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Original Article

Construction of Exercise Behavior Model in Patients with Rheumatoid Arthritis

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Abstract

Background: Despite the awareness that regular exercise has a positive impact on maintaining health, patients with rheumatoid arthritis (RA) engage in markedly less exercise than do the general population. Weaimed to construct and test a structural equation model of exercise behavior in patients with RA based on self-determination theory and self-efficacy theory.

Methods: Participants were 214 outpatients with RA at Chonnam National University Hospital located in the Gwangju City, South Korea from Mar to Apr 2018. A structured self-report questionnaire was used to assess autonomy support, autonomy, competence, relatedness, autonomous motivation, self-efficacy, and exercise behavior. Collected data were analyzed using SPSS 22.0 and AMOS 22.0 program.

Results: The structural model showed a good fitness with the data (χ^2= 727.27, df = 392, P<0.001, TLI = 0.92, CFI = 0.93, RMSEA = 0.07, SRMR = 0.07). Autonomous motivation and self-efficacy had a significant effect on exercise behavior in patients with RA. This model explained 21.2% of the variance of exercise behavior in patients with RA.

Conclusion: Self-efficiency and autonomous motivation should be promoted in order to strengthen the exercise behavior of patients with RA.

Keywords: Exercise behavior; Rheumatoid arthritis; Self-determination; Self-efficacy

Introduction

Rheumatoid arthritis (RA) is an auto-immune disease accompanied by systemic complications affecting the major body organs including the heart, lungs, and blood vessels, joint pain, spasticity, and edema, as well as inducing permanent joint deformity and malformation (1). In patients with RA, anxiety and depression are common, compared to the general population and have been associated with fatigue, pain, and health care costs (2). Worse physical health can lead to mental problems (3). Reciprocally, mental health problems can also impact on physical activity (4). Thus, it is important that these problems are recognized, to ensure suitable psychological treatment and appropriate management of RA.

In general, regular exercise has been robustly associated with positive physical and psychological health (5). Many experimental studies indicate higher levels of exercise engagement to lead to improvements in inflammatory disease activity, physical function, and mental health (6-8). Patients with RA are restricted from exercise and activity for a variety of reasons (9). The major reasons behind the lack of exercise including physical activities among patients with RA are related to severe fatigue, joint pain, functional impairment, joint stiffness, and fear that exercise would exacerbate joint damage (10, 11). These are a cause of lack of motivation, and either make them remain uninterested in exercise or feel that exercise is not important (12).

The self-determination theory (SDT) that has attracted much attention recently is concerned with motivating people in engaging in a behavior on their own and it predicts and explains the initiation and continuance of health behaviors in health-related fields (13,14). In particular, it is focused on the motivation of exercise behaviors (15). As the SDT posits that autonomy support, which has been reported as a major factor that influences exercise behaviors in patients with RA (16). Moreover, the SDT describes that humans' basic psychological needs, comprising autonomy, competence, and relatedness, must be satisfied, under the assumption that humans pursue physical and mental health (13). These basic psychological needs ultimately affect autonomous motivation (17). Autonomously motivated individuals are more likely to be effective in self-regulation of behavior. Also, autonomous motivation engages in behavior for the inherent interest and satisfaction derived from engaging in the action itself (18). Autonomous motivation is a major predictor of exercise behavior (19, 20).

From the perspective of motivation, self-efficacy is a key component as it can influence healthy behaviors, including exercise, directly or indirectly (21). Especially, self-efficacy is one of the most reliable factors for exercise behavior (22). People with high exercise self-efficacy are able to continue with exercise behaviors better than those who do not, as they are able to overcome the factors that hinder exercise behavior (23). Moreover, exercise self-efficacy significantly increases exercise behavior in patients with RA (24).

Hence, both SDT and self-efficacy are important theories in the health psychology literatures. There is some similarity in terms of psychological factors between the basic psychological needs and self-efficacy. Especially in competence and self-efficacy, these variables tend to be considered similar concepts (25). Rodgers and colleagues (24) argue that self-efficacy is only concerned with the perception of one's ability to succeed, while competence relates to one's perception of having achieved a state of mastery. Competence and self-efficacy are theoretical and practical differences (25). Therefore, a study is required that attempts to integrate the benefits of both self-efficiency and SDT, and to identify the effects on exercise behavior. But only a few studies have examined self-efficacy and aspects of SDT together. Also, it remains elusive about the associations of SDT and exercise self-efficacy and how self-efficacy mediates the association between autonomous support and exercise behavior in patients with RA, especially among the Korean population. Thus, it is necessary to establish a hypothetical model (Fig. 1) that includes autonomy support, basic psychological needs (autonomy, competence, relatedness), exercise self-efficacy, autonomous motivation, and exercise behavior. Explaining the direct and indirect relationships among factors that affect exercise behavior in patients with RA would be useful for developing a guideline to promote exercise behavior in patients with RA.

Study hypotheses

In this study, we suggested the following hypotheses to represent the relations between these factors: *Hypothesis 1 (H1). The autonomy support has a significant effect on the autonomy.*

Hypothesis 2 (H2). The autonomy support has a significant effect on the competence.

Hypothesis 3 (H3). The autonomy support has a significant effect on the relatedness.

Hypothesis 4 (H4). The autonomy support has a significant effect on the self-efficacy.

Hypothesis 5 (H5). The autonomy has a significant effect on the autonomous motivation.

Hypothesis 6 (H6). The competence has a significant effect on the autonomous motivation.

Hypothesis 7 (H7). The relatedness has a significant effect on the autonomous motivation.

Hypothesis 8 (H8). The self-efficacy has a significant effect on the autonomous motivation.

Hypothesis 9 (H9). The autonomous motivation has a significant effect on the exercise behavior.

Hypothesis 10 (H10). The self-efficacy has a significant effect on the exercise behavior.

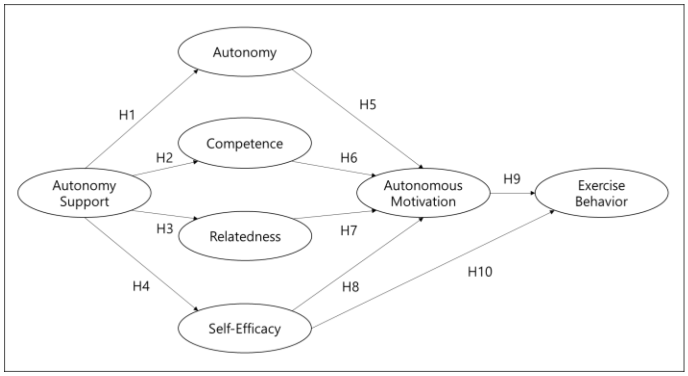


Fig. 1: The hypothetical model of the study

Materials and Methods

Procedure and participants

This study was approved by the Institutional Review Board at Chonnam National University Hospital (CNUH-2018-033).

After obtaining permission from the department of rheumatology and nursing department at Chonnam National University Hospital located in the Gwangju city, South Korea, data were collected from March 12 to April 24, 2018. The study participants were convenience sampled from outpatients with RA at Chonnam National University Hospital in Gwangju City. The number of participants was computed using Soper's SEM software, and with an effect size of .15, power of .90, significance α of .05, and 30 study variables, the minimum sample size was computed to be 190. Out of 220 questionnaires, we excluded 6 questionnaires with incomplete responses. Thus, a total of 214 participants were included in the final analysis.

Instruments

We obtained permission from the original author and translator via email prior to using the study instruments. Seven self-reported instruments (autonomy support, autonomy, competence, relatedness, autonomous motivation, self-efficacy, and exercise behavior) used to gather the data.

Exogenous variables

Autonomy Support Scale was measured using the 6-items of the Important Other Climate Questionnaire (IOCQ) (26). Each item was measured using a five-point Likert scoring scale. A higher score indicated that the patient had higher autonomy support level. Cronbach's α was 0.93.

Endogenous variables

The Basic Psychological Needs Scale (autonomy, competence, and relatedness) were measured using the Psychological Need Satisfaction in Exercise Scale (PNSES) (27,28). The autonomy, competence, and relatedness subscales each comprises 6 items, for a total of 18 items. Each item was measured using a five-point Likert scoring scale. A higher score indicated that the patient had higher autonomy, competence, and relatedness level. Cronbach's α for the autonomy subscale was 0.88, for the competence subscale was 0.92, and for the relatedness subscale was 0.89.

The Self-efficacy Scale was measured using the 18 items of the Exercise Self-Efficacy Scale (29). Each item was measured using a ten-point Likert scoring scale. A higher score indicated that the patient had higher perceived efficacy level. Cronbach's α was 0.94.

Autonomous Motivation Scale was measured using the 19-items of the Behavioral Regulation Exercise Questionnaire-2 (BREQ-2) (30). We used 8-items: 4-items for identified regulation and 4-items for intrinsic regulation, which have been associated with autonomous motivation, with reference to the literature (31). Each item was measured using a five-point Likert scoring scale. A higher score indicated that the patient had higher autonomous motivation level. Cronbach's α for the identified regulation subscale was 0.82, for the intrinsic regulation subscale was 0.90, for the autonomous motivation was 0.88.

Exercise Behavior Scale was measured using the 17 items of the Korean version of the International Physical Activity Questionnaire (IPAQ-K) (32). The reliability and validity of the tool were significantly high, at Spearman Rho of 0.642-762, and Kappa of 0.416-669. The score was computed based on the IPAQ score conversion scale. Metabolic Equivalent Task (MET) units (-min/week) were used, and exercise behavior score was computed by multiplying activity intensity (walking 3.3., moderate intensity activity 4.0, high intensity activity 8.0) by duration (min) and weekly frequency of the activity, with a higher MET-min indicating a higher degree of exercise. In this study, exercise behavior was classified into health promotion exercise behavior, minimal exercise behavior, and non-exercise behavior

Statistical Analysis

The collected data were analyzed using the IBM SPSS 22.0 and AMOS 22.0 software (Chicago, IL, USA). Measured Variables were analyzed with descriptive statistics, and reliability was verified using Cronbach's α. The correlations among the major variables were analyzed using Pearson's correlations coefficient, and the normality of the sample was confirmed using skewness and kurtosis. Confirmatory factor analysis was performed to verify the validity of the latent variables, and construct reliability and average variance extract (AVE) were computed for each subfactor for each variable. The fit of the hypothetical model was examined using the χ^2 statistic, Q value (Normed), TLI (Tucker Lewis Index), CFI (Comparative Fit Index), RMSEA (Root Mean Square Error of Approximation), and SRMR (Standardized Root Mean Square Residual). The direct and indirect path coefficients among the factors to explain their effect on exercise behavior were computed using the structural equation modeling (SEM) analysis.

Results

Descriptive statistics, reliability, and convergent validity

All parameters used in our hypothetical model did not exceed an absolute value of skewness of 3.0 and absolute value of kurtosis of 10.0, thus satisfying univariate normality. Further, the absolute value of the correlation coefficients among the variables satisfied the criterion of .85 or below, with a range of .16–.69, which confirms the lack of multi-collinearity. For reliability analysis, internal consistency was analyzed using Cronbach's α coefficients, and the Cronbach's α values for the parameters of each construct were all above .70, confirming adequate reliability. On the other hand, factor loading the instruments ranged from .55–.95, with AVE of .52–.71 and construct reliability (CR) of .78–.95, thus satisfying the convergent validity criteria (Table 1).

Verification of the structural model for exercise behavior in patients with RA

Identification and goodness of fit test for the hypothetical model

Our model comprises of seven latent variables and 30 measured variables. There were 465 pieces of information (Number of pieces of information = K(K+1)/2, K= Number of measured variables) and 70 parameters, and as number of the pieces of information exceeded that of parameters (465>70), thereby satisfying the requirements for model identification. Regarding the fit of the hypothetical model, the Q statistic was smaller than 3.0, at 1.90, and the fit indices CFI and TLI were above .90, and RMSEA and SRMR were smaller than .08 In this study, the model had a relatively good fit, with χ^2 =727.27 (df=392, *P*<.001), CFI=.93, TLI=.92, RMSEA=.07, SRMR=.07. The overall fit of the model fulfilled the recommended level, so we finalized the hypothetical model without modification.

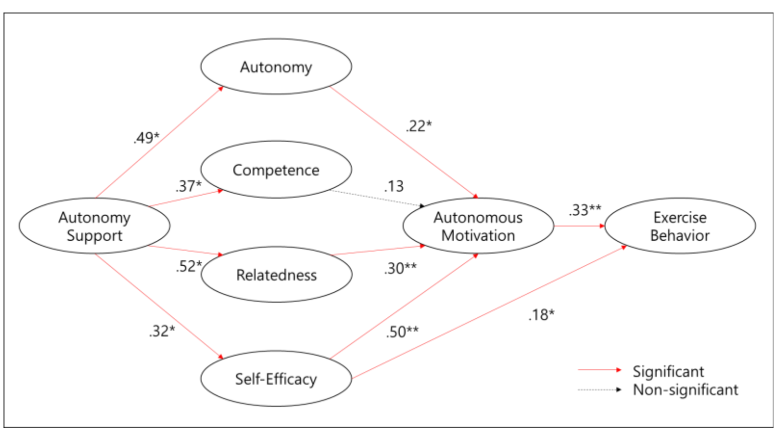
Table 1: Descriptive Statistics of the Measured Variables, (N=214)

Variables (items)	*Likert*	*M ± SD*	*Skewness*	*Kurtosis*	*S.E.*	*CR*	*AVE*	*Cronbach'α*
Autonomy support(6)	1~5	3.82±0.71	-1.372	3.880	.67~.90	.92	.67	.93
Basic psychological needs								
Autonomy(6)	1~5	3.09±0.72	-0.190	-0.612	.55~.83	.92	.64	.88
Competence(6)	1~5	3.86±0.56	-0.605	1.278	.67~.87	.88	.56	.92
Relatedness(6)	1~5	3.70±0.63	-1.042	2.271	.66~.84	.89	.57	.89
Self-efficacy(18)	0~10	5.19±1.75	-0.412	-0.104	.92~.95	.95	.52	.94
Autonomous Motivation						.78	.71	.88
Identified regulation(4)	1~5	3.92±0.58	-0.325	1.211	.73			
Intrinsic regulation(4)	1~5	3.45±0.78	-0.196	-0.215	.87			
Exercise Behavior	1~3	2.16±0.49	-1.738	2.161				

Note: S.E.= standardized estimate

Analysis of the effects of the hypothetical model

Of 10 study hypotheses proposed by the hypothetical model, nine hypotheses were supported, but one hypothesis (H6) was rejected (Fig. 2) (Table 2). Autonomy support had a significant direct effect on autonomy (β=.49, *P*=.032), competence (β=.37, *P*=.014), relatedness (β=.52, *P*=.032), and self-efficacy (β=.32, *P*=.026). Autonomy had a significant direct effect on autonomous motivation (β=.22, *P*=.017), but competence did not have a direct effect on autonomous motivation (β=.13, *P*=.213). Relatedness had a significant direct effect on autonomous motivation (β=.30, *P*=.004), and self-efficacy also had a significant direct effect on autonomous motivation (β=.50, *P*=.002). Autonomous motivation had a significant direct effect on exercise behavior (β=.33, *P*=.023). Also, self-efficacy had a significant total effect on exercise behavior (β=.35, *P*=.006). This was a result of direct (β=.18, *P*=.014) and indirect (β=.16, *P*=.005) effect. Cconsequently autonomous motivation and self-efficacy had a significant effect on exercise behavior, and they explained for 21.2% of the variance.



*P<0.05, **P<0.01

Fig. 2: Path diagram for effect coefficients of the hypothetical model

Table 2: Effect of predictive variable in the hypothetical model

Endogenous variable Exogenous	*Direct Effect (P)*	*Indirect Effect (P)*	*Total Effect (P)*	*SMC*	*Hypothesis*
Autotomy					
Autotomy support	.49(.032)	-	.49(.032)	.244	*H1:* Supported
Competence					
Autotomy support	.37(.014)	-	.37(.014)	.137	*H2:* Supported
Relatedness					
Autotomy support	.52(.032)	-	.52(.032)	.267	*H3:* Supported
Self-efficacy					
Autotomy support	.32(.026)	-	.32(.026)	.105	*H4:* Supported
Autonomous Motivation				.566	
Autonomy	.22(.017)	-	.22(.017)		*H5:* Supported
Competence	.13(.213)	-	.13(.213)		*H6:* Rejected
Relatedness	.30(.004)	-	.30(.004)		*H7:* Supported
Self-efficacy	.50(.002)	-	.50(.002)		*H8:* Supported
Exercise Behavior				.212	
Autonomous Motivation	.33(.023)	-	.33(.023)		*H9:* Supported
Self-efficacy	.18(.014)	.16(.005)	.35(.006)		*H10:* Supported

Discussion

This study was to establish a hypothetical model to investigate factors that affect exercise behavior and analyze the paths and influence among these factors in patients with RA based on the SDT and Bandura's self-efficacy.

First of all, it was found that autonomy support had the greatest direct effect on the relatedness followed by autonomy, competence, and self-efficacy. The previous studies confirmed that the autonomy support had the greatest effect on relatedness, followed by autonomy and competence (15, 33). These results confirm that autonomy support may have a positive effect on the basic psychological needs, and that it is an important predictor of exercise behavior. Also, another study showed that spousal behaviors supporting the self-determination had a strong and significant effect on exercise self-efficacy of adults with multiple sclerosis (34). The physical and psychological condition have been shown to be associated with poor management of RA including exercise behavior. On the other hand, autonomy support from significant others can improve patients' ability to manage for disease. Friends' or physiotherapists' autonomy support directly affected basic psychological needs for exercise (35, 36). Moreover, significant others' supportive behavior had a direct and indirect effect on exercise self-efficacy (37). Overall, in clinical practice, it is important for those who care for RA patients to engage in supportive activities that promote their exercise.

Second, this study confirmed that autonomy and relevance, among the basic psychological needs, and exercise self-efficacy had a significant direct effect on autonomous motivation. But competence, one of the psychological needs, did not have a significant effect on autonomous motivation. Previous study showed that all basic psychological needs directly influenced autonomous motivation (33). However, in our study, only two of the psychological needs had a direct effect on autonomous motivation. One reason for the inconsistency may be that about 63% of our participants were aged 50 years or older and many of our participants had comorbidities such as fibromyalgia syndrome. Therefore, future study needs to identify factors that affect autonomous motivations by distinguishing disease-related characteristics of the participations. Nevertheless, we found that self-efficacy is a significant factor that affects autonomous motivation. In a prior study, self-efficacy was found to mediate the relationship between intrinsic motivation and exercise behavior (38). In the SDT, autonomous motivation is the most fundamental motive (39). So, intrinsic motivation is formed when people feel that they are able to make autonomous choices, and people who experience autonomy practice health-related behaviors. Thus, it would be worthwhile for researchers to investigate the relationship between self-efficacy and autonomous motivation.

Finally, major consequence of this study is that autonomous motivation and self-efficacy had a significant effect on exercise behavior. In the analysis of our model, autonomous motivation and self-efficacy explained for 21.2% of exercise behavior in patients with RA. This result is in line with the previous studies which autonomous motivation has a significant effect on exercise behavior in patients with RA (16, 19). In a prior study of patients with type 2 diabetes, autonomous motivation was most strongly associated with engagement in exercise behavior (40). A previous study emphasize the importance of autonomous motivation for exercise behavior (41). The effect of autonomous motivation on exercise behavior was direct. The results of this study support the idea of SDT that internalization of the value of good health behavior is necessary for engagement in a physically active lifestyle. Health care practitioners can promote patients' exercise behavior by supporting their autonomous motivation. Furthermore, in this study, exercise self-efficacy was a significant mediator in the relationship between autonomy support and exercise behavior. Self-efficacy was identified as a major factor that affects exercise behavior through the mediation of autonomy support (42). Furthermore, the self-efficacy had a significant effect on exercise behavior.

In mentioned studies, it is well known that self-efficacy directly affects exercise behavior. However, this study confirmed that self-efficacy, along with basic psychological needs (autonomy, relatedness) in SDT, had a direct effect on autonomous motivation, which had a major effect on the exercise behavior of RA patients. Thus, clinical trials will require the development and application of programs that promote basic psychological needs, autonomy, relatedness and self-efficacy, as a strategy to promote exercise behavior of patients with RA. It is believed that this will promote autonomous motivation for exercise behavior of patients with RA.

In spite of the significant results, this study definitely has particular limitations. Our research design is cross-sectional design. This design allows relationships between variables to be identified at one point of time only and does not allow causal relationships among variables to be established. In addition, convenience sampling method and selected target sample restricted the generalization of the findings.

Conclusion

This study provided a new good fit structural model that suggests that the self-efficacy and autonomous motivation had positive effects on the exercise behavior in patients with RA. The structural equation model, which based on SDT and self-efficacy can be used to provide better understanding of the links between exercise behavior and contributing components, and make stronger recommendations for effective intervention in patients with RA.

Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors declare no conflict of interest.

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