

Factors influencing the self-management of kidney transplant patients based on self-determination theory: a cross-sectional study

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Background: Self-determination theory is useful for explaining how kidney transplant recipients self-manage their postoperative health, including drug regimens, but few studies have applied this theory to transplant recipients. This study aimed to examine the influence of health professionals' autonomy support, autonomous motivation and competence on kidney transplant patients' self-management based on the self-determination theory.

Methods: This study included 79 kidney transplant patients from one outpatient clinic in a general hospital in Seoul, Korea. Data on the health professionals' support of patient autonomy and the kidney transplant patients' autonomous motivation, competence, and self-management were collected from self-report questionnaires.

Results: The factors that influenced self-management behavior in kidney transplant patients were competence ($\beta=0.377$, $P=0.001$) and autonomous motivation ($\beta=0.293$, $P=0.006$). The explanatory power of these variables was 30.1%.

Conclusions: This study found that autonomous motivation and competence in kidney transplant patients affected their self-management, indicating that if healthcare professionals enhance patients' competence and autonomous motivation, their self-management can be improved. The development of intervention programs that assist healthcare professionals in strengthening patients' autonomous motivation and competence is recommended.

Keywords: Self-management; Kidney transplantation; Self-determination

INTRODUCTION

In South Korea, kidney transplants are the most common organ transplantation procedures. From 2016 to 2019 there were more than 2,000 kidney transplants annually, and the average 3-year survival rate was 89% [1]. Self-management, including medication adherence, is critical for transplant success. However, a meta-analysis found that

the average rate of nonadherence to immunosuppressant therapy, diet, exercise, and other healthcare requirements was 25 cases per 100 patients per year (PPY), with immunosuppressant nonadherence highest in kidney recipients (36 cases per 100 PPY vs. 15 cases in other recipients) [2]. The consequences of nonadherence are serious and include acute rejection episodes, reduced graft function and survival, and increased morbidity [3]. Vlaminck et al. [4]

HIGHLIGHTS

- To maintain health, it is important for transplant patients to perform continuous self-management after transplantation.
- Self-determination theory is useful for explaining the factors affecting the self-management of transplant recipients.

found that 22.6% of kidney transplant patients did not adhere to their medication regimen and 21.2% of nonadherent patients had rejection reactions. Overall, 50% of acute rejection reactions and 15% of organ losses are associated with treatment noncompliance [5].

Among the theories and models that support positive health behavior, self-determination theory (SDT) models how individuals can act independently while, at the same time, paying attention to their intrinsic motivations and understanding the factors that initiate and maintain their own positive health behavior [6,7]. SDT assumes that human behavior is sustained over the long term only when there is intrinsic autonomous motivation. It also assumes that socio-environmental factors that satisfy basic psychological needs, such as autonomy, competence, and relatedness affect the initiation and continuation of behavior [6] and that socio-environmental conditions influence autonomous motivation and competence. The different levels of competence and autonomous motivation that patients experience are influenced by their interactions with healthcare professionals [7]. The concept of autonomy support has been proposed to explain this relationship as a socio-environmental condition [8]. Deci and Ryan [6,7] highlighted the role of social environments in supporting one or more of the three psychological needs (i.e., autonomy, competence, and relatedness), thus influencing the degree to which motivation is autonomous and health behaviors and health-related outcomes are positive.

Many published studies have applied SDT to health-related contexts, especially in the fields of physical activity and tobacco abstinence [9]. Furthermore, empirical research based on SDT has demonstrated the perseverance of positive health behaviors among patients with chronic diseases such as hypertension, diabetes, alcohol use disorder, AIDS, and mental disorders [10-16]. SDT appears to be useful in explaining the self-management of transplant recipients at high risk of side effects from immunosup-

pressants; however, few studies worldwide have used SDT to understand transplant recipients' behavior. Therefore, this study aimed to examine the factors associated with self-management in kidney transplant patients based on SDT.

This study utilized SDT to examine the influence of patient competence and autonomous motivation, as well as health professionals' support of patient autonomy on kidney transplant patients' self-management. The three specific objectives of the study were (1) to describe the levels of autonomous motivation, competence, healthcare professionals' autonomy support, and self-management; (2) to investigate the correlations between autonomous motivation, competence, healthcare professionals' autonomy support, and self-management; and (3) to identify the factors that were associated with kidney transplant patients' self-management.

METHODS

Ethical Considerations and Data Collection Procedure

We conducted this study in compliance with the principles of the Declaration of Helsinki. The study's protocol was reviewed and approved by the Institutional Review Board of Gangnam Severance Hospital (IRB No. 3-2020-0118). Data were collected from patients who visited the outpatient clinic of Gangnam Severance Hospital from April 20 to August 20, 2020, using a questionnaire, after first obtaining written informed consent. All participants were informed of the study's purpose, the right to withdraw from the study at any time, that the collected data would not be used for purposes other than research, and that their anonymity was guaranteed.

This study used a cross-sectional design to examine the factors associated with self-management behavior in kidney transplant patients. The participants were kidney transplant patients who were undergoing follow-up care in an outpatient clinic at Gangnam Severance Hospital in Seoul, Korea. The participants understood and agreed to the purpose of the study. The inclusion criteria included adults over 19 years old who had received outpatient treatment after kidney transplant surgery and could read and communicate in Korean.

The sample size was calculated based on the G*Power program (<https://www.psychologie.hhu.de/arbeitsgruppen/allgemeine-psychologie-und-arbeitspsychologie/>

gpower), with a significance level of 0.05, power of 0.80, an effect size of 0.15, and five predictor variables for regression analysis. A minimum sample size of 68 was required for the regression model. Taking a 20% dropout rate into consideration, 82 patients were recruited and 79 participants were included in the final selection. Three were excluded for incomplete responses to the questionnaire.

Before performing the multiple regression analysis, a multicollinearity test was performed to check whether the interrelatedness of the independent variables in this study was problematic. The range of tolerance was 0.763 to 0.983 (the evaluation criterion was >0.1) and the variation inflation factor ranged from 1.017 to 1.311 (the evaluation criterion was <10), verifying the appropriateness of the suggested variables.

Measures

The instruments in this study were used with the permission of the original author and translator. The following descriptions of these instruments are also presented in Table 1 [17-19]. Healthcare professionals' autonomy support refers to eliciting and acknowledging patients' perspectives, supporting their initiatives, offering choices/options, and providing relevant information so that the patients can decide, select, and control their own behavior while minimizing pressure and control [20]. Healthcare professionals' autonomy support was measured using the Health Care Climate Questionnaire developed by Williams et al. [17] that was translated and adapted into Korean by Seo [18]. The scale comprised 15 items, with each item rated on a 7-point scale from 1 to 7. A higher score reflected a higher level of patient-perceived autonomy support from healthcare professionals. Cronbach's alpha was 0.84 in the study by Seo [18] and 0.92 in this study.

Autonomous motivation, which refers to individuals' self-regulation and ability to control their own behavior as

well as complete or participate in a task, is a key psychological factor in the initiation and continuation of an action and improvement of performance and life satisfaction [6]. Autonomous motivation was measured using a tool developed for patients with diabetes by Williams et al. [17] and translated and adapted into Korean by Seo [18]. The scale comprised eight items, with each item rated on a 7-point scale from 1 to 7. A higher score reflected a higher level of autonomous motivation. Cronbach's alpha was 0.80 in the study by Williams et al. [17], 0.65 in the study by Seo [18], and 0.89 in this study. Competence refers to the perception of oneself as an efficient individual coping with the environment [6]. Competence was measured by the Perceived Competence Scale developed by Williams et al. [17] and translated and adapted into Korean by Seo [18]. The scale comprised four items, with each item rated on a 7-point scale from 1 to 7. A higher score reflected a higher level of competence. Cronbach's alpha was 0.87 in this study.

Self-management was measured using a tool developed by Kim [19] to measure self-care behavior in kidney transplant patients. The self-management measurement tool consisted of two items on medication, five items on diet, three items on infection prevention, eight items on daily life, and two items on rejection. The scale comprised 20 items, with each item rated on a 5-point scale from 1 to 5. A higher score reflected a higher level of self-management. Cronbach's alpha was 0.84 in the study by Kim [19] and 0.82 in this study.

Data Analysis

All collected data were analyzed using SPSS ver. 22 (IBM Corp., Armonk, NY, USA). Patients' demographic characteristics, autonomous motivation, competence, self-management, and health professionals' autonomy support, as recognized by kidney transplant patients, were ana-

Table 1. Instruments used to measure variables that influence kidney transplant recipients' health behavior

Variable	Instrument	Item	Range (min-max)	Meaning
Health professionals' autonomy support	Health Care Climate Questionnaire: developed by Williams et al. [17], modified by Seo [18]	15	1-7 (15-105)	Higher score means higher support
Autonomous motivation	Treatment Self-Regulation Questionnaire: developed by Williams et al. [17], modified by Seo [18]	8	1-7 (8-56)	Higher score means higher autonomous motivation
Competence	Perceived Competence Scale: developed by Williams et al. [17], modified by Seo [18]	4	1-7 (4-28)	Higher score means higher competency
Self-management	Self-Care Behavior Scale: developed by Kim [19]	20	1-5 (20-100)	Higher score means higher self-management

lyzed with frequency, percentage, means, and standard deviations (SDs). Differences in autonomous motivation, competence, health professionals' autonomy support, and self-management based on the participants' demographic characteristics were analyzed using the t-test and one-way analysis of variance. The correlations between variables were examined with Pearson correlation coefficients, and

the variables associated with self-management were identified using multiple regression.

RESULTS

Participants' Demographic Characteristics

The average age of the 79 participants was 54.1 (SD, 12.13) years. Most participants were in the age range of 60 to 69 years (31.6%), with the youngest being 27 years old and the oldest being 78 years old. Regarding education level, 42 of the 79 participants (53.2%) were college graduates and 37 (46.8%) had completed high school or less. The average posttransplantation period was 5.25 (SD, 4.18) years. Of the 79 participants, two (2.5%) had experienced re-transplantation (Table 2).

Table 2. Participants' demographic characteristics (n=79)

Characteristics	No. (%)
Sex	
Male	46 (58.2)
Female	33 (41.8)
Age (yr) ^{a)}	
<40	13 (16.5)
40–69	60 (75.9)
≥70	6 (7.6)
Marital status	
Married	64 (81.0)
Single	15 (19.0)
Employment	
Employed	50 (63.3)
Unemployed	29 (36.7)
Education	
High school or less	37 (46.8)
College graduates	42 (53.2)
Exercise frequency	
Never	5 (6.3)
Sometimes (1–2 times/wk)	40 (50.7)
Regularly (3 times/wk)	34 (43.0)
Time since transplantation (yr) ^{b)}	
<1	11 (13.9)
1–10	63 (79.8)
>10	5 (6.3)
Experienced immunosuppressant complications	
Yes	12 (15.2)
No	67 (84.8)
Experienced complications	
Yes	22 (27.8)
No	57 (72.2)
Type of donor	
Parent	12 (15.2)
Sibling & child	28 (35.5)
Spouse	19 (24.1)
Relative & other	3 (3.8)
Brain-dead donor	17 (21.5)

^{a)}Mean, 54.1 years; ^{b)}Mean, 5.25 years.

Differences in Self-management by Demographic Characteristics

Self-management significantly differed by marital status (P=0.024), employment status (P=0.048), education level (P=0.010), and exercise frequency (P=0.006). Married people, those without a job, those with a lower education level, and those with a higher frequency of exercise showed higher self-management. Table 3. Provides data on the distribution of these scores according to demographic characteristics.

Levels of Healthcare Professionals' Autonomy Support, Autonomous Motivation, Competence, and Self-management

The average total score for healthcare professionals' autonomy support was 92.45 (SD, 11.44), corresponding to an average of 6.1 out of 7 points for each item. The average total score for autonomous motivation was 51.97 (SD, 5.30), with an average item score of 6.50 out of 7 points. The average total score for competence was 20.62 (SD, 4.07), and the average per-item score was 5.16 out of 7 points. The average total score for self-management was 86.77 (SD, 7.96), with an item-level average of 4.34 out of 5 points.

Correlations between Healthcare Professionals' Autonomy Support, Autonomous Motivation, Competence, and Self-management

Self-management showed a statistically significant positive correlation with healthcare professionals' autonomy

support ($P=0.002$), competence ($P<0.001$), and autonomous motivation ($P<0.001$). All variables were significantly related to one another (Table 4).

Factors Influencing Participants' Self-management

Healthcare professionals' autonomy support, autonomous motivation, and competence were used as independent variables to identify the factors influencing self-management. The most influential factor on self-management behavior was competence ($\beta=0.377$, $P=0.001$) with an explanatory power of 24.7%. Autonomous motivation was the next influential factor ($\beta=0.293$, $P=0.006$), and the explanatory power of these two variables was 30.1% (Table 5).

DISCUSSION

This study investigated the factors affecting self-manage-

Table 3. Comparison of patient self-management according to general characteristics (n=79)

Category	Self-management		
	Mean±SD	t/F	P-value
Marital status		2.09	0.024
Married	88.14±6.96		
Single	83.53±10.19		
Education		4.85	0.010
Middle school or lower	90.25±6.24		
High school	89.92±7.30		
College/university or higher	84.76±7.85		
Employment		2.01	0.048
Employed	85.80±8.28		
Unemployed	89.54±6.40		
Frequency of exercise		5.47	0.006
Never	84.40±10.52		
Sometimes (1–2 times/wk)	84.87±7.37		
Regularly (3 times/wk)	90.41±6.98		

SD, standard deviation.

Table 5. Factors influencing participants' self-management

Variable	B	SE (B)	β	t	P-value
Competence	0.703	0.193	0.377	3.634	0.001
Autonomous motivation	0.434	0.154	0.293	2.825	0.006
Healthcare professionals' autonomy support	0.074	0.059	0.129	1.253	0.214
$R^2=0.319$, adjusted $R^2=0.301$, $F=17.763$ ($P<0.001$)					

SE, standard error.

ment in kidney transplant patients based on SDT. Healthcare professionals' autonomy support was positively correlated with competence, autonomous motivation, and self-management. Competence showed a statistically significant positive correlation with self-management. Autonomous motivation was positively correlated with self-management. These results provide evidence supporting SDT, indicating the importance of creating a social environment that satisfies the patients' needs. Possible strategies include understanding patients' emotions, allowing patients to make decisions freely about desirable behaviors such as self-management, and fostering a reliable, supportive relationship between patients and healthcare professionals [21].

The finding that competence was the most influential factor in self-management was consistent with the study by Jeon and Park [22], which reported that competence was an important factor in the self-management of liver transplant recipients. In addition, our results were consistent with the study reported by Ng et al. [23], in which perceived competence had the greatest influence on health behavior variables. Patients who perceived that they could efficiently overcome and cope with their health problems on their own scored higher on self-determination and maintained positive health behavior over the long term [6]. Therefore, patients' self-management can be expected to improve if healthcare professionals encourage patients'

Table 4. Correlations between healthcare professionals' autonomy support, autonomous motivation, competence, and self-management

Variable	Healthcare professionals' autonomy support	Autonomous motivation	Competence
	r (P-value)	r (P-value)	r (P-value)
Autonomous motivation	0.386 (0.000)	1	0.392 (0.000)
Competence	0.287 (0.010)	0.392 (0.000)	1
Self-management	0.336 (0.002)	0.473 (0.000)	0.441 (0.000)

perceived competence and acceptance of their health status after kidney transplantation as well as their ability to resolve health problems on their own through regular and continuous education.

The finding that autonomous motivation was the next influential factor on self-management was consistent with the results of Seo [18], who found that autonomous motivation can have direct, indirect, and total effects on the continuation of positive health behavior.

Health care professionals' autonomy support was not a significant influencing factor, but it did show a significant correlation with competence, autonomous motivation, and self-management. These findings are consistent with previous studies showing that health experts' support for autonomy did not directly affect the health behavior of patients, but their support did help to sustain patients' health behavior by enhancing autonomy and competence [24-27]. According to SDT, health care professionals' autonomy support affects one or more variables among autonomy, competence, and relatedness; internal motivation can develop and changes in health behavior can occur when at least one of these is satisfied [7]. Ryan and Deci [24] reported that participants who receive positive feedback from healthcare professionals feel satisfied with their own competence, promoting autonomous motivation. Jeong and So [25] found that the direct effect of healthcare professionals' autonomy support on patients' self-care behavior was not significant though the indirect and total effects were significant, consistent with the results of this study. Park [26] reported that the indirect effect of autonomy support on self-care was significant among patients with percutaneous coronary interventions, consistent with this study. Our results are also similar to those of Austin et al. [27], who found that autonomy support affected self-management behavior via the mediating variable of competence. Seo [18] found that, although healthcare professionals' autonomy support did not directly predict health behavior, it promoted health behavior by increasing autonomous motivation, and it had a positive effect on patients with diabetes or hypertension who needed long-term diet control, exercise, and drugs regimens. Williams et al. [28] also reported that healthcare professionals' autonomy support increased competence, thereby sustaining tobacco cessation. Ng et al. [23] found that patients' basic psychological needs were satisfied when healthcare professionals presented the treatment plan and explained the value of health behaviors, provided an opportunity for choices in treatment and nursing, and explained how

health behaviors were performed, thus having an indirect mediating effect on the self-management of patients.

The present findings indicated that the competence and autonomous motivation of kidney transplant patients increased when healthcare professionals strengthened their support for autonomy. The results of this study provide a rationale for the development of strategies to help healthcare professionals promote self-management among kidney transplant patients. In the current Korean medical environment where healthcare professionals encounter many patients in a limited amount of time, it can be challenging to sufficiently support patient autonomy and affect behavioral changes. However, healthcare professionals can make significant contributions by employing strategies and programs that increase patients' competence and autonomous motivation. Promoting autonomy among patients does not mean simply leaving them alone to decide and act for themselves; rather, it means encouraging patients to make healthy behavior choices, providing them with the necessary information to make decisions, and respecting their choices [7]. Enhanced interactions with patients can engender a therapeutic environment in which kidney transplant recipients can practice and recognize the importance of positive health behavior.

Methods for providing patient education may include group-based video conferences using mobile phones, as suggested by McGillicuddy et al. [29]. They reported that a mobile phone-based blood pressure self-management system for kidney transplant patients with real-time individualized feedback helped implement medication protocols and enhance patients' self-efficacy. A study by van der Burgt et al. [30] reported that a work environment that motivates healthcare professionals to provide autonomy support was also important and that collaboration and support among colleagues can be motivating.

In conclusion, the results of this study support the influence of autonomous motivation and competence on kidney transplant patients' self-management and improved health behavior. This study used convenience sampling from a single general hospital and had a small sample size, therefore the generalizability of these findings may be limited. We propose a study using a larger representative sample of participants from multiple institutions. Furthermore, intervention studies with healthcare professionals based on SDT should be conducted to foster the self-management of transplant recipients.

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Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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REFERENCES

1. Korean Network for Organ Sharing (KONOS); Korea Centers for Disease Control and Prevention. 2019 Yearly organ donation statistics [Internet]. Seoul: KONOS; 2020 [cited 2022 Mar 20]. Available from: <https://www.konos.go.kr>.
2. Dew MA, DiMartini AF, De Vito Dabbs A, Myaskovsky L, Steel J, Unruh M, et al. Rates and risk factors for non-adherence to the medical regimen after adult solid organ transplantation. *Transplantation* 2007;83:858-73.
3. Sanders-Pinheiro H, Colugnati FAB, Marsicano EO, De Geest S, Medina JOP; Adhere Brazil Consortium Group. Prevalence and correlates of non-adherence to immunosuppressants and to health behaviours in patients after kidney transplantation in Brazil - the ADHERE BRAZIL multicentre study: a cross-sectional study protocol. *BMC Nephrol* 2018;19:41.
4. Vlamincck H, Maes B, Evers G, Verbeke G, Lerut E, Van Damme B, et al. Prospective study on late consequences of subclinical non-compliance with immunosuppressive therapy in renal transplant patients. *Am J Transplant* 2004;4:1509-13.
5. Denhaerynck K, Dobbels F, Cleemput I, Desmyttere A, Schäfer-Keller P, Schaub S, et al. Prevalence, consequences, and determinants of nonadherence in adult renal transplant patients: a literature review. *Transpl Int* 2005;18:1121-33.
6. Deci EL, Ryan RM. The "What" and "Why" of goal pursuits: human needs and the self-determination of behavior. *Psychol Inquiry* 2000;11:227-68.
7. Deci EL, Ryan RM. Self-determination theory in health care and its relations to motivational interviewing: a few comments. *Int J Behav Nutr Phys Act* 2012;9:24.
8. Sheldon KM, Williams G, Joiner T. Self-determination theory in the clinic: motivating physical and mental health. New Haven: Yale University Press; 2003.
9. Ntoumanis N, Ng JY, Prestwich A, Quested E, Hancox JE, Thøgersen-Ntoumani C, et al. A meta-analysis of self-determination theory-informed intervention studies in the health domain: effects on motivation, health behavior, physical, and psychological health. *Health Psychol Rev* 2021;15:214-44.
10. Williams GC, Patrick H, Niemiec CP, Williams LK, Divine G, Lafata JE, et al. Reducing the health risks of diabetes: how self-determination theory may help improve medication adherence and quality of life. *Diabetes Educ* 2009;35:484-92.
11. Johnson HM, Sullivan-Vedder L, Kim K, McBride PE, Smith MA, LaMantia JN, et al. Rationale and study design of the MyHEART study: a young adult hypertension self-management randomized controlled trial. *Contemp Clin Trials* 2019;78:88-100.
12. Juul L, Maindal HT, Zoffmann V, Frydenberg M, Sandbaek A. Effectiveness of a training course for general practice nurses in motivation support in type 2 diabetes care: a cluster-randomised trial. *PLoS One* 2014;9:e96683.
13. Lee JW, Kang K. Association of basic psychological needs with recovery attitude in inpatients with alcohol use disorders based on the self-determination theory. *J Korean Acad Psychiatr Ment Health Nurs* 2019;28:344-52.
14. Kennedy S, Goggin K, Nollen N. Adherence to HIV medications: utility of the theory of self-determination. *Cogn Ther Res* 2004;28:611-28.
15. Senecal C, Nouwen A, White D. Motivation and dietary self-care in adults with diabetes: are self-efficacy and autonomous self-regulation complementary or competing constructs? *Health Psychol* 2000;19:452-7.
16. Ahn HC, Kim MA. Effects of self-determination on recovery of persons with mental illness living in mental health care facilities: the moderating effect of social support. *Ment Health Soc Work* 2017;45:53-82.
17. Williams GC, Freedman ZR, Deci EL. Supporting au-

- tonomy to motivate patients with diabetes for glucose control. *Diabetes Care* 1998;21:1644-51.
18. Seo YM. A structural model development for health behavior adherence in hypertensive or diabetic patients [dissertation]. Daegu: Kyungpook National University; 2008.
 19. Kim SY. Predicting factors on self-care behavior in kidney transplantation patients [dissertation]. Seoul: Korea University; 2011.
 20. Williams GC, Grow VM, Freedman ZR, Ryan RM, Deci EL. Motivational predictors of weight loss and weight-loss maintenance. *J Pers Soc Psychol* 1996;70:115-26.
 21. Flannery M. Self-determination theory: intrinsic motivation and behavioral change. *Oncol Nurs Forum* 2017;44:155-6.
 22. Jeon MK, Park YH. Structural equation modeling of self-management of liver transplant recipients. *J Korean Acad Nurs* 2017;47:663-75.
 23. Ng JY, Ntoumanis N, Thøgersen-Ntoumani C, Deci EL, Ryan RM, Duda JL, et al. Self-determination theory applied to health contexts: a meta-analysis. *Perspect Psychol Sci* 2012;7:325-40.
 24. Ryan RM, Deci EL. Overview of self-determination theory: an organismic dialectical perspective. In: Deci EL, Ryan RM, editors. *Handbook of self-determination research*. Rochester (NY): University of Rochester Press; 2002. p. 3-33.
 25. Jeong HW, So HS. Structural equation modeling of self-care behaviors in kidney transplant patients based on self-determination theory. *J Korean Acad Nurs* 2018;48:731-42.
 26. Park AR. A structural model of health behavior compliance in patients with percutaneous coronary intervention based on self-determination theory [dissertation]. Gwangju: Chonnam National University; 2015.
 27. Austin S, Senécal C, Guay F, Nouwen A. Effects of gender, age, and diabetes duration on dietary self-care in adolescents with type 1 diabetes: a Self-Determination Theory perspective. *J Health Psychol* 2011;16:917-28.
 28. Williams GC, McGregor HA, Sharp D, Levesque C, Kouides RW, Ryan RM, et al. Testing a self-determination theory intervention for motivating tobacco cessation: supporting autonomy and competence in a clinical trial. *Health Psychol* 2006;25:91-101.
 29. McGillicuddy JW, Gregoski MJ, Weiland AK, Rock RA, Brunner-Jackson BM, Patel SK, et al. Mobile health medication adherence and blood pressure control in renal transplant recipients: a proof-of-concept randomized controlled trial. *JMIR Res Protoc* 2013;2:e32.
 30. van der Burgt SM, Kusurkar RA, Croiset G, Peerdeman SM. Exploring the situational motivation of medical specialists: a qualitative study. *Int J Med Educ* 2018;9:57-63.