An analysis of structural relationship among the components of quality of life of kidney transplant recipients by using a causal model

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Abstract

The purpose of this study is to analyze the structural relationship among the components of quality of life of kidney transplant recipients by using a causal model. The subjects were 329 recipients who had regular checks-up following transplantation in seven general hospitals in Tokyo, Gunma, Aichi, Okayama, and Hiroshima, and agreed to participate in this study. Ferrans and Powers's Quality of Life Index — Kidney Transplant version was used to measure perceived quality of life. The self-administered questionnaires were handed over to the subjects, who completed the instrument on the spot. After that, the answers were collected immediately. The factor analysis and the covariance structure analysis were used to make clear the structural relationship among the components of quality of life. The results of data analysis were as follows : (1) Five components of quality of life were extracted ; socio-economic functioning, family ties, emotional support, physical health, and peace & happiness. (2) The scores in the family ties dimension and the physical health dimension were higher than in the others, and the score in the socio-economic functioning dimension was the lowest. (3) The physical health showed the starting point in a causal model. (4) The physical health influenced the family ties and the socio-economic functioning. (5) The socio-economic functioning strongly influenced the peace & happiness and the emotional support. (6) The family ties influenced the socio-economic functioning, the emotional support, and the peace & happiness. Therefore, it was conceivable that it was particularly important to make approaches for the physical health, the family ties, and the socio-economic functioning dimensions to improve quality of life.

Key words : kidney transplant recipient, components of quality of life, path diagram of quality of life

Introduction

More recently, greater attention has been given to quality of life in a medical field. In the studies of kideny transplant, since the early 1970s when Simmons. R et al who was a sociologist began the research of organ transplant in U.S.A, many studies on quality of life have been made in the fields of medicine, nursing, sociology and psychology.

Quality of life is generally defined as a broad set of attribute or dimentions of multidimentional construct, and includes individual value[1-3].

Therefore, in the various studies, quality of life was measured by evaluating both objective and subjective indicators in the physical, psychological, and social aspects, or by assessing life satisfaction perceived by the individual[4-15]. It was proven that kidney transplant recipients have a better quality of life than hemodialysis patients. On the other hand, however, a variety of stressful events, such as fear of rejection and side effects due to steroid or immunosuppressive drugs, uncertainty about future, change in body appearance, change in family responsibilities, change in work, and things like that, arose after transplant[16,17]. Molzahn[18] stated that the recipient whose transplant had failed had a substantially lower quality of life. The information about quality of life as above-mentioned gives nurse an important clue to what to do to help the recipients. Being aware of how the components of quality of life influence each other and how multidimensional and complicated construct quality of life is, nurse can anticipate which dimentions of quality of life should be approached to help the recipients.

Few antecedent studies have shown that there is a structural relationship among the components of quality of life. So, the purpose of this study is to analyze the structural relationship among the components of quality of life of kidney transplant recipients by using a causal model so that a nursing intervention can be made use of.

Methods

Sample and Setting. The subjects were 329 kidney post-transplant recipients having regular checks-up who agreed to participate in this study. The subjects were sellected, by convenience sampling, from seven general hospitals in Tokyo, Gunma, Aichi, Okayama, and Hiroshima. Two hundred and ten recipients responded to questionnaires during the months of June-August 1995, and 119 recipients responded during the months of October-December 1997.

Data Collection. The data were collected through the use of self-administered questionnaires including questions regarding various aspects of life, and demographic and medical characteristics such as age, marital status, employment status, education, period after the transplant, and donor.

Ferrans and Powers's Quality of Life Index — Kidney Transplant version (QLI) was used to measure perceived quality of life[19,20]. Ferrans defines quality of life as a person's sense of well-being that stems from satifaction or dissatisfaction with the areas of life that are important to him/her. It's taken into consideration that perception of the individual whose quality of life is being evaluated and the difference in individual values in the various areas are crucial. This instrument is an authorized translation into Japanese. The psychometric assessment of the QLI had been examined by Ferrans at al. QLI is a 64-item measure composed of two parts: Part I measures satisfaction with such various aspects of life as health care, physical health and functionig, marriage, family, friends, stress, job, standard of living, leisure, future retirement, life goals, general happiness, and the others, and part II measures the importance of the same aspects to the subject. For example, the paired items are "How much satisfied are you with your health?" and "How important is your health to you?" The scale is a six-point Likert-type scale: for Part I the scale ranges from "thoroughly satisfied" (6) to "greatly dissatisfied" (1)), and for part II it ranges from "very important"(6) to "very unimportant" (1). Scores are caluculated by weighing each satisfaction response with its paired importance response. Because of this weighting, scores reflect individual values as well as satisfaction, which produces a more accurate reflection of quality of life. The rationale for giving added weight is the belief that great satisfaction with highly important areas of life contributes positively to quality of life, whereas great dissatisfaction with highly important areas contributes negatively. The score ranges from 0 to 30. Higher scores indicate a better quality of life. The way of calculation is as follows.

Satisfaction score$-3.5=$Adjusted satisfaction score
Adjusted satisfaction score$\times$Importance score

=Adjusted item score

Sum all adjusted item scores ÷ The number of items answered + 15 = overall QOL scores

Sum adjusted item scores for the subscale ÷ The number of items answered for the subscale + 15 = QOL scores for the subscale

(to eliminate negative value, a constant of 15 is added to each score)

Procedure. After the voluntary participation of the subjects in this study were obtained, the questionnaires were handed over directly to the subjects, who completed the instrument on the spot. When they completed the questionnaires at the waiting room or the counseling room, the answers were collected immediately. When subjects were unable to respond to the questionnaires on that day at the clinical setting, they were asked to mail the answer later.

Data Analysis. Data analysis was made by using the computer program HALBAU Ver.4.0

and SAS Ver6.04. The factor analysis was used to examine the factor structure, using data collected from 137 recipients excluding those who gave the incomplete responses to the questionnaires. To analyze the structural relationship among the components of quality of life, the covariance structure analysis was used. The three hundred and twenty nine questionnaire responses were analyzed by using the covariance structure analysis. After the validities of some constructed path diagrams were confirmed, the most appropriate path diagram was chosen.

Results

Background. Sixty-four percent of the subjects were male, and 65 percent were in their 30's and 40's. The majority were in the prime of their life, were married (64%), and had a job (73%). The mean number of years following the kidney transplant was 6.4 years. The rate of living-

Table 1 Demographic and Medical Characteristics of Subjects

n   (%)   n=329

Sex	male	209	(63.5)
	female	120	(36.5)
Age	41.3 years ±10.0 (17~67Y)		
	10~20's	46	(13.9)
	30's	96	(29.2)
	40's	119	(36.2)
	50 years and over	68	(20.7)
Marital Status	single	97	(29.6)
	married	221	(64.3)
	divorced	17	(5.2)
Employment Status	employed	241	(73.3)
	unemployed	66	(20.1)
Education	junior high school graduate	48	(4.6)
	senior high school graduate	167	(50.9)
	junior college graduate	47	(14.3)
	over college graduate	61	(18.6)
Periods after the transplant	6.4 years ±4.6 (3M~23.4Y)		
	under 1 year	83	(27.1)
	1~3 year	70	(21.3)
	3~10 year	107	(32.5)
	over 10 years	68	(20.7)
	no answer	1	(0.4)
Donor	living-related	182	(55.3)
	cadaver	146	(44.4)
	both	1	(0.3)

Table 2 Quality of Life Items Factor Analysis

Rotated Factor pattern, Promax method n=137

items	Factor1 Socio-Economic Functioning	Factor2 Family Ties	Factor3 Emotional Support	Factor4 Physical Health	Factor5 Peace & Happiness	Communalities
22 financial independence	*0.972*	−0.280	−0.314	−0.063	0.140	0.798
19 job/unemployment	*0.696*	−0.011	−0.091	0.034	0.110	0.521
13 family responsibilities	*0.691*	−0.006	0.021	0.088	−0.076	0.667
14 usefulness to others	*0.690*	−0.037	0.199	0.092	−0.104	0.620
21 education	*0.585*	0.128	−0.054	−0.075	0.021	0.366
28 goals achievement	*0.583*	−0.048	0.286	−0.577	0.181	0.703
25 happy old age/retirement	*0.545*	−0.094	0.186	0.174	0.075	0.571
31 personal appearance	*0.530*	0.159	0.225	−0.025	−0.094	0.497
32 yourself in general	*0.515*	0.059	0.191	0.029	0.230	0.729
18 standard of living	*0.459*	0.008	0.037	−0.089	0.350	0.491
23 leisure activities	*0.434*	0.069	0.010	−0.001	0.279	0.443
09 spouse/significant others	−0.123	*0.826*	0.053	−0.002	0.103	0.725
07 your children	0.047	*0.796*	0.064	0.006	−0.187	0.621
08 family's happiness	0.043	*0.714*	−0.190	0.104	0.277	0.688
06 family's health	0.146	*0.609*	0.049	0.016	−0.053	0.479
16 your home	0.079	*0.556*	0.115	−0.066	0.242	0.614
10 sex life	0.060	*0.247*	0.140	0.111	0.157	0.281
12 emotional support	−0.031	−0.019	*0.876*	−0.018	−0.050	0.677
11 your friend	−0.146	0.176	*0.664*	0.099	0.019	0.565
27 belief system	0.170	−0.100	*0.497*	−0.050	0.083	0.339
17 your neighborhood	0.047	0.081	*0.483*	−0.150	0.236	0.423
15 stress & worries	0.254	0.070	*0.406*	0.133	−0.054	0.442
01 your health	−0.051	−0.248	0.040	*0.749*	0.298	0.663
03 transplanted kidney	−0.082	0.117	−0.008	*0.690*	−0.154	0.451
02 health care	−0.003	0.118	−0.090	*0.589*	0.190	0.452
05 living a long time	0.166	0.069	0.008	*0.502*	0.006	0.385
04 physical independence	0.333	0.155	−0.003	*0.368*	−0.117	0.369
24 travel on vacations	0.178	−0.008	−0.063	0.075	*0.577*	0.460
29 happiness	0.259	0.113	0.175	−0.022	*0.555*	0.783
26 peace of mind	−0.002	0.153	0.411	0.046	*0.451*	0.713
30 life satisfaction	0.283	0.048	0.264	0.025	*0.420*	0.689
factor contribution	2.896	1.985	1.491	1.509	1.214	17.228
factor contribution rate	9.342	6.403	4.810	4.869	3.916	
cummulative contribution	9.342	15.745	20.555	25.424	29.340	
Cronbach's alphas	0.78	0.84	0.76	0.76	0.83	Total QOL 0.95

Table 3 Inter-factor Correlations

	Factor1	Factor2	Factor3	Factor4	Factor5
Factor1	1.000				
Factor2	0.406	1.000			
Factor3	0.525	0.497	1.000		
Factor4	0.376	0.288	0.428	1.000	
Factor5	0.514	0.407	0.455	0.280	1.000

Table 4 Quality of Life Scores

	n	Mean±SD	Range
Overall QOL	329	20.7±4.0	10.2-29.8
Scocio-ecnomic Functioning	329	18.6±4.9	5.1-30.0
Family Ties	329	23.4±4.9	6.3-30.0
Emotional Support	328	19.9±3.9	8.2-30.0
Physical Health	329	23.1±4.6	3.6-30.0
Peace and Happines	329	20.9±5.5	2.1-30.0

related donated recipients and the cadaver donated recipients were almost the same (See table 1).

Components of Quality of Life. From the results of the factor analysis, five factors were extracted on the basis of the eigenvalues and clinical experience ; socio-economic functioning, family ties, emotional support, physical health, and peace & happiness (See table 2). Table 3 showed the inter-factor correlations. The mean score on overall quality of life was 20.7. The family ties and the physical health were on high scores in quality of life. The socio-economic functioning was the lowest (See table 4).

Structural Relationship Among the Components. The result of the analysis of the structural relationship among the components of quality of life is illustrated Figure 1. This path diagram, which is called causal model, was the most appropriate of all models analyzed by using a covariance structure analysis. Goodness of Fit Index (GFI) was 0.73 which meant that this model applied to 73 percent of the data. The values of all the causal coefficients expressed in this path diagram were statistically significant by t-test ($p < 0.05$). The components in this causal model appropriately correspond to each observed variable (quality of life items). As for the structural relationship among the components of quality of life, the physical health was the starting point. The causal relationship between the socio-
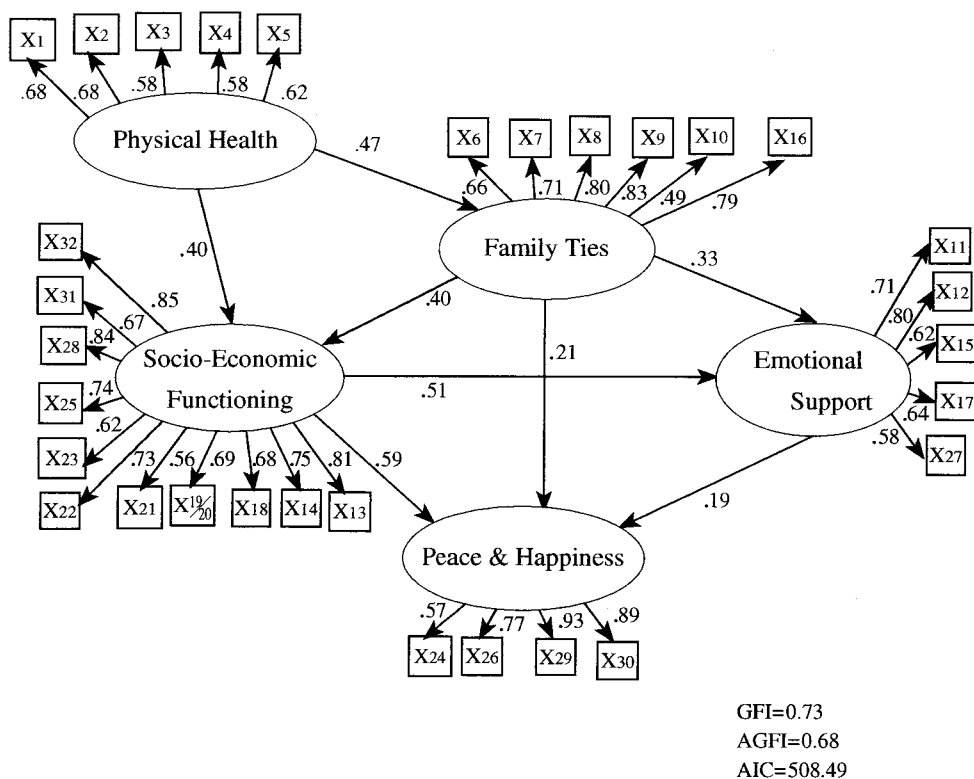

GFI=0.73
AGFI=0.68
AIC=508.49

Fig. 1 Path Diagram of Quality of Life of Kidney Transplant Recipients

economic functioning and the peace & happiness was the strongest (causal coefficient 0.59). In addition, the causal relationship between the socio-economic functioning and the emotional support (the same 0.51) and the causal relationship between the physical health and the family ties (the same 0.47) more strongly showed than the others.

In comparison of the the direct effects and the indirect effects, the indirect effect on the peace & happiness via the socio-economic functioning from the family ties was stronger than the direct effect on the peace & happiness from the family ties (the same 0.24). The other direct effects were stronger than the indirect effects.

Discussion

Ferrans & Powers's QLI is categorized into the following four dimensions : health & functioning, socio-economic, psychological/spiritual, and family[20]. But the result of this study showed five dimensions, and the psychological/spiritual clarified by Ferrans & Powers can be separated into the two : emotional support and peace & happiness. However, the components of quality of life were in reasonably good agreement with Ferrans's.

In this path diagram, it was found that physical health, family ties, and socio-economic functioning were particularly important to improve quality of life. The physical health showed a starting point, and it influenced strongly socio-economic functioning and family ties. It was definitely shown that physical health was an essential part of quality of life for kidney transplant recipients.

As hemodialysis patients desire to live a full life, and to restore their own health, they hope to undergo a kidney transplant[21,22]. However, Haruki[23] stated that the failed kidney transplant recipient who had the frequent physical problem after transplant didn't desire to undergo a kidney transplant again. Hayward et al[16] reported that the possibility of rejection and possibility of infection were greatly stressful items for the kidney transplant recipients. White et al[17] identified that health-related items , "being uncer-

tain about whether the transplant will be a success or not", "concern about risk of infections and/or viruses", and "concern about what the long-term side effect of antirejection medicine might be", were more stressful than family/relation and work/financial.

In the light of some study reports as above and the high score of physical health shown in this study, it was confirmed that the kidney transplant recipients' chief concern over the quality of life was the physical health itself.

The socio-economic functioning strongly influenced the peace & happiness and the emotional support ; nevertheless the socio-economic functioning score was the lowest in this study. At the same time when nurses closely approach their physical health dimension, they would need to help recipients find their goal and some social roles for themselves. In an antecedent study, it had been found that recipients having a job were higher than those having no job in physical health of quality of life and recipients in their 20's and 30's with no job showed low level in the socio-economic functioning[24]. Accordingly, their characteristics being taken into consideration, in order to improve the recipients' quality of life, the team approach which satisfies their physical health and fulfills their socio-economic functioning would be needed.

The family ties influenced the emotional support and the peace & happiness. The family ties score was the highest, and it was conceivable that the transplant recipients would be supported by family members.

These results suggested that nurses need to approach physical health and socio-economic functioning and family ties so that the recipients can produce higher level of quality of life. Furthermore, it should be also taken for granted to approach psychological areas because a good balance of all the dimentions is necessary in improving quality of life.

Limitations. Data for this study were analyzed by using the covariance structure analysis. As GFI was 0.73, a more appropriate path diagram might be constructed. Promax (oblique

rotation) method was used for factor analysis. As the cumulative contribution rate was small (29.3%), it could not be said that all the demensions of life were satisfactorily expressed. By the way, cumulative contribution rate shown by using varimax (orthogonal rotation) method was 56.6 percent.

Conclusion

In conclusion, the results of factor analysis showed five factors. They were socio-economic functioning, family ties, emotional support, physical health, and peace & happiness. The scores in the family ties and the physical health were higher than in the others, but the score in the socio-ecnomic functioning was the lowest. It was found that the physical health, the family ties, and the socio-economic functioning were particularly important to improve quality of life. The physical health was the starting point in the causal relationships among each component.

The structual relationship among the components of quality of life maken clear in this study would be quite promising to lead to care for or educate each individual recipient appropriately.

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References

1) Ferrans, C. E.: Quality of life; Conceptual issues. Sem. Oncol. Nurs., 6: 248-254, 1990.
2) Grant, M., Padilla, V. G., Ferrell, B. R. and Rhiner, M.: Assessment of Quality of Life With a Single Instrument. Sem. Oncol. Nurs., 6: 260-270, 1990.
3) Jalowiec, A.: Issues in Using Multiple Measures of Quality of Life. Sem.Oncol. Nurs., 6: 271-277, 1990.
4) Simmons, R. G., Marine, S. K. and Simmons, R. l.: Gift of life; The effect of organ transplantation on individual, family, and societal dynamics., ix-xxvii, New Brunswick and Oxford: U.S.A, 1977.
5) Bremer, B. A., Mccauley, C. R., Wrona, R. M., and Johnson, J. P.: Quality of life in end-stage renal disease; A reexamination. Am. J. Kidney. Dis., 13: 200-209, 1989.
6) Evans, R. W., Manniner, D. L., Garrispn, L. P., Gary,

H. L., Blagg, C. R., Gutman, R. A., Hull, A. R. and Lowrie. E. G.: The quality of life of patients with end-stage renal disease. N. Eng. J. Med., 312:553-559, 1985.
7) Gallagher. L. S: Functional capacity and activity level before and after renal transplantation. ANNA. J., 18: 378-406, 1991.
8) Gokal. R.: Quality of life in patients undergoing renal replacement therapy. Kidney. Int., 43: s23-s27, 1993.
9) Hathaway, D., Hartwing, M., Winsett, R. P. and Gaber, A. O.: Quality of life 6-12 months after renal transplant. ANNA. J., 19.: 152, 1992.
10) Laupacis, A., Pus, N, Muirhead, N., Wong, C., Ferguson, B. and Keown, P.: Disease-specific questionnaire for patients with a renal transplant. Nephron., 64: 226-231, 1993.
11) Martinez, C.: Personal experience with a transplant. Transplant Proc., 22:959-960, 1990.
12) Mc. Natt, G. and White. M.: Return to work in renal transplant recipients. ANNA. J., 19: 151, 1992.
13) Simmons, R. G., Anderson, C. and Kamstra, L.: Comparison of quality of life of patients on continuous ambulatory peritoneal dialysis, hemodialysis and after transplantation. Am. J. Kidney. Dis., 4: 253-255, 1984.
14) Simmons, R. G., Abress, L. and Anderson, C.: Quality of life after kidney transplantation. Transplantation., 45: 415-421, 1988.
15) Simmons, R. G. and Abress, L.: Quality of life issues for end-stage renal disease patient. A. j. Kidney. Dis., 15: 201-208, 1990.
16) Hayward, M. B., Kish, J. P., Frey, G. M., Kirchner, J. M., Carr, L. S. and Wolfe, C. M.: An Instrument to Identify Stressors in Renal Transplant Recipients. ANNA. J., 16: 81-84, 1989.
17) White, M. J., Starr, A. J., Ketefian, S. and Voepel-Lewis. T.: Stress, Coping, and Quality of Life in Adult Kidney Transplant Recipients. ANNA. J., 17: 421-424, 1990.
18) Molzahn, A. E.: Quality of Life after Organ Transplantation. J. Adv. Nurs., 16: 1042-1047, 1991.
19) Ferrans, C. E. and Power, M. J.: Quality of life index; development and psychometric properties. Adv. Nurs. Sci., 8: 15-24, 1985.
20) Ferrans, C. E. and Power, M. J.: Psychometric Assessment of Quality of Life Index. Res. Nurs. Health., 15: 29-38, 1992.
21) Hathaway, D., Strong, M. and Garza, M.: Post transplant quality of life expectations. ANNA. J., 17: 433-439, 1990.
22) Hayashi, Y.: Coping for the better quality of life (QOL) after adult kidney transplantaion and factors affecting on the coping. Bill. Sch. Health Sci. Okayama Univ., 7: 49-57, 1996.
23) Haruki, S.: Hemodialysis or Kideny Transplant?., 227-237, Japan Medicl Center: Japan, 1997.
24) Hoshina, E., Hayashi, Y., Nakanishi, Y., Kanao, N. and Watanabe, K.: Relationships between the QOL Components in kidney posttransplant recipients and their demographic characteristics. Bull. Sch. Health. Sci, Okayama Univ., 9: 9-14, 1998.

因果関係モデルによる腎移植レシピエントの QOL の分析

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要 約

本研究は，因果関係モデルによって，腎移植後レシピエントの QOL の構成要素間の関係を明らかにすることを目的としている。対象者は，東京，群馬，愛知，岡山，広島の7医療機関に外来通院中で，研究に同意が得られた329名の腎移植後のレシピエントである。レシピエントの QOL に関するデータは，Ferrans & Powers の Quality of Life Index－Kidney Transplant version の測定用具を用いて収集した。収集は外来受診時に行い，対象者に自己記入式質問紙を配布し，その場で記入してもらった後，直ちに回収した。データ分析は，QOL の構成要素と構成要素間の因果関係を明らかにするために，因子分析と共分散構造分析を行った。分析結果は以下の通りである。すなわち、(1) QOL の構成要素として、社会・経済的な機能，家族の絆，情緒的な支え，身体の健康，安らぎと幸福の5つが抽出された。(2)「家族の絆」と「身体の健康」についての得点が高く，「社会・経済的な機能」についての得点が最も低かった。(3)因果関係モデルにおいて，「身体的な健康」が原点となっていた。(4)「身体的な健康」は，「家族の絆」と「社会・経済的な機能」に影響を及ぼしていた。(5)「社会・経済的な機能」は，「安らぎと幸福」と「情緒的な支え」に強く影響を及ぼしていた。(6)「家族の絆」は，「社会・経済的な機能」，「情緒的な支え」，「安らぎと幸福」に影響を及ぼしていた。したがって、レシピエントの QOL を高めるために，「身体的な健康」，「家族の絆」，「社会・経済的な機能」の側面に働きかけていくことが特に重要であると考えられた。

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