Development of the Japan Science and Technology Agency Index of Competence to Assess Functional Capacity in Older Adults: Conceptual Definitions and Preliminary Items

Hajime Iwasa, PhD[1,2,3], Yukie Masui, PhD[2,3], Hiroki Inagaki, PhD[2,3], Yuko Yoshida, PhD[2,3], Hiroyuki Shimada, PhD, RPT[2,3,4], Rika Otsuka, MA[2,3], Kazunori Kikuchi, MA[2,3], Kumiko Nonaka, PhD[2,3], Hiroto Yoshida, PhD[3,5], Hideyo Yoshida, MD, PhD[2,3], and Takao Suzuki, MD, PhD[2,3,4]

Abstract

Improvement in the health of older people and changes in their lifestyles necessitate a scale that can better measure their competence at a higher level. This study describes the development process of the Japan Science and Technology Agency Index of Competence (JST-IC) by (a) refining conceptual definitions and developing preliminary items and (b) examining the basic properties of the items. Participants were 1,253 septuagenarians (539 men and 714 women) living in communities, who were asked to judge whether they were independent via 88 items. To examine the basic properties of the preliminary items, five different analyses were conducted. Thirty-four items were considered as inappropriate (6 overlapped between the analyses): (a) 9 due to very high or low ratios of responders who answered "yes," (b) 4 due to gender or regional differences, (c) 5 due to their weak association with health status, (d) 9 due to low communalities in factor analysis, and (e) 13 due to redundancy of meaning with other items. Conceptual definitions and preliminary items were developed, and the basic properties of the items were examined to create the JST-IC. The next step would be to screen the remaining 54 items to create the final version of the scale.

Keywords

competence, community-dwelling older adults, functional capacity

Introduction

Assessing Competence Among Older Adults

The proportion of older adults aged 65 and above in Japan was 4.9% in 1950, increased to 17.4% in 2000, and is predicted to reach up to 35.7% by 2050 (National Institute of Population and Social Security Research, 2002; Statistics Bureau, Ministry of Internal Affairs and Communications, 2001). For such an increasingly aged society, it is important to detect and treat common geriatric symptoms early and to promote the maintenance of functional capacity, to maintain the health and well-being of older people (Iwasa et al., 2003; Suzuki et al., 2003).

A health index for older people recommended by the World Health Organization (WHO; 1984) uses the degree of independence concerning functional capacity. *Functional capacity* is a general term for various physical and mental functions necessary for older people to lead their daily lives. The hierarchical model of competence by Lawton (1972) systemizes functional capacity into the following seven conceptual levels: (1) *Life Maintenance*, (2) *Functional Health*, (3) *Perception-Cognition*, (4) *Physical Self-Maintenance*, (5) *Instrumental Self-Maintenance*, (6) *Effectance*, and (7) *Social Role*. *Physical Self-Maintenance*, the fourth level of the model, corresponds to the independent state of

[1]Fukushima Medical University, Japan
[2]Tokyo Metropolitan Institute of Gerontology, Japan
[3]Research Institute of Science and Technology for Society, Tokyo, Japan
[4]National Center for Geriatrics and Gerontology, Obu, Japan
[5]Tohoku Bunka Gakuen University, Sendai, Japan

Corresponding Author:
Hajime Iwasa, Department of Public Health, School of Medicine, Fukushima Medical University, 1 Hikarigaoka, Fukushima 960-1295, Japan.
Email: hajimei@fmu.ac.jp

activities, referred to as activities of daily living (ADL). Those who do not achieve independence are categorized as "persons requiring care." However, as more than 80% of community-dwelling older adults are physically independent (Cabinet Office, Government of Japan, 2014), it is insufficient to use this as the only measure of functional capacity in older people. Indeed, the fifth to seventh stages of the competence also encompass higher level functions. Therefore, the fifth to seventh levels are collectively referred to as *higher level competence* (Iwasa et al., 2009; Suzuki et al., 2000).

The Tokyo Metropolitan Institute of Gerontology Index of Competence (TMIG-IC; Koyano, Shibata, Nakazato, Haga, & Suyama, 1987, 1991) was developed in Japan based on the hierarchical model of competence (Lawton, 1972) and used to assess the competence of community-dwelling older people. In this index, older people are asked to report their independence in 13 activities using a yes/no format. The TMIG-IC comprises three subordinate scales: *Instrumental Self-Maintenance, Intellectual Activity*, and *Social Role*, with each scale corresponding to the stages of *Instrumental Self-Maintenance* (Stage 5), *Effectance* (Stage 6), and *Social Role* (Stage 7) in the model (Lawton, 1972), respectively. The total score on the 13 items is indicative of higher level competence. The factorial validity, predictive validity, and reliability of the TMIG-IC have already been verified (Koyano et al., 1991). The TMIG-IC has been utilized in several studies to examine the relationship between higher level competence in community-dwelling older adults and other variables such as mortality (Takata et al., 2013), motor fitness (Makizako et al., 2010), cognitive function (Iwasa et al., 2008; Iwasa et al., 2003), depression (Iwasa et al., 2009), lifestyle habit (Yoshida, Yamazaki, Takahashi, & Yasumura, 2013), personality (Iwasa, Masui, Gondo, Kawaai, & Inagaki, 2010), interpersonal exchange (Jingu, Egami, Kinukawa, Sano, & Takei, 2003), and diet variety (Kumagai et al., 2003).

The Necessity for Developing a New Index

The living environment of older people has changed greatly in terms of the following five scopes since the TMIG-IC was developed around 25 years before. It is therefore probable that the expected competence of older people has altered due to such changes.

1. Change in the household structure—moving toward isolation: Among the households that include a person aged 65 years and above, the percentage of households with a single-living older person was 13.1% in 1986; this figure increased to 18.4% in 1998, and 24.2% in 2010 (Ministry of Health, Labour and Welfare, 2010). These statistics imply that the social isolation of older people is increasing, and that older adults

today are required to maintain their health and competence through largely their own efforts and the effective Japanese social insurance scheme (i.e., medical insurance, long-term care insurance, and pension system).

2. The social demand for active older people: There is an increasing demand for older individuals who aspire to perform productive activities in recent years. "Productive activities" refer to "activities that produce goods or services, regardless of whether or not there is any remuneration involved," for example, paid work, voluntary activities, and provision of assistance free of charge to family members, friends, and neighbors (i.e., housework, nursing care, and taking care of children; Herzog, Kahn, Morgan, Jackson, & Antonucci, 1998; Sugihara, 2010). The performance of productive activities not only promotes psychological adaptation in old age but also reportedly affects health maintenance in older adults (Sugihara, Sugisawa, Shibata, & Harada, 2008). In other words, today's society seeks an image of older persons who can perform productive activities and have the competence to execute them.

3. Increase in the number of older people as victims of crime: The percentage of older people as victims of crime has been on the increase (National Police Agency, 2013). Among the overall number of recognized crimes, those with older victims constituted 4.3% in 1993, which doubled to 9.5% by 2012. Among these crimes, intellectual crimes (i.e., fraud and embezzlement) were the most common, comprising 21.7% in 2012. In recent years, due to an increase in single-person older person households (Ministry of Health, Labour and Welfare, 2010), the need for older people to protect themselves and their possessions has increased.

4. Advancement and prevalence of electronic devices: Information and communication technology (ICT) devices that did not exist in the lives of older people in the past are now increasingly common. A survey conducted at the end of 2013 showed that the Internet usage rate was 68.9% among those aged 65 to 69 years, 48.9% for those aged 70 to 79 years, and 22.3% for those aged 80 years and above (Ministry of Internal Affairs and Communications, 2014). Mobile phones and emails have become indispensable tools for communication with one's family and friends. The Internet is now used ubiquitously in health and public offices, and is utilized to collect information on leisure activities. Such changes to the living environment require older people to be able to operate these new devices.

Table 1. Participant Characteristics (N = 1,253).

Gender (women), n (%)	714 (57.0)
Age group (years), n (%)	
70-74	712 (56.8)
75-79	541 (43.2)
Living alone, n (%)	175 (14.0)
Education, n (%)	
Primary education	384 (30.6)
Secondary education	489 (39.0)
University or higher	343 (27.4)
Others	37 (3.0)
Self-rated health (poor/very poor), n (%)	227 (18.1)
Ability to travel	
Able to travel by oneself using available modes of transportation	1,116 (89.1)
Unable to travel by oneself	137 (10.9)

5. Usage of everyday life information: Older individuals today need to be able to actively collect and scrutinize information and use it in their everyday life. Various media, for example, newspapers, TV, and the Internet, bring information that affect the lives of older people, such as the effects of health from radiation and air pollutants, global warming, and health practices for longevity. Health literacy is of particular significance for older adults (Ishikawa, Nomura, Sato, & Yano, 2008; Tokuda, Okubo, Yanai, Doba, & Paasche-Orlow, 2010). Health literacy refers to collecting health information necessary for maintaining one's health (i.e., information on the effects of therapeutic drugs, medical services, and safety of food products), scrutinizing it, and using it in everyday life.

This competence is believed to have changed to adapt to the changes in the living environment as the above. To clarify whether the competence of community-dwelling older people has improved, we compared the results of the survey conducted during the development of the TMIG-IC (1991; Koyano, Hashimoto, Fukawa, Shibata, & Gunji, 1993) with those of a recent survey in 2012 (Suzuki, Yoshida, & Masui, 2012). Both surveys were conducted on a randomly selected sample of older people aged 65 years and above across Japan. The average TMIG-IC score (with the highest possible score of 13) was 10.8 (SD = 3.0) in the 1991 survey, and 11.3 (SD = 2.7) in the 2012 survey. The percentage of those securing a perfect score (13 points) on the TMIG-IC was 39.3% in the 1991 survey and 48.9% in the 2012 survey. Thus, the average TMIG-IC score was higher in the 2012 survey than in the 1991 survey.

The Objective of the Present Study

As described above, first, the living environment of older individuals has changed greatly; second, the competences of community-dwelling elderly may be improving. Based on these two points, there is a demand for a new index (the Japan Science and Technology Agency Index of Competence [JST-IC]) that can better measure the competence of older people. The JST-IC developed in this study is a scale that (a) can measure higher level competence according to Lawton's hierarchical model of competence (Lawton, 1972), (b) can measure the "competences required for older individuals living alone to become independent and lead an active daily life" within the living environment of the modern active older citizen, and (c) has properties that require higher functioning to execute compared with the TMIG-IC (Koyano et al., 1991).

Thus, the objectives of this study were to devise conceptual definitions and preliminary items for the new scale, and to examine the basic properties of the preliminary items through five examination procedures: (a) ratio of respondents who answered yes to each item, (b) gender- and regional-based differences, (c) relation to health status, (d) factor analysis, and (e) resemblance of meaning with other items.

Method

Participants

This study was conducted in two areas: an urban area ("Town A") and a non-urban area ("Town B"). Individuals aged 70 to 79 years living in the community participated in this study. In Town A, equal interval sampling extracted every 10th person of the target age from the municipal resident registration files. In Town B, all individuals of the target age were extracted from the resident registration files. The total sample size consisted of 2,210 people (Town A: n = 1,071, 473 men and 598 women; Town B: n = 1,139, 499 men and 640 women). The survey was mailed to these 2,210 individuals, who completed it anonymously and returned it. When it was difficult for a respondent to fill in the survey due to a functional disorder, a house mate was permitted to act as a proxy. The survey was conducted between July and August 2011. We received 1,381 surveys (529 from Town A and 772 from Town B; total response rate = 62.5%). Of these, 128 were excluded from the analysis due to missing gender, age, and information about who responded to the questionnaire. Finally, 1,253 participants (56.7% participation rate; 539 men and 714 women; 74.0 ± 2.8 years old) with complete data sets were included. Table 1 shows the characteristics of the participants. The study was approved by the Ethics Committee of the Tokyo Metropolitan Institute of Gerontology. The study was described to all participants, who were advised that (a) their participation would be entirely voluntary, (b) they could withdraw from the study at any time, and (c) if they chose to withdraw or to not participate, they would not be disadvantaged in any way.
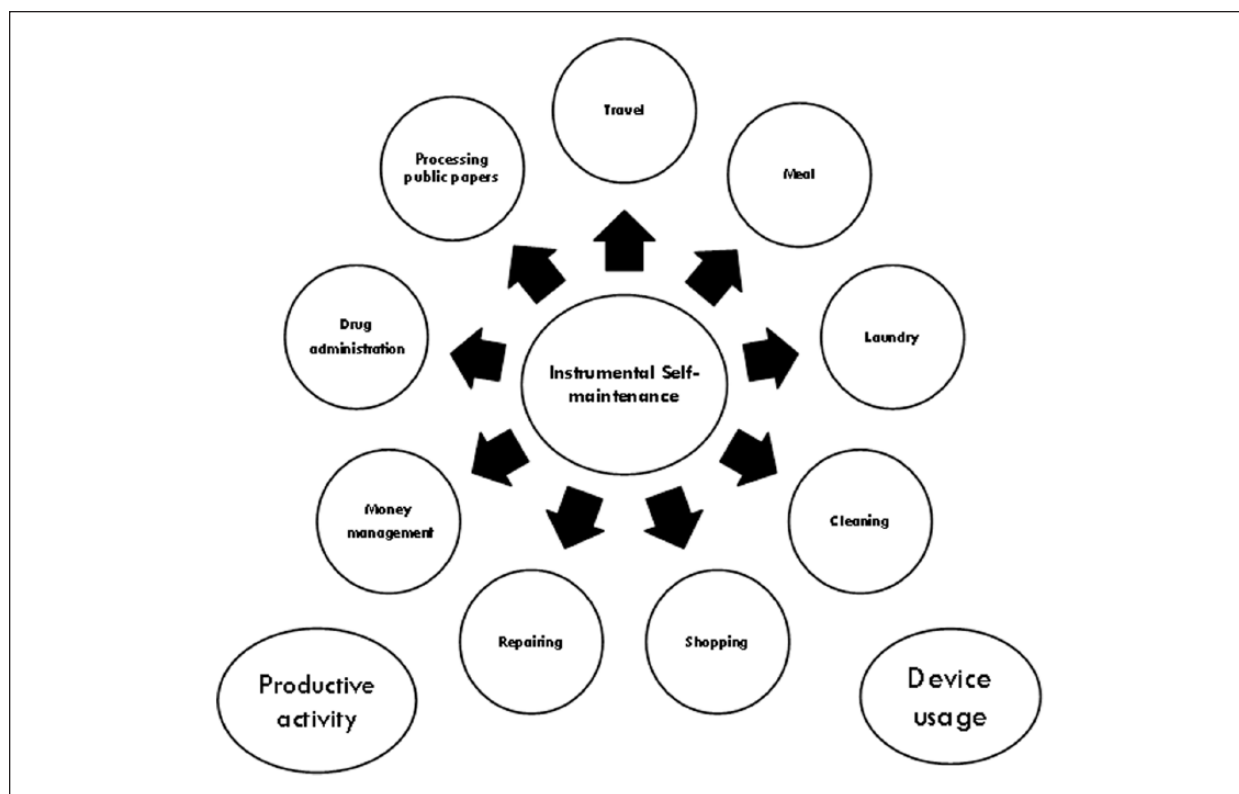
Figure 1. Expanding the scope of *Instrumental Self-Maintenance.*
Note. Instrumental self-Maintenance refers to the competence necessary for older persons living alone in the modern society to live independently.

Conceptual Definitions and Preliminary Items of the New Scale

Specific conceptual definitions and preliminary items were developed according to each subordinate scale of the TMIG-IC (Koyano et al., 1987, 1991; Lawton, 1972). When developing the conceptual definitions, information was collected from preceding studies in addition to lectures from gerontology specialists. We examined the collected information to derive conceptual definitions, develop items that measured each concept, and modify their wording.

The 11 domains of *Instrumental Self-Maintenance* were identified as (a) *Travel* (performing the procedures necessary for long-term travel, which includes looking up the directions to reach a new place and making travel and boarding reservations), (b) *Meal* (performing an eating behavior that is planned and that considered nutrition and hygiene), (c) *Laundry*, (d) *Cleaning*, (e) *Shopping* (buying products with consideration to a budget and by using new shopping devices), (f) *Repairing* (repairing household electrical appliances), (g) *Money management*, (h) *Drug administration*, (i) *Processing public papers* (using public offices and services), (j) *Device usage* (adapting to ever-progressing electrical appliances and ICT devices), and (k) *Productive activity* (performing productive activities that were paid or free, such as caring for others, producing goods and services,

and economic activities (Herzog et al., 1998; Okamoto, 2008; Sugihara et al., 2008; Figure 1).

The four domains of *Intellectual Activity* were identified as (a) *Intellectual tasks* (engaging in various hobbies with proficiency), (b) *Intellectual curiosity* (attitude and behavior related to engaging in new pieces of information actively), (c) *Information gathering* (attitude and behavior related to collecting information necessary for protecting one's safety and health, information necessary in everyday life, and making decisions about such information), and (d) *Creativity* (creating new things [e.g., invent devices or engage in an artistic activity] within one's life, and attitude and behavior that attempts to engage ingenuity; Figure 2).

The following five domains were set as sub domains of *Social Role*: (a) *Social interaction* (includes interaction with others), (b) *Social participation* (focuses on the activities for regional promotion), (c) *Familial and community roles* (fulfilling a role between individuals, family members, and in groups and regional activities, (d) *Social contribution* (whether the respondent engages in social contribution activities, especially with the next generation and the local community), and (e) *Paid work* (Figure 3).

Eighty-eight proposed items were developed (33 for *Instrumental Self-Maintenance*, 35 for *Intellectual Activity*, and 20 for *Social Role*; see Table 2 and Supplemental Material). Following this, we asked community-dwelling older adults to check each item with
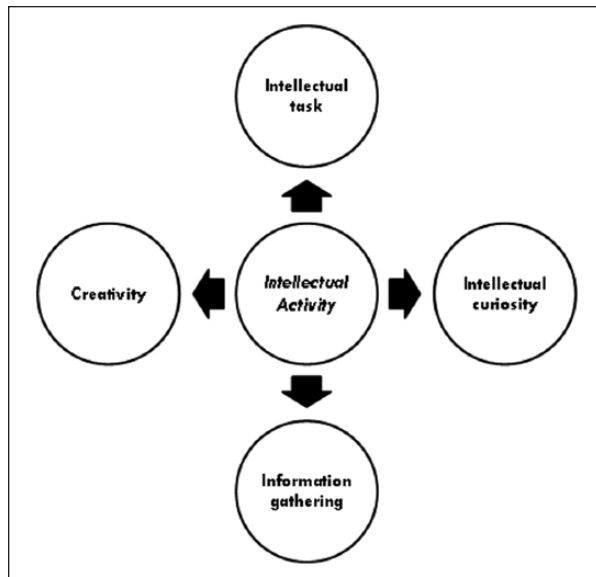
Figure 2. Expanding the scope of *Intellectual Activity*.
Note. Intellectual Activity refers to the competence necessary to actively engage in intellectual experience, access information, and sift through information.
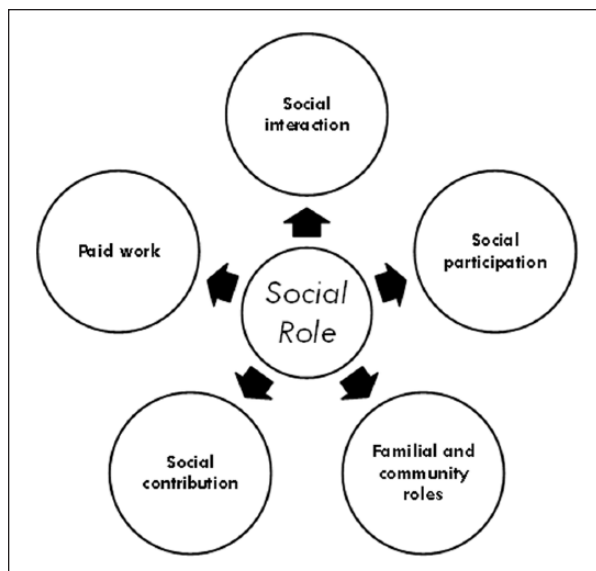

Figure 3. Expanding the scope of *Social Role*.
Note. Social Role refers to the competence necessary to actively participate in society and fulfill appropriate roles.

regard to ease in comprehension and response. Subsequently, further adjustments were made to the items with reference to their comments, by considering linguistic and semantic equivalents. To answer the JST-IC items, participants were asked to judge whether they were independent across the 88 items using a yes/no format.

Other Measurements

Data for age, gender, regional states, education level, chronic disease, the TMIG-IC, self-rated health, living with family, and basic ability to travel were included in the mail survey. Regional states were dichotomized for living in Town A or Town B. Chronic disease was self-reported by the participants, and was defined as having at least one of the following diseases: cancer, stroke, heart disease, or diabetes mellitus. To assess the TMIG-IC, participants were asked to report whether they were independent with respect to 13 daily tasks (e.g., using public transportation). Basic ability to travel was self-rated by the participants from 1 (*able to travel by oneself using public transportation, car, or bike*) to 6 (*bedbound*). Self-rated health was scored from responses to the question, "Would you say that your health in general is excellent, good, poor, or very poor?" The responses to this question were then dichotomized; people who responded "excellent" or "good" to the question were given a score of 0 and those answering "poor" or "very poor" were given a score of 1.

Data Analysis

To examine the basic properties of the preliminary items and identify inappropriate items, the following five scopes of analyses were conducted to examine (a) the ratio of yes response, (b) gender- and regional-based differences, (c) relation to health status, (d) factor analysis, and (e) resemblance of meaning with other items. To examine gender- and regional-based differences, and association of self-rated health in each JST-IC preliminary item, chi-square tests were performed using phi coefficients as indicators of effect size (Cohen, 1988, 1992). Exploratory factor analysis using the preliminary items with principal axis factoring was conducted to estimate communalities in each item and to identify inappropriate items. All statistical procedures were performed using SPSS for Windows (version 20.0; IBM, Chicago, IL, USA).

Results

Table 2 shows the properties of the 88 preliminary items with regard to the shortened name, ratio of respondents who answered yes to each item, effect size on gender- and regional-based difference, relation to health status, communalities of factor analysis, and whether the item resembled other items in meaning.

1. Ratio of yes response: Nine items were regarded as inadequate for the new scale; items with 90% or more of "yes" responses (i.e., a lower difficulty level compared with the TMIG-IC) were thought to be inadequate. These items include "separate your garbage (94.0% "yes" response)," "visit the electronics store to repair electronics (90.4% "yes")," "make payments when receiving bills for utilities (94.9% "yes")," "consume medication (95.7% "yes")," "secure residency certificate (93.2% "yes")," "make a phone call

(96.8% "yes")," and "watch or read the news frequently (93.5% "yes")." Similarly, items with 10% or lower of "yes" responses were thought to show floor effects and were considered inadequate. These items include "compose or perform a music piece (6.9% "yes" response)" and "engage in activities to pass on local customs (9.8% "yes")" (Table 2).

2. Gender- and regional-based differences: As the new scale developed in this study can measure competence through everyday activities reflected in each item, it is possible that these activities are affected by lifestyle factors and socioeconomic status. To develop a "pure" competence scale, excluding the effect of these lifestyle factors and socioeconomic status on the construct of the scale is essential. Thus, chi-square tests were performed to examine gender- and regional-based differences for each item using calculated phi coefficients as indicators of effect size. In accordance with previous studies (Cohen, 1988, 1992), a medium effect size (i.e., phi coefficient ≥0.30) indicated that the item contained gender- or regional-based differences. For gender-based differences, "prepare a meal by considering its nutritive value" (61.5% "yes" response from men and 89.5% from women; phi = -0.33), "use an iron" (71.2% "yes" from men and 94.1% from women; phi = -0.31), and "engage in crafts or sewing" (4.1% "yes" from men and 54.7% from women; phi = -0.53) were considered inadequate items. For regional-based differences, "ride the train or bus using an IC card ticket" (84.1% "yes" response from Town A and 24.6% from Town B; phi = 0.60) was considered an inadequate item (Table 2).

3. Relation to health status: The JST-IC developed in this study, as well as the TMIG-IC, assess competence. As competence may have a close relationship to health status in older adults (Iwasa et al., 2009; Koyano et al., 1991; Takata et al., 2013), items that have little association to health status can be considered as inappropriate items. Thus, we examined the relationships between self-rated health and each item, and regarded items whose phi coefficients were less than 0.10 as inappropriate items, leading to "engage in crafts or sewing" (phi = 0.09), "write poems" (phi = 0.06), "collect newspaper clippings" (phi = 0.09), "participate in an elders' association" (phi = 0.07), and "engage in activities to pass on local customs" (phi = 0.06), being considered as inappropriate items (Table 2).

4. Factor analysis: Exploratory factor analysis was conducted with a four-factor solution reached while referring to a scree plot (ratio of cumulative contribution: 36.2%). Communalities in each item were also estimated in the four-factor

solution, and items that had communalities of 0.15 or lower were considered inappropriate. Consequently, nine items, for example, "purchase things using an e-money card" (communality = 0.12), were considered as inappropriate (see Table 2).

5. Resemblance of meaning between items: we considered resemblance and duplication of meaning between items, and classified 13 items as inappropriate items (Table 2).

After performing the above five examinations, 34 items were considered as inappropriate (some items overlapped in more than one examination category) out of the 88 preliminary items, and 54 items were entered as potential items for the new scale for competence (Table 2).

Discussion

The living environment of community-dwelling older people has changed greatly, and the competences of community-dwelling older adults may have improved since the TMIG-IC was developed at around 25 years before. To develop the JST-IC such that it can measure the competence of modern day older citizens at a higher level, this study aimed to develop conceptual definitions and preliminary items for the new scale, and to examine the basic properties of the preliminary items. According to each subordinate scale of the TMIG-IC, specific conceptual definitions and 88 preliminary items in the JST-IC were developed (33 for *Instrumental Self-Maintenance*, 35 for *Intellectual Activity*, and 20 for *Social Role*). After testing the item properties with the above mentioned five analyses—(a) the ratio of yes response, (b) gender- and regional-based differences, (c) relation to health status, (d) factor analysis, and (e) resemblance of meaning with other items—54 items were selected as potential items for the new scale for competence in older people.

Nine items were regarded as inappropriate due to either a very high (≥90%) or very low (≤10%) "yes" response rate. The mean score on the TMIG-IC was 11.6 (*SD* = 2.5) and the ratio of yes response was 90% or more in 9 of all 13 items in the TMIG-IC in the present study. As the JST-IC should require a higher level of functioning to complete compared with the TMIG-IC, the number of items that have a ceiling effect should be lower compared with the TMIG-IC. In addition, items that show floor effects are believed to be inappropriate items as psychometric measurements. These 9 items were subsequently regarded as inadequate items.

Due to regional- or gender-based differences, four items were regarded as inadequate, with three of them related to housework. As married women are traditionally more prone to engage in housework in Japan, participants in this study (i.e., 70 to 79 years old in 2011) were assumed to have had similar lifestyles. Thus,

Table 2. Basic Properties of the Preliminary Items (*N* = 1,253).

Number	Items (shortened)	Yes response ratio (%)	Gender difference (phi)	Regional difference (phi)	Relation to health status (phi)	Communality	Resemblance of the meaning to other items
1	Reach a new place by looking up the directions	83.8	0.14	0.10	0.30	0.47	
2	Buy tickets and make reservations at hotels	79.2	0.14	0.12	0.31	0.52	○[a]
3	Travel by oneself	68.2	0.23	0.09	0.32	0.43	
4	Prepare a meal while considering its nutritive value	76.4	−0.33[b]	0.09	0.21	0.41	
5	Economize the budget and shop accordingly	82.4	−0.18	0.08	0.20	0.38	
6	Purchase an expensive item by oneself	62.8	0.15	0.11	0.27	0.34	
7	Shop by mail order	63.6	−0.07	0.15	0.21	0.31	
8	Use an iron	83.2	−0.31[b]	0.11	0.24	0.36	
9	Clean the house by oneself	84.8	−0.15	−0.03	0.29	0.39	
10	Separate your garbage	94.0[c]	−0.20	0.05	0.25	0.54	
11	Order the electronics store to repair electronics	90.4[c]	−0.04	0.05	0.30	0.49	
12	Make payments when receiving bills for utilities	94.9[c]	−0.08	0.06	0.28	0.70	
13	Manage bankbook, and PIN number by oneself	88.3	−0.27	0.15	0.17	0.42	
14	Keep track of the balance of one's deposits	87.0	−0.27	0.15	0.18	0.39	
15	Consume medication	95.7[c]	−0.08	0.02	0.24	0.50	
16	Explain how a medication affects you	89.4	−0.07	0.07	0.23	0.36	
17	Secure residency certificate	93.2[c]	−0.05	0.09	0.32	0.67	
18	Apply for services at a public office	87.5	−0.01	0.10	0.32	0.59	
19	Arrange a direct debit account transfer	87.2	−0.07	0.09	0.32	0.59	
20	Take care of an ill person	67.3	−0.03	0.03	0.38	0.33	
21	Take care of a plant	84.5	−0.12	0.03	0.34	0.40	
22	Operate a video recorder	52.1	0.24	0.11	0.19	0.37	
23	Record a TV show using a timer	43.1	0.20	0.11	0.19	0.34	
24	Use a computer	28.6	0.22	0.19	0.18	0.50	○[a]
25	Use the Internet	23.0	0.24	0.21	0.16	0.47	
26	Ride the train using an IC card ticket	52.8	−0.05	0.60[b]	0.20	0.30	
27	Purchase things using an e-money card	15.6	0.06	0.15	0.11	0.11[d]	
28	Make a phone call	96.8[c]	−0.08	0.06	0.22	0.52	
29	Use a mobile phone	71.5	0.07	0.17	0.19	0.32	
30	Send an email	41.0	0.04	0.26	0.19	0.44	
31	Use a fax machine	57.8	0.16	0.27	0.19	0.48	
32	Use the ATM	70.4	−0.01	0.26	0.19	0.40	
33	Transfer money using the ATM	63.2	0.04	0.25	0.22	0.45	○[a]
34	Have a hobby	82.9	0.02	0.10	0.23	0.37	○[a]
35	Watch educational programs	69.3	−0.05	0.13	0.18	0.39	
36	Engage in gardening	69.0	−0.12	−0.11	0.19	0.22	
37	Engage in crafts or sewing	32.3	−0.53[b]	0.03	0.09[e]	0.15[d]	
38	Make art or craftwork	20.0	−0.07	−0.01	0.12	0.14[d]	

(continued)

Table 2. (continued)

Number	Items (shortened)	Yes response ratio (%)	Gender difference (phi)	Regional difference (phi)	Relation to health status (phi)	Communality	Resemblance of the meaning to other items
39	Enjoy art, films, or music	67.5	−0.06	0.22	0.23	0.38	
40	Play games such as Go, Shogi, mahjong, or cards	35.4	0.27	0.01	0.12	0.11[d]	
41	Attend senior citizens' college	29.1	−0.05	0.05	0.18	0.30	
42	Compose or perform a music piece	6.9[c]	−0.05	0.11	0.11	0.04[d]	
43	Write poems	11.2	−0.05	0.09	0.06[e]	0.10[d]	
44	Was complimented for non-vocational activities	47.9	−0.09	0.08	0.14	0.33	
45	Participated in an exhibition related to a leisure activity	39.5	−0.11	0.03	0.10	0.27	o[a]
46	Spend a lot of time on your hobby	58.3	0.02	0.06	0.21	0.32	o[a]
47	Research health information	76.3	−0.05	0.06	0.13	0.38	
48	Determine the credibility of health information	73.7	0.02	0.08	0.21	0.46	
49	Understand and convey health information to people	78.1	−0.05	0.08	0.24	0.50	o[a]
50	Incorporate health information into daily life	80.6	−0.10	0.07	0.23	0.52	
51	Use health checkups regularly	87.7	0.02	0.04	0.14	0.16	
52	Pay attention to your meals or exercise to maintain health	86.0	−0.05	0.06	0.19	0.38	
53	Have own health practice	75.5	−0.01	0.04	0.23	0.31	
54	Do light exercises regularly	76.4	0.04	0.04	0.26	0.17	
55	Participate in sports regularly	38.8	0.11	0.04	0.18	0.22	
56	Watch or read the news frequently	93.5[c]	0.01	0.10	0.28	0.31	
57	Have interests in news from overseas	78.4	0.10	0.17	0.15	0.30	
58	Actively try new things	38.7	−0.01	0.10	0.18	0.42	
59	Research things in which you are interested	67.8	0.10	0.12	0.20	0.46	
60	Contact a specialized consultation service	21.6	0.06	0.17	0.12	0.21	
61	Collect newspaper clippings	29.4	−0.09	0.11	0.09[e]	0.13[d]	
62	Read municipal press releases	76.0	−0.06	0.01	0.16	0.26	
63	Determine the credibility of newly acquired information	71.5	0.02	0.09	0.22	0.45	o[a]
64	Comprehend and convey newly acquired information to people	72.1	0.04	0.13	0.21	0.50	o[a]
65	Incorporate newly acquired information in your daily life	67.0	−0.04	0.11	0.20	0.44	o[a]
66	Ever participated in launching a new organization	22.7	0.12	−0.02	0.11	0.34	

(continued)

Table 2. (continued)

Number	Items (shortened)	Yes response ratio (%)	Gender difference (phi)	Regional difference (phi)	Relation to health status (phi)	Communality	Resemblance of the meaning to other items
67	Follow any measures to prevent oneself from crimes	77.8	−0.11	0.03	0.13	0.23	
68	Seek more information related to agricultural chemicals	32.6	−0.09	0.07	0.13	0.14[d]	
69	Be creative while doing daily tasks	72.4	−0.11	0.03	0.24	0.39	
70	Talk intimately with your friends	88.1	−0.13	0.03	0.21	0.27	
71	Talk intimately with people in the neighborhood	79.4	−0.14	−0.10	0.18	0.29	
72	Talk to people in their 20s	53.8	−0.02	0.01	0.19	0.24	○[a]
73	Talk to young people	67.0	−0.05	0.03	0.24	0.28	
74	Participate in a neighborhood association	28.1	0.04	−0.14	0.15	0.48	
75	Participate in an elderly association	20.2	0.01	−0.09	0.07[e]	0.30	
76	Participate in regional events	30.6	0.04	−0.14	0.15	0.42	
77	Encourage people during their times of hardship	87.6	−0.08	0.08	0.21	0.39	
78	Listen to people actively during their times of hardship	82.4	−0.07	0.09	0.22	0.37	○[a]
79	Take care of your family members or acquaintances	64.1	−0.03	−0.02	0.16	0.23	
80	Engage in housework	88.3	−0.25	0.11	0.27	0.47	
81	Assume a managerial position in a residents' association	36.9	0.14	−0.01	0.15	0.46	
82	Assume roles such as the leader in a residents' association	25.8	0.17	0.03	0.14	0.48	○[a]
83	Engage in charity	23.9	0.02	−0.06	0.10	0.41	
84	Make any voluntary donations	55.3	−0.11	0.02	0.12	0.24	
85	Offer advice to young people	52.2	0.04	0.01	0.17	0.34	
86	Engage in activities to pass on local customs	9.8[c]	0.11	−0.12	0.06[e]	0.26	
87	Currently engaged in paid work	24.5	0.14	0.03	0.14	0.09[d]	
88	Able to engage in paid work	43.2	0.25	0.09	0.28	0.24	

[a]Eliminated for resemblance of meaning to other items.
[b]Eliminated for gender-based or regional-based differences.
[c]Eliminated due to a very high (≥90%) or very low (≤10%) ratio of "yes" responses.
[d]Eliminated due to low communalities in factor analysis (≤0.15).
[e]Eliminated due to a weak association with health status.

including these items may make the scale susceptible to traditional gender roles. Our results indicated that the ratio of "yes" responses to the following items were higher for women than for men: "prepare a meal by considering its nutritive value" (60% in men vs. 90% in women), "using an iron" (70% in men vs. 93% in women), and "engage in crafts or sewing" (4% in men and 54% in women). The item "ride the train or bus using an IC card ticket" had a regional-based difference and was identified as inappropriate; at the time of the survey, the IC card ticket was not completely implemented for public transportation (i.e., bus or train) in

some regions of Town B, leading to a significant difference in the ratio of "yes" response between the two towns (83% in Town A vs. 24% in Town B).

Five items were not closely associated with health status and were subsequently identified as inappropriate. Most of these items consisted of activities that could be performed indoors (e.g., "write poems" and "collect newspaper clippings") and were therefore unlikely to require physical fitness. Furthermore, participants who responded "yes" to two of these items ("participate in an elders' association" and "engage in activities to pass on local customs") might not necessarily have engaged in these activities; they might have just belonged to such associations. Moreover, although we asked participants whether they engaged actively in such social activities, the interpretation of the phrase "engaging in activity" might differ between the researcher and respondents. Therefore, these items were deemed to be weakly associated with health status and identified as inappropriate.

Nine items were identified as inappropriate because their communalities estimated by factor analysis were low, meaning that they could be determined by factors, such as lifestyle, preferences, and customs, other than competence. For instance, the item "play games such as Go, Shogi, mahjong, or cards" could be attributed to preference or lifestyle other than merely the ability (competence) to enjoy such games. Likewise, the item "currently engaged in an income-generating job" could be attributed to lifestyle instead of simply the ability to contribute paid work. These items may, thus, lower the internal consistency of the scale and were subsequently identified as inappropriate.

After checking the resemblance and duplication of the meaning between items, 13 items were decided as inappropriate. As the final version of the JST-IC would have a minimum number of items, items that resemble or have duplicate meanings with other items were eliminated at this stage of development.

After performing the above five analyses that tested the basic properties of each item, 54 items were selected as potential items for the new scale for competence. The potential items included "Use a mobile phone (#29)," "Determine the credibility of health information (#48)," "Follow any measures to prevent oneself from crimes (#67)," "Assume a managerial position in a residents' association (#81)," and others (see Table 2, Supplemental Material). The items (a) can assess higher level competence according to Lawton's hierarchical model of competence, (b) can measure the "competences required for older individuals living alone to become independent and lead an active daily life" within the living environment of the modern active older adults, and (c) has properties that require higher functioning to execute compared with the TMIG-IC.

Future Research

Our next step includes screening the remaining 54 items to develop the final version of the scale. This would be achieved through a second survey, which would consist of administering a questionnaire containing a narrowed list of items obtained from the present survey to a randomly selected sample of community-dwelling older people across Japan. Confirmatory factor analysis would be used on the resulting data to obtain the final version of the scale. The validity and reliability of the final version of the scale will then be examined. Then, a third survey consisting of the scale developed in the second survey would be administered to another randomly selected sample of community-dwelling older people across Japan. The cross-validity of the factor structure of the final version of the scale, developed from the findings of the first and second surveys, will be examined and the normative values developed for the population of older people in Japan.

Author Contributions

H.I. and Y.M. engaged in study conceptualization, data collection, data analysis, interpretation of results, and had primary responsibility for writing this article. H.I. and Y.Y. engaged in study conceptualization, data collection, data analysis, and interpretation of results. H.S., R.O., K.K., K.N., H.Y., H.Y., and T.S. contributed to interpretation of results and discussions on the manuscript. All the authors read and approved the final manuscript.

Authors' Note

Hajime Iwasa and Yukie Masui are co–first authors.

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