will be utilized in the forthcoming 2003 general panel survey of the Kobe earthquake victims.

5. REFERENCES

- Alesch, D. (2001). “A quantitative and qualitative analysis of small organization survival and recovery following a natural hazard event.” A session summary (recorded by C. L. Reiss), the 2001 Hazards Research and Applications Workshop, <http://www.colorado.edu/hazards/ss/ss01/s35.html>
- Aono, F., Tanaka, S., Hayashi, H., Shigekawa, K., & Miyano, M. (1998). “A study of disaster victims behavior after the Hanshin-Awaji earthquake: A Nishinomiya case study report.” Proceedings of the 8th Annual Conference of the Institute of Social Safety Science, 36-39. (In Japanese)
- Berger, P., & Luckman, T. (1966). *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*. NY: 1966.
- Frankl, V. E. (1959). *Man's Search for Meaning*. New York: Pocket Books.
- Kimura, R., Hayashi, H., Tatsuki, S., & Tamura, K. “Determinants and Timing of Housing Reconstruction Decisions by the Victims of the 1995 Hanshin-Awaji Earthquake Disaster: A 2001 Replication.” *Journal of Social Safety Science*, 3, 23-32.
- Kübler-Ross, E. (1969). *On Death and Dying*. NY: Simon & Schuster/Touchstone.
- Lifton, R.J. (1967). *Death in Life: The Survivors of Hiroshima*, NY: Random House.
- Lifton, R.J. (1976). *The Life of the Self: Toward a New Psychology*, NY: Basic Books.
- Karatani, Y., Hayashi, H. & Kawata, Y. (2000). “Development of socioeconomic rehabilitation index based on Kobe statistics for the Great-Hanshin-Awaji earthquake disaster” *Journal of Social Safety Science*, 2, 213-222.
- Shigekawa, K. & Hayashi, H. (1997). “A study of disaster process as viewed from disaster responders’ perspectives: The Kobe earthquake case study.” Proceedings of the 7th Annual Conference of the Institute of Social Safety Science, 370-375. (In Japanese)
- Takashima, M. & Hayashi, H. (1999). “Spacio-temporal patterns of recovery process under large earthquake disaster: A case study for Hanshin-Awaji earthquake.” *Journal of Social Safety Science*, 1, 1-8.
- Tamura, K., Hayashi, H., Tatsuki, S., & Kimura, R. (2001). “A quantitative verification of the seven elements model of socio-economic recovery from the Kobe earthquake.” *Journal of Social Safety Science*, 3, 33-40. (In Japanese)
- Tanaka, S., Aono, F., & Hayashi, H. (1998). “Disaster victims behavior analysis after the Hanshin-Awaji earthquake disaster.” the Proceedings of the 3rd China-Japan-US Trilateral Symposium on Lifeline Earthquake Engineering, 309-314.
- Tanaka, S., Hayashi, H. & Shigekawa, K. (1999). “A study of disaster process based on the analysis of time-series development of disaster victims behaviors.” *Journal of Japan Society for Natural Disaster Science*, 18(1), 21-29. (In Japanese)
- Tatsuki, S., & Hayashi, H. (2002). “Seven critical element model of life recovery: General linear model analyses of the 2001 Kobe panel survey data.” Proceedings of the 2nd Workshop for “Comparative Study on Urban Earthquake Disaster Management”, 27-46.
- Wenger, D., Rubin, C.B., Nigg, J., Berke, P. & Bolton, T. (1996). “S96-4 What is known and trends for improving recovery and reconstruction following disasters” A session summary (recorded by C. Streeter), the 1996 Hazards Research and Applications Workshop <http://www.colorado.edu/hazards/ss/ss96.html#4>.
- Webb, G., Tierney, K., & Dahlhamer, J. (2000). “Businesses and Disasters: Empirical Patterns and Unanswered Questions.” *Natural Hazards Review* 1: 83-90.

