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Article

Development of a structured interview to explore interpersonal schema of elderly living alone based on autobiographical memory

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Abstract: As a growing public interest in social health of elderly, studies focusing on social networks and interpersonal relationships of the elderly are needed. The present study was conducted to develop a structured interview to evaluate the interpersonal schema based on Self-Defining Memory of elderly. First, the word cues that the elderly often report on interpersonal events were confirmed. Next, the indices and scoring rules were prepared, including Relationship frequency (RF), Conflict frequency (CF), Dominance mean (Dm), and Warmth mean (Wm). Healthy elderly people living alone (mean age = 71.81, SD = 3.95) were interviewed. Finally, the correlation between each index and Short form of Korean Inventory of Interpersonal Problems Circumplex Scales (KIIP-SC) was analyzed for criterion validity. The inter-rater reliability was substantial (Kappa = .61 ~ .66). Based on the analysis of criterion validity, the indices of CF, Dm, and Wm indices showed an appropriate level of criterion validity. This study developed a structural interview based on a novel system of reporting autobiographical memory and established indices with appropriate validity to evaluate interpersonal relationships. The interview is expected to identify the characteristics of interpersonal relationships of the elderly and contribute to the establishment of the elderly community, accordingly.

Keywords: Interpersonal relationship; Interpersonal schema; Elderly; Structured interview

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1. Introduction

The paradigm for health is shifting along with the increment of human lifespan throughout advances in medicine [1]. For health policy makers of nowadays, it will be a key task to pay attention to the social aspects of health and to avoid factors that hinder personal and social health. In this regard, one of the emerging issues is significant increase in the number of elderly living alone as becoming an aging society [2]. It has been associated new social problems including deaths due to loneliness associated with social alienation and narrower interpersonal relationships of the elderly living alone [3]. Accordingly, the policy to protect against social alienation by developing an elderly community has become a global trend in recent years [4-6]. Most of these elderly communities are based on geographic proximity [4-5]. However, the natural development and maintenance of interpersonal relationships are not only shaped by simple geographic proximity, but are also affected by various interpersonal factors as individual characteristics, schema and attitudes toward interpersonal relationships, and shared lifestyles and interests [8-10]. Hence, it is important to identify and analyze factors that affect the interpersonal relationships for a successful elderly community.

The interpersonal schema is considered as a decisive factor that fundamentally affects both the initiation and maintenance of interpersonal relationships among many other factors influencing interpersonal relationships [8]. The interpersonal circumplex model (IPC) describes the interpersonal behaviors based on two orthogonal fundamental domains: Dominance (or agency, control) and Warmth (or communion, affiliation) [11-12]. The model hypothesizes that interpersonal schema and behavior represent the interaction between domination/submission and friendliness/hostility. The individual differences in interpersonal relationship are classified into eight sectors (or octants) under these two axes. The octants with high relevance are adjacent to each other, and if they are unrelated, they are located at an angle of 90°, and if they exhibit opposite characteristics, they are located at an angle of 180° (figure 1). The advantage of IPC that it is not only directly related to the conceptualization and evaluation of personality disorders [13], but is also consistent with personality classification according to the five-factor theory, enabling a broad interpretation of the interpersonal behaviors of healthy and clinical population [14-15].

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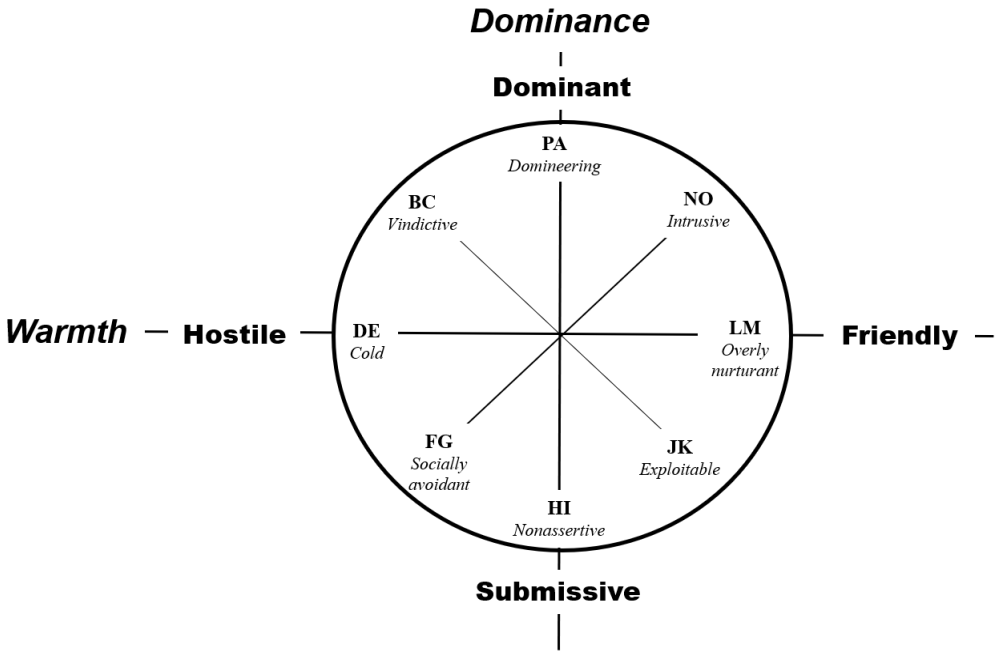

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Figure 1. Interpersonal Circumplex Model[11-12]
Note. The IPC model classified interpersonal schema and behaviors into eight octants under orthogonal two axes (Dominance and Warmth). Each octant was described as Domineering (PA), Vindictive (BC), Cold (DE), Socially avoidant (FG), Nonassertive (HI), Exploitable (JK), Overly Nurturant (LM), and Intrusive (NO) characteristics.

Considering that the importance of interpersonal relationships is constantly being emphasized in the mental health of the elderly, literatures focusing on interpersonal relationships of and evaluation tools specific to the elderly based on IPC are insufficient despite the high utility of the model. Moreover, various scales used to assess interpersonal schema based on IPC have been developed and used for clinical and research applications to date, still these scales are limited by their self-reported features using paper and pencil [16, 12]. In addition to the general disadvantages of self-reporting assessment tools, such as the impact of social desirability and problems caused by individuals not really understanding themselves well [17], the paper-delivered tests raise realistic concerns especially in the elderly, including the high illiteracy rate of elderly population compared to younger adults, which may interfere with the response of the elderly to questions [18-19]. Further, the paper-and pencil-based self-reported tests are associated with inherent limitations, as personalization is difficult because the item content is limited to general situations and interpersonal relationships [17]. An objective measure that has greater ecological valid than paper-and pencil-based self-reported tests would be needed to evaluate the interpersonal schema in elderly.

Self-Defining Memory (SDM) is a part of autobiographical memory but is more specific, vivid, emotionally intense memory, suggesting that self-discovery enables self-understanding, and contributes to a sense of identity [20]. Exploring SDM would be helpful not only to increase the ecological validity based on individual experience but also to utilize the strengths of the IPC model in the assessment of interpersonal schema, because it reflects the continuing interests and unresolved conflicts of individuals, and contains a core belief (schema) of oneself and the world [21]. In particular, SDM for interpersonal events is formed by experiences and behaviors in individual relationship to date, which can again influence the future interpersonal behaviors [22-23]. It is considered as appropriate for the evaluation of interpersonal relationships and serves as an important predictor of individual behavior in future relationships. Many researchers have developed several types of interview and performance evaluation tools to assess autobiographical memories [24-25]. However, most of the measurements have been developed for the purpose of identifying disease-specific impairment of autobiographical memory, with limited validity for evaluation of the extent and degree of impairment such as the accuracy and specificity of memory, and impossible to evaluate core beliefs or relationship schema quantitatively [24, 26-27].

We aimed to develop a structured interview for evaluating the Interpersonal schema based on Autobiographical Memory (IAM) of elderly living alone. In particular, we tried to develop the interview suitable for the evaluation of interpersonal schemas, while not being too broad in the content of the reported SDM. To this end, we standardized the word cues to those of life events involving interpersonal relationships that elders living alone often report. In addition, in order to systematically measure the interpersonal schema according to the two dimensions of Dominance and Warmth based on the IPC, we developed scoring rules according to the typical interpersonal schema and behaviors of each axis based on previous studies [16].

2. Materials and Methods

Development of the structured interview

1. Literature review and initial development

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Cue item generation was conducted via a systematic review of assessment tools based on the Self Memory System (SMS) [28], well supported theoretical model of autobiographical memory (AM) by evidences. Previous studies have evaluated semantic memories and schema of AM using word cues, mainly presented as emotional words or events that people commonly experience in their lives. In this study, items were created using a list of life events as cues in order to facilitate the retrieval of self-referential memories by the elderly [29-32]. Berntsen and Rubin [29] provided a list of 35 cultural and universally experienced events in a lifetime. In this study, 'other' items were added to consider the specificity of Korean elderly. A structured interview was constructed based on derived cues of eggplant. Questions and prompts for each question were designed to enable the Korean elderly to understand based on a review of a single geriatric psychiatrist and two clinical psychologists, and were visually presented to increase the attention and memory of cue words [33-34].

2. The pilot study

The purpose of the pilot study was to identify the content categories of AM mainly reported by the elderly living alone in Korea, determine the word cue appropriate for assessing the interpersonal schema, and determine the interview structure. Most of the previous studies on AM and SDM of healthy people used general cue words because older people were not the only focus of research, suggesting limitations that cues were not only overly broad, but also unsuitable for the elderly. Therefore, we tried to standardize the word cues appropriate for the elderly living alone.

First, convenience sampling of the elderly living alone in Wonju City and aged 65 to 80 years based on the census data of the Ministry of Health and Welfare (MoHW), confirming participation by telephone. In order to adjust for the role of cognitive decline in the understanding of tasks and recall of autobiographical memory, individuals whose Mini-mental state examination-dementia screening (MMSE-DS) [35-36] scores of -1.5 sd or below compared to age and educational norm or those who were diagnosed with major neurocognitive disorder were excluded. The total number of participants was 30 (Females = 21, mean age = 71.73 years, SD = 3.67). Based on a review of all the 36 cards, participants were instructed to choose and freely talk about 3 to 5 most memorable events in their lives within 2 hours without any restriction. Interviewers were three students who were enrolled in their master's course majoring in clinical psychology, and the interviews were conducted under the supervision of a licensed clinical psychologist. The entire interview was recorded with the participants' consent. In the analysis of the pilot study, 12 cues with a reported frequency of more than 20% were selected (Table 1), and all the 12 cues were related to interpersonal relationships. Finally, the interview structure of IAM was established through agreement between one geriatric psychiatrist and two clinical psychologists after reviewing the entire recording protocol.

Table 1. Word Cues

No.	Category	No.	Category
1	Serious illness	7	Marriage
2	Having grandchildren	8	Divorce
3	Death of parents	9	Baptism
4	Spousal bereavement	10	Socializing with peers
5	First job	11	Earning money for the first time
6	Brothers/sisters	12	Procreation

Note. Ordered by frequency of appearance.

3. Final interview protocol

In the final version of IAM, the categories for autobiographical memory were modified to a total of 10. As a result of the pilot study, 'First job' and 'Earning money first time' were merged because the participants showed similar reports under these two categories,

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and 'marriage' and 'divorce' were also merged because these categories were reported similarly by the spouses. Among 10 thematic category cards, three important events in the participants' life were selected and reported.

Next, the following scoring rules were prepared for scoring and coding individual interpersonal schema.

Relationship frequency (RF): When the content of SDM included interpersonal relationships in each category, a score of 1 was coded. Therefore, the total RF score was in the range of 0-3.

Conflict frequency (CF): A score of 1 was coded when there was at least one expressed reference to the fight, disagreement, or disappointment caused by a conflict of desire or goal between at least two characters (not necessarily including participants) and the total score was in the range of 0-3 [37].

Finally, each reported SDM was scored according to the typical behavior index of the Dominance and Warmth axes [16]. The Dominance and Warmth scores for each question ranged between -1.0 and 1.0. Higher scores on the Dominance axis indicated SDM for dominant behavior in interpersonal situations, and lower scores indicated SDM for submissive behavior. Higher scores on the Dominance axis suggested that SDM for intimate and friendly behavior in interpersonal situations, and lower scores indicated SDM for cold and indifferent or even hostile behavior. The average score of the interpersonal schema reported under each category was used as an indicator, so that the average location of the individual interpersonal schema was identified on the quadrant consisting of two dimensions: domination-obedience (Dominance index mean value; Dm) and friendliness-hostility (Warmth index mean value; Wm).

Participants

Similar to the pilot study, the study involved elderly living alone in Wonju city and aged between 65 and 80 years based on the census data of the MoHW for the elderly living alone. First, among the individuals who did not participate in the pilot study, 150% of the participants were allocated based on the dropout rate via stratified random sampling according to the residential area (urban vs. rural) and gender. Only individuals who agreed to participate in the study through telephone contact were recruited. In order not to be disturbed by cognitive decline in the understanding of tasks and recall of autobiographical memory, individuals whose Mini-mental state examination-dementia screening (MMSE-DS) [36-37] scores of -1.5 SD or below compared to age and educational norm or who were diagnosed with major neurocognitive disorder were excluded. In addition, since depressed mood was known to affect the recollection of autobiographical memories in the elderly [38], the depressed elderly who scored 10 or more in the Geriatric Depression Scale-Short Form(SGDS) [39] were also excluded. Participant demographic information is presented in Table 2.

This study was conducted with the approval of the institutional ethics committee of Yonsei University Wonju Severance Christian Hospital (protocol #CR318026).

Table 2: Demographic characteristics(n=100).

	Mean(range) or %	SD
Age (year)	71.50(65-79)	3.72
Gender (female; %)	63	
Education (year)	7.31(0-20)	4.15
Period of living alone (year)	18.23(1-47)	10.77
MMSE-DS	26.73(20-30)	2.24

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SGDS	3.09(0-9)	2.73

Note. MMSE-DS = mini-mental status examination-dementia screening; SGDS = Geriatric depression scale-short-form

Additional outcome measures

MMSE-DS [35-37]: it is a 30-point questionnaire used to screen dementia. It consists of brief items used to evaluate time and place orientation, memory registration and recall, attention, naming, command execution, repetition, visuospatial ability, understanding and judgment.

SGDS [39]: It is a shortened form of a 30-item elderly depression scale developed by Yesavage [40] to measure elderly depression. The sensitivity and specificity of sGDS for depression screening has been reported to be comparable to that of conventional GDS. The total score ranged between 0 and 15.

Short form of Korean Inventory of Interpersonal Problems Circumplex scales (KIIP-SC) [41]: KIIP-SC is a shortened version of the Inventory of Interpersonal Problems Circumplex scales (IIP-C) developed by Alden, Wiggins, and Pincus [42] based on the IPC model. IIP-C has been used to comprehensively evaluate interpersonal issues and identify the most important interpersonal issues. The KIIP-SC is a self-report test of 80 questions and consists of 8 subscales: Domineering subscale (PA) measures issues related to controlling and manipulating others; Vindictive subscale (BC) measures challenges related to excessive interest in one's well-being; Cold subscale (DE) evaluates problems related to emotional experience and expression; Socially avoidant subscale (FG) measures difficulties related to non-social tendencies and shyness; Nonassertive subscale (HI) measures lack of self-confidence, assertiveness, and self-esteem; Exploitable subscale (JK) is used to assess behaviors related to persuasion and exploitation without maintaining independence; Overly Nurturant subscale (LM) measures issues caused by excessive sensitivity and altruism; and Intrusive subscale (NO) assesses behaviors related to excessive involvement with others. KIIP-SC is composed of a total of 40 items based on 5 questions that best reflect each of the 8 factors, and the internal consistency (Cronbach's α) ranged from .61 to .89 among college students and adults.

Procedure

Since the measure developed in this study is a structured interview, the interviewers were trained in the interview and scoring methods in advance and obtained sufficient practice before conducting the IAM. The interviewers were composed of college graduates working as life managers of elderly living alone and were familiar with interviewing the elderly.

This study was based on 1:1 interviews at a place convenient for the study participants (home or outpatient clinic at a university hospital located in Wonju). Written explanations and oral explanations were provided so that the participants fully understood and provided informed consent before participation in the interviews. After the MMSE-DS and SGDS, a structured interview lasting about 30 minute was conducted, and KIIP-SC was prepared. Every protocol used in the analysis was written verbatim. The interpersonal schema was scored by two expert clinical psychologists independently.

Statistical analysis

The data were analyzed using SPSS 25.0. First, descriptive statistics were analyzed to identify participants' demographic information. Next, Cohen's Kappa coefficients of indicators in the structured interview scored by each rater were tested for inter-rater reliability. The interpretation of the inter-rater reliability was as follows [43]. >.00 = poor; .00 to .20 = slight; .20 to .40 = fair; .40 to .60 = moderate; .60 to .80 = substantial; .80 to 1.0 = almost perfect. If the raters' scores were inconsistent, the average was calculated and adjusted for the next analysis. Finally, to examine the criterion validity, a Person's correlation analysis

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between different subscales of KIIP-SC, RF, CF scores, average and standard deviation scores of D and W was performed.

3. Results

Table 2 shows demographic information of participants, with a total of 62 women and 37 men completing the interview.

3.1. Inter-rater agreement of IAM

Table 3 shows Cohen's Kappa coefficients for reliability of indicators scored independently by the two raters. All of the RF, CF, D, and W indicators showed substantial agreement (RF Kappa = .66, p <.001; CF Kappa = .61, p <.001; D Kappa = .62, p <.001; W Kappa = .62, p <.001).

Table 3: Inter-rater agreement of the Interpersonal schema based on autobiographical memory (IAM) sub-indicators.

	Kappa	P
RF	.66	.000
CF	.61	.000
Dominance index	.62	.000
Warmth index	.62	.000

Note. RF = Relationship Frequency; CF = Conflict Frequency.

3.2. Criterion validity

Next, Pearson's correlation analysis was performed to examine the correlation between sub-indicators of IAM (Table 4). The RF showed a significant positive correlation only with CF (r = .37, p <.001). Meanwhile, CF showed a significant correlation with Dm and Wm (Dm r = .30, p <.05; Wm r = -.73, p <.001).

To examine the validity of the criterion, the correlation between the Sub-indicators of IAM and subscales of KIIP-SC was calculated (Table 4). First, the RF did not show a significant correlation with the subscale of KIIP-SC. CF showed a significant positive correlation with the HI and NO subscales of KIIP-SC (HI r = .47, p <. 001; NO r = .47, p <.001). Next, Dm showed a significant positive correlation with the NO subscale of KIIP-SC with r =.43, p <.05, and Wm showed a significant negative correlation with the FG and HI subscales of KIIP-SC (FG r = -.41*, p <.05; HI r = -.48, p <.001).

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Table 4: Correlation between the Interpersonal schema sub-indicators and subscales of Short form of Korean Inventory of Interpersonal Problems Circumplex scales (KIIP-SC)

	1	2	3	4	5	6	7	8	9	10	11	12
1. RF	-											
2. CF	.37**	-										
3. Dm	.09	.30*	-									
4. Wm	.03	-.73**	.02	-								
5. PA	.23	.31	.09	-.08	-							
6. BC	-.04	.00	.11	.01	.35**	-						
7. DE	-.02	.26	.05	-.31	.18	.65**	-					
8. FG	.00	.26	.03	-.41*	.34**	.48**	.70**	-				
9. HI	.14	.47**	.29	-.48**	.19	.56**	.71**	.55**	-			
10. JK	.10	.08	.07	.13	.35**	.38**	.45**	.48**	.51**	-		
11. LM	.18	.09	.16	.12	.28**	.27**	.36**	.45**	.40**	.75**	-	
12. NO	.26	.47**	.43*	-.23	.55**	.25*	.21*	.41**	.18	.50**	.50**	-
Mean	2.56	.90	-.56	.63	9.00	11.82	13.51	11.45	14.22	13.37	13.96	10.31
Sd	.63	.81	.69	1.21	2.45	3.02	3.68	3.11	3.54	3.27	2.92	2.28

Note. RF = Relationship Frequency index; CF = Conflict Frequency index; Dm = Dominance index mean value; Wm = W armth index mean value; PA = Domineering subscale of Short form of Korean Inventory of Interpersonal Problems Circu mplex scales(KIIP-SC); BC = Vindictive subscale of KIIP-SC; DE = Cold subscale of KIIP-SC; FG = Socially avoidant subsc ale of KIIP-SC; HI = Nonassertive subscale of KIIP-SC; JK = Exploitable subscale of KIIP-SC; LM = Overly Nurturant sub scale of KIIP-SC; NO = Intrusive subscales of KIIP-SC

4. Discussion

In this study, a structured interview was developed to evaluate the Interpersonal schema based on Autobiographical Memory (IAM) of the elderly living alone, and the reliability and validity of the ratings were examined. It was organized based on a search of autobiographical memories, overcoming the limitations of the self-report scale, and provided personalized evaluation using events that are important to individuals. In addition, a word list that frequently reported self-defining memories related to interpersonal relationships was provided for the elderly living alone in Korea, so that the interview evaluated their interpersonal schemas more efficiently.

First, the inter-rater reliability of IAM was identified. The substantial reliability of all indicators suggested that the agreement between the raters of indicators for the interpersonal schema based on the interview was sufficiently reliable. Therefore, the scoring method provided by the structured interview tool developed in this study represents a stable method for the evaluation of interpersonal schema based on the exploration of personal self-defining memories.

Next, in order to examine the validity of the structured interview, the correlation between the sub-indicators of the interview was determined, and the relationship with the

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KIIP-SC sub-scale was analyzed. The relationship frequency (RF), a level of reporting on the content of interpersonal relation in important self-defining memories did not show any significant correlation with other indicators except the conflict frequency (CF) reporting interpersonal conflicts. Since there was no significant association with any of the subscales of KIIP-SC, the RF was considered insufficient to identify the interpersonal schemas. However, CF showed a significant negative correlation with the mean value of the Warmth index (Wm), which measures the point on the scale of the scale of behaviors from intimate and compassionate to cold and indifferent in interpersonal behavior. It showed a significant positive correlation with the mean value of the Dominance index (Dm), which measures the point on the continuous line from the dominant behavior to the submissive behavior in interpersonal relationships. In other words, individuals who report more memories of conflicts related to interpersonal relationships, whether or not they are involved in the conflict, are expected to be more likely to exhibit relative cold behavior and were indifferent in interpersonal relationships as well as behaviors controlling or dominating others.

Correlation between the subscales of IAM and KIIP-SC was confirmed to analyze the criterion validity. The CF score showed a significant positive correlation with the HI and NO subscales of KIIP-SC. As we mentioned above, it revealed SDM related to interpersonal conflict, and was also significantly correlated with challenging interpersonal relationship. Thus, the elderly who recalled conflict situations more frequently among other memories related to interpersonal relationships are likely to exhibit relative dysfunction in interpersonal behaviors, such as difficulty to express their thoughts and feelings in social situations, while excessively interfering and engaging with others' actions.

The Dm score, measured in autobiographical memory selected as important to oneself, showed a significant positive correlation with the NO subscale of KIIP-SC, which measures issues related to excessive involvement with others. Thus, individuals exhibiting more proactive and dominant behavior in interpersonal relationships based on autobiographical memories more frequently experienced problems involving interference with and engaging in actions with others, which was consistent with the location of NO subscale on a high level of Dominance axis in the IPC model [41, 44]. However, the Dm score did not show a significant correlation with the PA subscale of KIIP-SC, which is used to measure challenges related to controlling and manipulating others and located at the highest level on the Dominance axis. Also, no negative correlation was observed between the Dm score and the HI, the nonassertive subscale of KIIP-SC, located at the bottom of the Dominance axis.

The Wm score showed a significant negative correlation with the FG, representing challenges related to social avoidance and HI, representing challenges related to non-assertiveness. Individuals who more often express intimacy in interpersonal relationships and behave favorably towards others are very unlikely to experience issues related to excessive avoidance of social interaction or lack of self-confidence and self-assertion. This negative correlation suggests that the Wm score is valid for the assessment of behavior in the Warmth axis since FG is a parameter located at the bottom of the Warmth axis in the IIP model. However, the Wm score did not show significant correlation with the LM subscale of KIIP-SC, which measure issues related to excessive responsibility for the needs of others, or DE subscale, which measures limitations related to emotional experience and expression. Each subscale was placed at the highest and the lowest sides on the Warmth axis of IPC model, respectively.

The above results are likely due to the primary focus of KIIP-SC on problematic behaviors reviled in interpersonal relationships. It is necessary to understand the terms of interaction with the individual environment whether or not an individual's main behavioral patterns in interpersonal relationships caused problems [45-46]. Thus, the elderly living alone who increasingly reported the dominant and leading behaviors based on a high Dm score showed intimacy with others but likely manifested frequent issues related to invasive and excessive interference behavior, rather than challenges related to control and manipulation of others [41, 44]. Likewise, individuals who report as more apathetic

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and indifferent to others based on a low Wm score were likely to experience difficult social interaction and suppression, rather than issues caused by intentional distancing [41].

The study limitations are as follows. First, the study participants were limited to the elderly living alone in small and medium-sized towns, and therefore do not represent a large city or rural area. It is possible that the characteristics of the residential area were reflected in the interpersonal behaviors and schemas reported by participants. This limitation was addressed by recruiting participants according to the demographic characteristics of the elderly living alone in Wonju city, and determining the schematic of SDM and interpersonal relations according to actual interpersonal relationship patterns of the elderly living alone. Second, further studies are needed to determine whether the interpersonal schema identified using the structured interview developed in this study can actually predict the behavior of the elderly living alone. In this study, an interpersonal problematic behavior scale was used to confirm the validity of the criterion, and not the real-world interpersonal behaviors of participants. Therefore, further studies are needed to identify the role of interpersonal schematic index based on this interview in the actual interpersonal relationship behavior. Finally, the interviewers and the raters of interview were separated, and the raters only read the written verbatim for scoring, since this study was conducted as a part of a research project providing emotional support for the elderly living alone. As a result, it is possible that the reliability of the evaluation is somewhat questionable because nonverbal communication clues such as facial expressions, intonation, and gestures were not considered [47]. The inter-rater reliability may be enhanced by providing structured manuals and formal training to enable implementation and scoring, and direct evaluation of the interviewer's method.

5. Conclusions

This study developed a structured interview to evaluate interpersonal schemas based on autobiographical memory, and analyzed its reliability and validity. Until now, most of the measures of interpersonal relationship schemes relied on self-reports, which are limited by the effects of social desirability, insufficient ecological validity, and the inability to use by the illiterate. We addressed this limitation using a brief interview method, and a more personalized evaluation strategy based on autobiographical memories. In addition, this study is meaningful in that it uses standardized cue words appropriate for the elderly living alone in Korea to systematically evaluate interpersonal relationships, and developed and validated indicators according to the IPC model, which is actively used in clinical and research fields. Based on the interviews developed in this study, it is expected that the characteristics of interpersonal relationship among the elderly living alone can be understood and used for social and public goals such as establishing elderly communities as well as in research applications.

6. Patents

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