Development of a scale to measure successful aging in late middle-aged women

Do-Young Lee[1], Gie-Ok Noh[2]*
[1]Changshin University, Changwon, Korea.
[2]Konyang University, Deajeon, Korea; nkorn91@konyang.ac.kr (G.O.N.).

Abstract: This study was conducted in two stages, the tool development stage and the tool verification stage, and was based on DeVellis' tool development guidelines. A total of 18 questions were confirmed as a result of developing a successful aging measurement tool for middle-aged women and verifying the validity. It consisted of a total of 5 factors, and in consideration of the characteristics of the items included in each factor, factor 1 was named 'inconvenience of aging', factor 2 was named 'inconvenience of female hormone deficiency', factor 3 was named 'family success', factor 4 was named 'appearance due to aging', and factor 5 was named 'aging and lifestyle change'. It is measured on a 5-point Likert scale, and the score is 18 points to 90 points, which means that the higher the score, the higher the successful aging. The tool developed in this study will be used to measure successful aging status tailored to middle-aged women.

Keywords: Instrumentation, Middle-aged, Successful aging, Validation study, Women.

1. Introduction

Middle-aged women physically experience hormonal changes in menopause between the ages of 40 and 59, and it is a time when problems such as depression, anxiety, and valuelessness occur as the role changes between production and stagnation occur, and are exposed to chronic diseases due to the acceleration of aging [1]. Although there is a recognition that middle-aged women in modern society can have independent and productive values due to improved education and economic levels and changes in social status and values, depression and women's health risk factors are still inherent due to practical problems such as child rearing, housework burden, and male-centered organizational structure [2]. Since aging is an inevitable fate, it is necessary to enjoy successful aging by understanding the aging process and positively preparing for life in old age by reducing negative feelings about aging. Helping middle-aged women, who are physically, socially, psychologically, and economically vulnerable periods, prepare for successful aging before reaching old age has important implications for the nursing profession that takes care of the health of the country and society [3]. In general, the lifestyle and life of middle age greatly affect the health, degree of dependence, and quality of life in old age, so how you spend your middle age is important to successfully spend your old age [4]. This means that appropriate care and nursing are needed even in middle age in the process of growth and development, and research that can contribute to the successful aging of middle-aged women should be interested in [2].

Aging is not just limited to the elderly, it is a universal phenomenon during the continuation of life that cannot be avoided by anyone, and it is a psychological developmental process that becomes mentally mature [5]. Most of the successful aging studies so far have been conducted on the elderly [6], and the development of a successful aging improvement program applying a refined theory is insufficient [7]. Therefore, this study needs to more clearly recognize successful aging in middle-aged women and measure the degree of successful aging for middle-aged women so that they can prepare for old age based on successful aging. The age range of middle-aged women is widely suggested to be 40-64

years old, and when this period was classified into the first half and the second half, the problem was suggested that the research conducted so far was mainly conducted without dividing middle-aged women into the first half and the second half [8]. In particular, the late middle-aged period is a time when health rapidly declines and socially faces and experiences retirement, and is on the verge of entering old age [9]. Therefore, it is necessary to conduct research that explores the characteristics focused on women in the late middle age.

Successful aging is not limited to old age and is one of the inevitable continuation of life for everyone, a psychological developmental process that embraces aging, accepts the past and the present, and matures mentally [10]. However, while the concept of anti-aging for the elderly is being emphasized day by day, interest in the successful aging of middle-aged women is still low. Although there was a study [11] that developed and presented a successful aging scale for middle-aged adults in Korea 14 years ago, it is difficult to find a study on middle-aged aging using this tool, and most of the successful aging studies published so far have been conducted on the elderly [12]. Moreover, Korea is not properly prepared for an aging society due to rapid aging, so most middle-aged women show a negative attitude toward aging and the elderly, so they tend to artificially slow or cover up aging rather than adequately cope with it [13]. Therefore, in order to help middle-aged women with successful aging, it is necessary to activate basic research first, and in particular, the development of tools to measure successful aging is necessary.

Some successful aging measurement tools developed for middle-aged women in Korea have been proposed. In the successful aging measurement tool developed in previous studies [14] for middle-aged women, it was determined that the degree of menopausal symptoms would greatly affect the level of successful aging, so tools including menopausal symptoms were developed. However, it is a tool developed for middle-aged women under the age of 40 to 65, and there are questions that are close to old age due to its large range, so it is considered unreasonable to measure it in middle-aged women. Therefore, this study intends to develop a successful aging measurement tool for middle-aged women in this study, limited to middle-aged women. According to a study by [15], despite the differences in characteristics of women's middle-aged age as pre- and late-stage, the research conducted so far mainly does not classify middle-aged women into pre- and late-stage, raising the need for more detailed research. In the study of [15], 50-59 years old were targeted for middle-aged women, and based on this, this study also intends to develop tools for middle-aged women. In addition, in the study of [14], questions related to interpersonal relationships were included, but questions about family members were not included. These areas need to be supplemented. Therefore, this study was attempted to identify the components of successful aging in middle-aged women and to develop measurement tools.

2. Research Method

2.1. Research Design
This study is a methodological study that develops tools to measure successful aging in middle-aged women and verifies the validity and reliability

2.2. Instrument Development Phase
This study was conducted in two stages: the tool development stage and the tool verification stage, and was based on the tool development guidelines of DeVellis [16].

2.2.1. A Conceptual Framework
Rowe & Kahn [17]'s active life participation model drew the conclusion that the absence of disease and disability, the absence of its risk factors, maintenance of high physical and cognitive functions, and active life participation for successful aging, and argued that successful aging was different from normal aging. However, it is being criticized for overemphasizing function and productivity and overlooking the risk of disease or disability due to aging and the subjective aspect of successful aging. In Ryff's integrated model [18], studies related to successful aging were conducted without a theoretical

framework, presenting the limitations of the studies, and presented the positive possibilities of continuing to grow and develop even in the later life of old age and unique resources and challenges. Baltes & Baltes 's Selective Optimization Compensation (SOC) model [19] is a theory that overcame the limitations of the existing successful aging theory and was viewed as an adaptation process according to aging along with the SOC concept. They experience a decline or decrease in potential and skills in the physical, cognitive, and social domains due to age, but despite the loss due to aging, they can achieve successful aging by selecting activities that are important to them, optimizing their skills, compensating for what they have lost, and coping strategies. It was also suggested that the 'selective optimization principle with compensation' does not apply only to old age, but also affects a lifetime from birth to death.

2.2.2. Instrument Components

In order to derive questions about the SOC strategy of middle-aged and late-aged women, focus group interviews were conducted with a total of 12 people composed of 4 groups of late-aged women. They were allowed to freely answer semi-structured open-ended questions. The time required for each group was less than 2 hours, and the components necessary for the SOC strategy of middle-aged women were conceptualized by analyzing the content of the focus group interview. Preliminary questions were prepared based on the data derived through literature review and focus group interviews, and a total of 72 items were composed in proportion to the content and number of topics derived for each constituent factor.

2.2.3. Item preparation

As a next step, 59 questions in two areas, "cognition" and "counteraction," were composed by removing overlapping questions with one nursing professor and one professor with experience in tool development and grouping and classifying similar contents into one.

2.2.4. Selection of a response forma

The scale decision recommended the use of a 4-point Likert scale to avoid bias toward neutrality, but the use of a 5-point Likert scale was also suggested to be appropriate for responses to attitudes and perceptions [16]. In this study, each question was measured on a Likert 5-point scale from 'not at all' (1 point) to 'very much' (5 points), and the higher the score of the question, the more desirable SOC strategy is used.

2.2.5. Content validity test

Expert content validity was conducted twice on the initial questions. According to the recommendation that 3 to 10 experts are appropriate for content validity verification [17], three professors in the nursing department and two clinical nurses in obstetrics and gynecology with a doctorate in nursing were selected as expert groups to verify the content validity index [CVI] of the measurement tool. Each question was analyzed on a 4-point Likert scale with 4 points for 'very appropriate', 3 points for 'appropriate', 2 points for 'not appropriate', and 1 point for 'not appropriate at all'. As a result of content validity verification, there were no questions with an I-CVI of less than 1.00, and some questions were revised and rearranged after receiving revised opinions.

2.2.6. Item review

The successful aging scale of late middle-aged women was composed of two areas, 23 cognitive questions and 29 coping questions, a total of 52 preliminary questions, and this survey questionnaire was composed.

2.3. Instrument validation phase
2.3.1. Participants of study

The reliability and validity verification of the preliminary tools developed in the study will be conducted for middle-aged women aged 50 to 59 who voluntarily agreed to participate in the study. In the factor analysis to verify the construct validity, a survey will be conducted by securing the number of subjects to satisfy the grounds that 5 to 10 times the number of tool items is recommended In this study, 38 questions were selected as a questionnaire corresponding to the criteria based on previous studies, and based on this, the preliminary tool developed in this study is expected to consist of 38 questions for successful aging measurement, so the study subjects collected data from 300 people, and if the number of subjects changes depending on the number of items in the tool after the development of preliminary questions, the change deliberation will be requested.

2.3.2. Data Collection and Ethical Considerations

The contents and methods of this study were approved by the Research Ethics Review Committee (IRB no. KYU 2023-05-009-001). Data collection was conducted electronically from November 2023 to January 2024 through the Internet platform address presented in the recruitment notice. Late-stage middle-aged women who met the presented selection criteria who wanted to participate through the recruitment notice read the explanation of the study, confirmed the purpose and content of the study, and conducted the questionnaire after voluntary consent. The questionnaire was conducted when the subject voluntarily agreed to participate by explaining the purpose and purpose of the study, the research procedure and method, the time required to fill out the questionnaire, personal information and matters related to the withdrawal of participation in the study. The questionnaire was made to fill it out by the subject themselves, and a predetermined gift certificate was provided in return after collecting it immediately after writing. The collected data was coded by the researcher with an identification code to prevent the exposure of personal information, and the coded information was managed to be accessible only by the researcher by setting a password.

2.3.3. Research Instruments

As a successful aging measurement tool, a successful aging measurement tool developed for middle-aged women by [14] was used. It consists of a total of 4 areas and 38 questions, and specifically, 14 questions for physical aging adaptation (physical health, menopausal symptoms, physical change adaptation), 11 questions for psychological aging adaptation (achievement, psychological change adaptation), 9 questions for social aging adaptation (personal relationships, social change adaptation, social support), and 4 questions for economic change adaptation. For each question, as a Likert 4-point scale, it is 1 point for 'not at all' to 4 points for 'always yes', and the higher the score, the higher the level of successful aging. In the study of [14], the reliability was Cronbach's α=.90, and the reliability of each sub-factor was .90 for physical aging adaptation, .89 for psychological aging adaptation, .89 for social aging adaptation, and .90 for economic change adaptation, respectively. In this study, Cronbach's α=.88 and the reliability of each sub-factor was .78 for physical aging adaptation, .79 for psychological aging adaptation, .78 for social aging adaptation, and .74 for economic aging adaptation.

2.3.4. Data Analysis

The data collected in this survey of this study were analyzed using the IBM SPSS/PC+ 27.0 program. The general characteristics of the subjects were analyzed by descriptive statistics of frequency and percentage, mean and standard deviation. In order to analyze the items of the developed tool, the skewness and kurtosis values were checked, and the items with skewness greater than or equal to the absolute value of 3 and kurtosis greater than or equal to 7 were first removed, and the correlation between the items and the total score was confirmed to remove the items less than .3 [20].

Kaiser-Mayer-Olkin (KMO) values and Barrett's sphericity verification values were checked to confirm whether the collected data were suitable for performing exploratory factor analysis, and the

adhesiveness was verified based on KMO.80 or higher and Barrett's sphericity verification p'.05.

Exploratory factor analysis was performed using maximum likelihood factor extraction (maximum likelihood) and varimax rotation to verify the composition validity of the tool. Only factors with eigen values of 1.0 or higher were extracted as sub-factors of the tool, and only items with factor loading of .50 or more were included, and only items with cross factor loading of .40 or less were included.

The correlation between the reference tool and the tool developed in this study was analyzed to verify the reference validity of the tool, and Cronbach's alpha coefficient and Cronbach's alpha coefficient were checked when removing the item to verify the reliability of the tool.

3. Results

3.1. General characteristics of the participants

The general characteristics of middle-aged women who participated in the study were age, occupation, religion, educational background, spouse presence, economic status, chronic disease, health status perception, life satisfaction, and menopause (Table 1).

The average age of the participants was 53.44±3.56, 231 (77.3%) of the subjects had a job, and 266 (89.0%) of them had a religion. As for the educational background, college graduates were the most common, with 168 people (56.2%), and 249 (83.3%) of the subjects were married with a spouse. 202 people (67.5%) responded that the economic status was moderate, 183 people (61.2%) did not have chronic diseases, and 163 people (54.5%) recognized that their health status was normal. As for life, 160 people (53.5%) answered that they were satisfied, and 197 of the subjects (65.9%) were confirmed to be menopause.

Table 1.
General characteristics of the subject (n=299).

Characteristic	Category	n (%)	M±SD
Age			53.44±3.56
Presence or absence of a job	Yes	231 (77.3)	
	No	68 (22.7)	
Presence or absence of religion	Yes	266 (89.0)	
	No	33 (11.0)	
Academic background	High school graduates and under	37 (12.4)	
	College graduate	168 (56.2)	
	Master's degree or higher	94 (31.4)	
Presence or absence of a spouse	Yes	249 (83.3)	
	No	50 (16.7)	
State of the economy	High	89 (29.8)	
	Middle	202 (67.5)	
	Low	8 (2.7)	
Presence or absence of chronic disease	Yes	116 (38.8)	
	No	183 (61.2)	
Health status recognition	Healthy	108 (36.1)	
	General	163 (54.5)	
	Unhealthy	28 (9.4)	
Satisfaction of life	Satisfaction	160 (53.5)	

	General	139 (46.5)	
Presence or absence of menopause	Yes	197 (65.9)	
	No	102 (34.1)	

3.2. Item Analysis

The normality was confirmed through skewness and kurtosis values of the collected data for item analysis. As a result of the analysis, the range of skewness was -1.61 to 0.19, there were no questions with an absolute value of 3 or higher, and the range of kurtosis was -1.16 to 3.62, and no questions with an absolute value of 7 or higher. Therefore, no questions were removed due to skewness and kurtosis values. Next, as a result of checking the correlation between each item and the total score, 11 items (3, 17, 18, 20, 28, 34, 43, 44, 49, 52, 53) with a correlation coefficient of less than .30 were identified, and correlation analysis was performed again after removing the corresponding items. As a result of the analysis after removing the items, the correlation coefficient was .32~.62, and a total of 48 items were used for exploratory factor analysis to verify the composition validity.

3.3. Construct Validity Testing

An exploratory factor analysis was conducted to verify the construct validity of the tool developed to measure the successful aging of middle-aged women. In order to conduct the analysis, verification was performed to confirm whether the data were suitable for factor analysis, and the Kaiser-Meyer-Olkin (KMO) value was .81, and as a result of Bartlett's sphericity test, it was confirmed to be significant ($\chi 2$=8033.76, p<.001), so it was suitable for factor analysis.

As a result of performing maximum likelihood factor extraction and varimix rotation as a method of exploratory factor analysis, the communality of each item was .33~.91. A total of 10 items were removed at this stage because items with less than .50 commonality had to be removed. The removed items were 16, 24, 25, 36, 38, 48, 41, 48, 50, 54, and 59.

After removing 10 items, a second factor analysis was performed on 38 items, and 6 items with less than .50 commonality (No. 21, 31, 32, 40, 45, 47) were identified, and the third factor analysis was performed after the relevant items were additionally removed. As a result of conducting the third factor analysis with 32 items, 6 items with less than .50 commonality (No. 33, 35, 37, 39, 55) were removed. The fourth factor analysis was performed on 26 items reflecting the results of the third factor analysis, and 7 items with less than .50 commonality (8, 14, 26, 42, 51, 56, 58) were removed. As a result of conducting the 5th factor analysis with the remaining 19 items, the commonality of all items was .50 or higher, so no additional items were removed.

As a result of the 5th factor analysis, a total of 5 factors with an eigen value of 1.0 or more were extracted, and the cumulative percentage of explanatory variance by factors was 65.1%. However, in the 5th factor analysis, item 12 with a factor loading value of less than .50 was identified, and the 6th factor analysis was performed after deleting the corresponding item. As a result of the 6th factor analysis, 5 factors with an eigenvalue of 1.0 or more were extracted, and the cumulative percentage of variance was 66.0% (Table 2).

Table 2.
Results of construct validity verification (N=299).

(Question number) item factor	Item factor loading value				
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
(1) I know that the hormone balance is broken.	**0.71**	0.27	-0.03	0.07	0.27
(2) I know that forgetfulness can occur.	**0.67**	0.15	-0.04	0.23	0.29

(7) I know it can be hard to hold back urine or incontinence.	**0.71**	0.32	-0.10	0.22	0.24
(9) You can sympathize with the contents of menopause delivered by the media.	**0.80**	0.15	-0.14	0.13	-0.09
(10) I know that you can often have a fever and cold sweat on your face.	0.14	**0.86**	0.06	0.17	0.17
(11) We know that vaginitis can occur as vaginal secretions decrease.	0.15	**0.97**	0.05	0.08	0.04
(13) We know that osteoporosis can occur due to decreased bone density, which increases the risk of fracture.	0.37	**0.61**	0.19	0.21	0.16
(15) I know that nerves can become edgy.	0.23	**0.57**	0.01	0.08	0.19
(19) The atmosphere in my family feels comfortable and warm.	0.18	0.02	**0.77**	-.10	0.20
(27) Understanding the thoughts and opinions of the family and trying to resolve the conflict.	-0.18	-0.06	**0.81**	0.15	-0.10
(29) We are solving economic problems well in our lives.	-0.21	0.17	**0.64**	0.06	-0.17
(30) They are doing their best to perform their roles within the family.	-0.16	0.06	**0.65**	0.17	0.03
(46) I believe there is an agreed belief or belief within the family.	0.19	0.07	**0.57**	0.16	0.13
(4) I know that regular medical checkups including cancer diagnostic tests are necessary.	0.36	0.31	0.19	**0.54**	0.11
(5) I know that the elasticity can be reduced as the skin gets wrinkles.	0.43	0.14	0.12	**0.78**	0.21
(6) I know that gray hair increases and changes to an aging appearance.	0.07	0.14	0.21	**0.70**	0.20
(22) We know that the rate of metabolism may decrease, resulting in weight gain.	0.19	0.22	0.04	0.20	**0.79**
(23) I know that sleep disorders can occur.	0.19	0.21	0.02	0.22	**0.79**
Eigenvalue	2.88	2.86	2.58	1.79	1.78
Description Variance (%)	16.0	15.9	14.3	9.9	9.9
Cumulative variance (%)	16.0	31.9	46.2	56.1	66.0

3.4. Criterion validity testing

In order to verify the reference validity of the tool developed in this study, the correlation with the tool developed by Jung & Sung [14] for middle-aged women was analyzed. As a result of confirming the correlation with the reference tool, statistical significance was confirmed, and the reference validity was verified ($r=.32$, $p<.001$).

3.5. Reliability testing

In order to verify the reliability of the 18-item tool finally developed in this study, the Cronbach's alpha value, sub-factors, and the reliability of all items were checked when removing the items. The

reliability of all the items was .88, and the reliability of each sub-factor was confirmed as 1.86, 2.88, 3.81, 4.82, and 5.86, so the reliability of the tool was verified to be suitable for use. In addition, there were no additional items that caused a change in reliability when removing the items, so no additional items were removed (Table 3).

Table 3.
Tool reliability analysis (N=299).

Factor (Number of questions)	Question number	Cronbach's alpha for deleted item	Cronbach's alpha
Factor 1 (4) Inconvenience of aging	1	0.87	0.86
	2	0.87	
	7	0.87	
	9	0.88	
Factor 2 (4) Inconvenience of female hormone deficiency	10	0.87	0.88
	11	0.87	
	13	0.87	
	15	0.87	
Factor 3 (5) Family success	19	0.88	0.81
	27	0.89	
	29	0.89	
	30	0.88	
	46	0.88	
Factor 4 (3) Appearance due to aging	4	0.87	0.82
	5	0.87	
	6	0.88	
Factor 5 (2) Aging and lifestyle change	22	0.87	0.86
	23	0.88	
Total	18 questions		0.88

3.6. Determination of the final tool

A total of 18 questions were confirmed as a result of developing a successful aging measurement tool for middle-aged women and verifying the validity and reliability. It is composed of a total of 5 factors, and considering the characteristics of the items included in each factor, factor 1 is named 'inconvenience of aging', factor 2 is named 'inconvenience of female hormone deficiency', factor 3 is named 'family success', factor 4 is named 'appearance due to aging', and factor 5 is named 'aging and lifestyle change' (Table 3). It is measured on a 5-point Likert scale, and the score is 18 points to 90 points, which means that the higher the score, the higher the successful aging.

4. Discussion

This study developed a successful aging tool for middle-aged women. The developed tool consists of 18 questions with 4 factors, and as a result of the construct validity verification, the 5 factors were named aging discomfort, 'convenience of female hormone deficiency', 'family success', 'appearance due to aging', and 'aging and lifestyle change' according to the characteristics of the marked items. In a recent study dealing with aging, it was suggested that preparation for retirement should be carried out from a life cycle perspective [21], and the outcome and process of successful aging should be properly

measured before old age. Middle age, which is the decisive background that determines the quality of life in old age, is the most important section in preparing for successful aging [22].

In this study, a tool to measure successful aging was developed based on the comprehensive and specific experiences of successful aging in middle-aged women. Therefore, it is believed that the tool of this study can be used to assess the degree of successful aging of middle-aged women and to reveal difficulties and obstacles to successful aging, and furthermore, it will provide important basic data for preparing nursing intervention measures that can support the successful aging of middle-aged women.

However, this study has some limitations. First, the validity of the developed tool was verified by exploratory factor analysis, and confirmatory factor analysis was not performed additionally. Therefore, we suggest additional research that supplements these areas. Second, since participants were selected by Internet platform addresses presented on the websites of some local institutions, this study has limitations in generalizing the results, so follow-up studies are needed to secure the validity of the developed tool. Finally, since this study developed a successful aging tool that reflected the characteristics of a specific target of middle-aged and late-aged women, it is expected that it can be expanded to research on tool development for subjects of different life cycles and gender.

Acknowledgments:

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