

# The Validity of the Smart Management Strategy for Health Assessment Tool-Life (SAT-Life) in General Population

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## Research

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# Abstract

This study aimed to determine the reliability and validity of the life version of the Smart Management Strategy for Health Assessment Tool (SAT-Life) for the general South Korean population. We recruited 1,200 respondents using an equal-probability sampling method from March to May 2018. A life version of the Smart Management Strategy for Health Assessment Tool (SAT-Life) Cronbach'  $\alpha$  was used to determine the reliability of the 30-item SAT-Life. Comparisons with the Self-Reported Health Status (SRHS), Short Form-12 (SF-12), McGill Quality of Life Questionnaire (MQOL), Patient Health Questionnaire-9 (PHQ-9), and Satisfaction with Life Scale (SWLS) were conducted for establishing the discriminant and concurrent validity. Three sets of SAT-Life demonstrated a high reliability with good internal consistency (Cronbach'  $\alpha$  0.86 for SAT-Core, 0.88 for SAT-Preparation, and 0.86 for SAT-Implementation). The total scores of the three SAT differentiated well between the before-maintenance group versus the maintenance group for achieving goals in the participants, and between the group with high depression score versus that with lower depression score in the general population. These SAT-Life scores were positively associated with health status and physical and mental quality of life (QOL). The scores of the SAT-Life were correlated with social support and spiritual well-being measured using the MQOL, and life satisfaction measured using SWLS. The 30-item SAT-Life had a satisfactory internal consistency and validity for the general South Korean population. Further validation should be carried out in a cohort study across different cultures, including an assessment of sensitivity.

## Introduction

Most people experience life crises infrequently and may face the stresses such as death of a spouse or child, divorce, imprisonment, personal illness, marital conflicts, and dismissal from work.(Holm and Holroyd 1992; Association 2017; Nipp et al. 2016; Parker et al. 2016) Macro-level events such as global economic crises also remarkably influence psychological illness and well-being.(Rafael Di Tella 2006; Parker et al. 2016)

People face many obstacles to overcoming crisis in life and proactively manage life crises.(Yun et al. 2014)Self-leadership enables them to focus on life goals and develop action plans and preventively overcome life crisis and promote their post-traumatic growth, well-being, and quality of life (QOL).(Covey 2004; Yun et al. 2014; McCorkle R 2011; Yun et al. 2018a; Suzuki et al. 2018; Perrin et al. 2014)Post-traumatic growth is the experience of positive change in the individual following traumatic challenges. (Grunfeld E 2006; Yun et al. 2014) Resilience involves the ability of the individual to respond positively to traumatic events.(Cosco et al. 2016)

To overcome the life crisis and prevent a new crisis, people need to evaluate and address their coping strategies.(Park et al. 2007; Yun et al. 2015; Nipp et al. 2016) However, there have been few tools assessing coping strategies, such as Seven Habit Profiles,(Covey 2004) Brief COPE(Carver 1997) and Post-Traumatic Growth Inventory (PTGI)(Tedeschi and Calhoun 1996).

In previous studies, we developed the Smart Management Strategy for Health Assessment Tool (SAT) (Yun et al. 2015), which evaluates the patient's time-specific strategies based on the conceptual frameworks of management strategy for health support of individuals overcoming the crisis and promoting their positive growth. Moreover, to reduce the assessment burden and elicit comprehensive information about the patient's strategies, we developed a 30-item short version of the SAT.(Yun et al. 2018b) The SAT-SF demonstrated good internal consistency and promising reliability compared to the original form.(Yun et al. 2018b)

Therefore, in this study, we aimed to modify the SAT-SF to assess coping strategies for overcoming life crises and improving QOL and well-being among the general population, validate the assessment tool with the general population, and rename it as the *Smart Management Strategy for Health Assessment Tool-Life version* (SAT-Life).

## Methods

### Study Design and Subject Recruitment

Data were collected from a broader general population targeted in the survey. Firstly, the survey was conducted with the general population aged 20–70 years and residing across 17 major cities and local districts from March to May 2018. In each major city and local district, all participants were recruited using two strata (age and sex) following the guidelines of the 2016 census of Korea. We used a probability-proportional-to-size technique for sample selection to represent a nationwide sample.(Paul S. Levy 2013) As the response rate was expected to be 30%, approximately 4,000 people were contacted over the 17 major cities and local districts. Finally, 1,200 of them agreed to respond to the survey.

The survey data were collected by skilled interviewers of World Research Co. Ltd., professionalized in conducting surveys in Korea, who explained the purpose and details of the questionnaire to the respondents. All recruiters provided informed consent. The research procedures followed the tenets of the Declaration of Helsinki and were approved by the Institutional Review Board of Seoul National University College of Medicine (IRB No: 1804-024-934).

## Measurements

To assess the validity and sensitivity of the SAT-Life among the general population, all the participants answered the questionnaire starting with socio-demographic characteristics including age, sex, marital status, income, educational level, residential area, religion, and employment status.

In addition to SAT-Life, the survey items were formulated on the basis of validated questionnaires including the 12-Item Short Form Survey (SF-12) that assessed respondents' physical and mental QOL(Kim et al. 2014), Patient Health Questionnaire-9 (PHQ-9)(Santos et al. 2013; Han et al. 2008) for depression, McGill Quality of Life Questionnaire (MQOL)(Shin et al. 2009) for subjective well-being

(especially for spiritual and social support), and Satisfaction With Life Scale (SWLS).(Diener et al. 1985) To measure the impact of different aspects of health status on SAT-Life, we also assessed the respondents' five health statuses from a holistic point of view (physical, mental, social, spiritual, and general health status).(Yun et al. 2016)

SAT-Life is based on the previously validated SAT-SF questionnaire for use among cancer patients to evaluate their self-management health strategies(Yun et al. 2015; Yun et al. 2017), and then modified to assess the general population's coping strategies to help them overcome life crises and improve their QOL and well-being. The SAT-Life assessment consisted of three strategy sets: 1) core strategies (SAT-C), 2) preparation strategies (SAT-P), and 3) implementation strategies (SAT-I). Each of the three strategy steps contained 10-item tools describing each step in detail and a four-point Likert scale (never, sometimes, quite often, and always).(Likert 1932) SAT-Life scores were on a scale of 0 to 100, and is from 100-point scoring algorithm.(Yun et al. 2018b) Higher SAT-Life scores mean that participants have healthier and more scheduled life habits. In our study, each of the SAT-Life values were categorized into binary groups with cutoff scores of 66.66 out of 100 to identify the psychometric properties within the general population.

## Statistical Analysis

Firstly, to test the reliability of the SAT-Life, we estimated Cronbach's  $\alpha$ , which is a measure of internal consistency of patient responses. In general,  $\alpha \geq 0.70$  was considered appropriate for the aggregation of responses into a single score.(Elvén et al. 2018) Secondly, descriptive statistical analysis was conducted for demographic characteristics of respondents. Third, to assess discriminant validity, we analyzed the general population with high competency in the SAT-Life scores (SAT-C, SAT-P, and SAT-I) under the hypothesis that they would perform better in goal practice, health status, and QOL, and show lower depression. We calculated each of SAT-C, SAT-P, and SAT-I strategy differentiation according to the participants' socio-demographic variables, goal practice level, five health statuses, physical and mental component summary from SF-12, and depression level on PHQ-9 to determine the validity of SAT-Life for use with the general population. To assess associations between them, univariate logistic analysis was performed to produce odds ratios (ORs). Each SAT-Life score, less than or equal to 66.6, was set as a reference point for comparisons between groups with higher SAT-Life scores on SAT-C, SAT-P, and SAT-I. (Fayers et al. 1995)

Finally, to assess concurrent validity, correlation analyses between SAT-Life, MQOL, and SWLS scores in the general population were conducted. All calculated  $p$ -values were two-sided with the significance level set at  $p < 0.05$ . SAS statistical package version 9.3 (SAS Institute, Cary, NC, 1990) and R 3.5.1 were used for all analyses.

## Results

# Baseline Characteristics of the Participants

The characteristics of the study participants are summarized in Table 1. The mean age of the total 1,200 respondents was  $46.97 \pm 14.18$  years, and 48.8% were men. The proportion of university graduates was 47.2%. The percentage of respondents who earned over 4,000\$ per month was 45.9% (Table 1.)

Variables		N	%
Sex	Male	586	48.8
	Female	614	51.2
Age (years)	21-39	463	38.6
	40-49	222	18.5
	50-59	230	19.2
	≥60	285	23.8
Marital status	Yes	860	71.6
	No	340	28.4
Education (NA=1)	≤Middle school	115	9.7
	>Middle, ≤High School	517	43.1
	≥ University graduate	567	47.2
Monthly income (NA=7) (\$, USD)	<2,000	112	9.4
	2,000~3,000	185	15.4
	3,000~4,000	346	28.8
	>4,000	550	45.9
Residential area	Metropolitan	549	54.7
	Rural	651	54.2
Religion	Christian (non-Catholic)	209	17.4
	Buddhist	167	14.0
	Catholic	101	8.4
	None	721	60.1
	Other	2	0.2
Employment	Self-employed	278	23.1
	Employed	563	46.9
	Unemployed	342	28.5
	Retired	17	1.4

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Table 1

Demographic characteristics of participants

## Reliability of SAT-Life

Each of the three SAT-Life sets was applied into cross-validation of the newly enrolled general population sample. All values on the three SAT-Life sets showed a high reliability with good internal consistency (Cronbach's  $\alpha$ : 0.860 for SAT-C, 0.880 for SAT-P, and 0.860 for SAT-I) (Table 2).

Strategy	Subscales	Number of Items	Cronbach's $\alpha$
SAT-C	Total (10 items)	10	0.860
	Fac1: Proactive Problem-Solving Strategy (items 5,6,7,8)	4	
	Fac2: Positive-Reframing Strategy (items 1,2,4)	3	
	Fac3: Creating Empowered Relationship Strategy (items 3,10)	2	
	Fac4: Experience-Sharing Strategy (item 9)	1	
SAT-P	Total (10 items)	10	0.880
	Fac1: Goal and Action Setting (Preparing) Strategy (items 2,3,4)	3	
	Fac2: Rational Decision-Making Strategy (items 5,6)	2	
	Fac3: Healthy Environment-Creating (Building) Strategy (items 9, 10)	2	
	Fac4: Priority-Based Planning Strategy (items 7,8)	2	
	Fac5: Pursuing Life Value Strategy (item 1)	1	
SAT-I	Total (10 items)	10	0.860
	Fac1: Self-Sustaining Strategy (items 1,4,5,9)	4	



Fac2: Self-Motivating Strategy (items 7,8)	2
Fac3: Self-Implementing (Maintaining) Strategy (item 6)	1
Fac4: Reflecting Strategy (item 10)	1
Fac5: Energy-Conserving Strategy (item 3)	1
Fac6: Activity-Coping Strategy (item 2)	1

**Abbreviations:** Fac, Factor; SAT-C, SAT-Core; SAT-P, SAT-Preparation; SAT-I, SAT-Implementation

Table 2

Descriptive statistics and subscale reliability of the SAT-Life with the general population (n=1,200)

		Core				Preparation				Implementation			
		High	Low	OR	P value	High	Low	OR	P value	High	Low	OR	P value
Sex													
	Male	189 (49.0%)	403 (49.5%)	1.02	0.91	130 (45.0%)	462 (50.7%)	1.26	0.10	130 (45.0%)	462 (50.7%)	1.248	0.117
	Female	197 (51.0%)	411 (50.5%)			159 (55.0%)	449 (49.3%)			158 (55.0%)	450 (49.3%)		
Age (60)													
	Old (60+)	298 (77.2%)	596 (73.2%)	1.24	0.16	225 (77.9%)	669 (73.4%)	1.27	0.15	218 (75.7%)	676 (74.1%)	1.09	0.648
	Not Old	88 (22.8%)	218 (26.8%)			64 (22.1%)	242 (26.6%)			70 (24.3%)	236 (25.9%)		
Education level													
	Univ.	202 (52.3%)	459 (56.4%)	1.18	0.21	140 (48.4%)	521 (57.2%)	1.42	0.01	141 (49.0%)	520 (57.0%)	1.38	0.020
	Below Univ.	184 (47.3%)	355 (43.6%)			149 (51.6%)	390 (42.8%)			147 (51.0%)	392 (43.0%)		
Income Level													
	Not Low	212 (54.9%)	445 (54.7%)	0.99	0.98	159 (55.0%)	498 (54.7%)	0.99	0.97	159 (55.2%)	498 (54.6%)	0.98	0.911
	Low (under 400)	174 (45.1%)	369 (45.3%)			130 (45.0%)	413 (45.3%)			129 (44.8%)	414 (45.4%)		
Goal													

practice													
	Before Maintenance*	163 (42.2%)	441 (54.2%)	1.62	<0.001	127 (43.8%)	477 (58.8%)	1.40	0.01	129 (44.8%)	475 (52.1%)	1.34	0.037
	Maintenance	223 (57.8%)	373 (45.8%)			162 (56.2%)	434 (41.2%)			159 (55.2%)	437 (47.9%)		
Physical Health Status													
	Very good	180 (46.6%)	257 (31.6%)	1.89	<0.001	151 (52.2%)	286 (31.4%)	2.39	<0.001	144 (50.0%)	293 (32.1%)	2.11	<0.001
	Not very good	206 (53.4%)	557 (68.4%)			138 (47.8%)	625 (68.6%)			144 (50.0%)	619 (67.9%)		
Mental Health Status													
	Very good	203 (52.6%)	266 (32.7%)	2.285	<0.001	158 (54.7%)	311 (34.1%)	2.33	<0.001	155 (53.8%)	314 (34.4%)	2.22	<0.001
	Not very good	183 (47.4%)	548 (67.3%)			131 (45.3%)	600 (65.9%)			133 (46.2%)	598 (65.6%)		
Social Health Status													
	Very good	215 (55.7%)	300 (36.9%)	2.15	0.046	168 (58.1%)	347 (38.1%)	2.26	<0.001	165 (57.3%)	350 (38.4%)	2.15	<0.001
	Not very good	171 (44.3%)	514 (63.1%)			121 (41.9%)	564 (61.9%)			123 (42.7%)	562 (61.6%)		
Spiritual Health Status													
	Ver	189	199	2.9	<0.	142	246	2.6	<0.	135	253	2.3	<0.

	Very good	(49.0%)	(24.4%)	7	001	(49.1%)	(38.1%)	1	001	(46.9%)	(27.7%)	0	001
	Not very good	197	615			147	665			153	659		
		(51.0%)	(75.6%)			(50.9%)	(61.9%)			(53.1%)	(72.3%)		
General Health Status													
	Very good	189	232	2.4	<0.001	160	261	3.0	<0.001	143	278	2.2	0.04
		(49.0%)	(28.5%)	1		(55.4%)	(28.6%)	9		(49.7%)	(30.5%)	5	
	Not very good	197	582			129	650			145	634		
		(51.0%)	(71.5%)			(44.6%)	(71.4%)			(50.3%)	(69.5%)		
SF-12 PCS (median, 91.7)													
	High (>91.7)	121	148	2.0	<0.001	99	170	2.2	<0.001	95	174	2.0	<0.001
		(%)	(%)	6		(%)	(%)	7		(%)	(%)	9	
	Low	265	666			190	741			193	738		
		(%)	(%)			(%)	(%)			(%)	(%)		
SF-12 MCS (median, 79.2)													
	High (>79.2)	205	323	1.7	<0.001	155	373	1.6	<0.001	159	369	1.8	<0.001
		(%)	(%)	2		(%)	(%)	7		(%)	(%)	1	
	Low	181	491			134	538			129	543		
		(%)	(%)			(%)	(%)			(%)	(%)		
PHQ-9													
	High (>11)	3	29	0.2	0.09	3	29	0.3	0.08	5	27	0.5	0.36
		(0.8%)	(3.7%)	1		(1.0%)	(3.2%)	2		(1.7%)	(3.0%)	8	
	Low ( $\leq 10$ )	383	785			286	882			283	885		
		(99.2%)	(96.3%)			(99.0%)	(96.8%)			(98.3%)	(97.0%)		

**Abbreviations:** OR, Odds Ratios; SF-12 PCS, Short Form-12 Physical Component Score; SF-12 MCS, Short Form-12 Mental Component Score; PHQ-9, Patient Health Questionnaire – 9. \*Before Maintenance in Goal practice involves the stages of Pre-contemplation, Contemplation, Preparation, and Action

Table 3

Associations of SAT-Life with demographic characteristics, SF-12, and PHQ-9 in the general population (n=1,200)

## Association among the SAT-Life scores with Demographic Characteristics, Health Status, Health-Related QOL, and Depression

Demographic characteristics including age, sex, education, and income level had statistically weak relations with all three SAT-Life scores. Associations between various health statuses (physical, psychological, social, spiritual, and general) and SAT-Life scores showed that higher SAT-C, I, P score lead to a better health status. Especially, mental health was strongly correlated with SAT-Life strategies (psychological health status: ORs = 2.285, spiritual health status: ORs = 2.965). SF-12 PCS and MCS, which are questionnaires assessing psychological factors, had significant associations with SAT-Life score (SF-12 PCS: ORs = 2.055, SF-12 MCS: ORs = 1.722).

For calculating ORs, SF-12 PCS and SF-12 MCS were converted into binary forms with the median value of each of factors as the cutoff value. One OR value, which is from between PHQ-9 and SAT-Life score is relatively low (PHQ-9: ORs = 0.212). PHQ-9 was generated by summing 9 PHQ score, and then subjecting 9 from it. Higher score on PHQ-9 indicate low levels of depression in general. A cutoff of 10 for PHQ-9 was used, because a group with scores equal to or more than 10 is recognized as having severe depression.

## Correlations of the SAT-Life with MQOL and SWLS scores

The correlations of the SAT-SF with other factors is shown in Table 4. Pearson's correlation coefficients between scores on SAT-Life and the other factors (MQOL social support, MQOL spiritual well-being, and SWLS) explain having strong affection for each other (r ranging from 0.410–0.429).

	Core		Preparation		Implementation	
MQOL Social support	0.415	<0.001	0.417	0.000	0.410	<0.001
MQOL Spiritual well-being	0.420	<0.001	0.410	0.000	0.414	<0.001
SWLS	0.410	<0.001 <sup>a</sup>	0.420	0.000	0.429	<0.001 <sup>a</sup>
<b>Abbreviations:</b> MQOL, McGill Quality of Life; SWLS, Satisfaction With Life Scale.						

Table 4

Correlations of SAT-Life scores with health status, quality of life, satisfaction with life, and subjective well-being in the general population (n=1,200)

## Discussion

SAT-Life has acceptable psychometric properties including internal consistency, discriminant validity, and concurrent validity in a sample of the general population. Our findings suggest that patients with high scores in the 3 SAT tool sets showed achievement of life goal, good health, QOL, and life satisfaction. Thus, patients with better self-management strategies seem to be associated with overcoming their life crises and improving their health, QOL, and subjective well-being.(Yun et al. 2015)

Little is understood about of the role of coping strategies in overcoming life crisis for the general population. The personal sets of the SAT were positively associated with better physical and mental QOL as measured using the SF-12. Our study indicates that these SAT-Life scores were able to differentiate well between the before-maintenance group versus the maintenance group for achieving goals,(Yun et al. 2018b) and between group with high and low scores on depression in the general population. Our findings may indicate the importance of focusing on coping strategies for prevention of depression. (Suzuki et al. 2018; Wang and Patten 2002) The scores of the SAT were correlated with social support and spiritual well-being measured with the MQOL, and life satisfaction measured using SWLS. Social support might strengthen social networks in the community that offers protection against the negative effects of economic recessions on health and QOL.(Fernandez et al. 2015) Elderly people showed the effect of economic crises on well-being.(Caspi 2010; Elder 2018; Parker et al. 2016)

A thorough examination of the reliability and validity may provide evidence for the implementation of life management strategies aimed at overcoming crisis and improving health, QOL, subjective well-being, and life satisfaction.(Meng and D'Arcy 2016; Suzuki et al. 2018) The SAT-Life could improve the usefulness of the SAT in overcoming life crisis and improving life.(Yun et al. 2014) During periods of financial crisis, governments may reduce public expenditure on social welfare and health services, and primary healthcare professionals are in a key position to identify the population experiencing a life crisis and

implement new strategies to ameliorate the impact of the crisis on them based on the assessment of their coping strategies with SAT-Life.(Fernandez et al. 2015; Meng and D'Arcy 2016)

Our findings have practical implications for public intervention and health promotion.(Meng and D'Arcy 2016) In order to improve the health, depression, and well-being of the general population, public interventions should focus on strategies that reduce negative coping at a population level.(Fernandez et al. 2015; Meng and D'Arcy 2016) SAT-Life can be completed easily and quickly, which might enhance the use of this test to monitor crisis-management strategies and allow the population to obtain feedback in community practice.(Yun et al. 2018b)

However, our study had some limitations. First, this study involved only the Korean population, and SAT-Life requires further validation using population with other life crisis and across different cultures. Second, we did not assess test–retest and psychometric properties of this SAT-Life, which may be limited. Finally, the sensitivity to change such as crisis improvement or progression, or new events, was not assessed. Further cohort studies need to assess its practical utility in the community.

In conclusion, the SAT-Life has appropriate psychometric properties for use with the general population. Further validation should be carried out in a cohort study across different cultures, including an assessment of sensitivity to change for supporting the practical application and usefulness in community.

## **Declarations**

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## **Competing Interest:**

The authors have no competing interests to declare.

## **Ethics approval and consent to participate**

Informed consent to participate in this public survey is obtained from all participants. Interested and eligible participants receive information about the study of verbal recording.

## Consent to publish:

Not Applicable

## Availability of data and materials (data transparency):

The raw data are being kept in the custody of Seoul National University Medical College and are available upon request.

## Code availability (software application or custom code):

Not applicable.

## Authors' contributions:

YHY participated in the study design, provided financial support and study materials, collected and assembled the data, interpreted the analyses, participated in the sequence alignment, drafted the manuscript, and finally approved the paper. JAS participated in the study design and coordination, collected study materials, conducted data analyses, and wrote the manuscript.

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