



The effect of progressive exercise prescription for group exercise guidance for Taiwan seniors and Integrated Care for old People: Post-event movement observation

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ABSTRACT

Purpose: This study is aimed at the seniors of the “2022 Taiwan Senior Citizens Fitness Club Subsidy Plan” with a sample.

Method: The doctor will diagnose and confirm whether the physical condition suits participation. Then, the professional sports instructor will design and arrange a progressive fitness enhancement group course suitable for the Senior person's physical fitness, conducted four times a week, every 2 h, for three months of group course training. Afterward, four group course instructors analyzed the motor ability of the three periods through a video, divided into 21 evaluation indicators. The data collection will be from January to May 2023. In addition, the Integrated Care for Old People (ICOPE) was used to assess the situation.

Result: The results showed that all indexes were significantly better than those in week one at week 6. All indexes at week 12 were significantly better than those in week one and week 6 ($p < .001$), and the benefit of all indicators was the largest (Cohen's d : 2.79–5.11), the reliability of the scores of each index ICC (0.73–0.94).

Conclusion: Progressive and multifaceted guidance on how to safely and effectively enhance the physical activity of senior citizens may be the most suitable method. Through progressive energy enhancement, the participants' physical activity and cognitive function can be improved, especially the overall rhythm of the music, which can be combined with high and low impact, dynamic and static balance control, agility, flexibility, and extensibility to achieve the benefits of health promotion.

1. Introduction

According to the National Health Organization's (WHO) definition, it is called an aging society When people over 65 years old exceed 7 % of the total population. When it reaches 20 %, it is called a hyper-aged society. In 2018, Taiwan entered an aging society (about 14.6 % of the population is over 65 years old) and is expected to enter a super-aging society in 2025. In addition, Taiwan's proportion of the elderly population over 80 years old was 16.8 % in 2013. It is estimated that it will rise to 30.7 % in 2050. Taiwan's elderly population over 60 exceeded the young population of 14 as early as 2011, showing that Taiwan's aging rate is increasing rapidly (Ministry of Interior Taiwan, 2018).

As the elderly age, their physical functions gradually decline, including decreased muscle strength, cardiorespiratory endurance, nerve conduction velocity, poor muscle flexibility, reduced activity...

and other problems, leading to reduced physical fitness (Symons & Swank, 2015; Medicine et al., 2021). Accordingly, the study is based on the 2022 Taiwan Senior Citizens Fitness Club Subsidy Plan, and the senior citizens are the project's target. Before the intervention, they are to be diagnosed by a doctor to confirm whether they can participate in the program before the course training and then be guided by a qualified fitness coach. The group exercise program is held 4 times a week for 2 h for 3 months, with 48 sessions. The gradual energy enhancement exercise guidance improves physical fitness and daily life function.

Tharp and Gallimore first used the systematic observation method in 1976 (Darst, 1989). Cohen et al. (2014) used the Coaching Behaviors Observational Recording System (CBORS) as a multi-faceted behavior observation and analysis tool. Observers can provide more objective, reliable, and effective observation data of the coach's training process. In addition, the time-sampling method is used to assist observation and analysis. Because the coach's training behavior is continuous, and it is

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difficult to observe and record highly interactive sports training or competition processes, the time-sampling method can provide and establish more reliable and effective observation data. [Brown et al. \(2006\)](#) used momentary time sampling to observe the behavior of the children to be observed every 5 s. Then, they recorded the physical activities of the observed children in the next 25 s. [Grimminger and Möhwald \(2017\)](#) used the quasi-experimental design; four measurement points were used to observe the experimental group, two cameras were used for video recording in all lessons, and the discussion with students after each lesson was recorded and transcribed.

Based on the concepts of systematic recording, time sampling and recording, and quasi-experimental study design, this study was extended to the post-event video observation method of analyzing the changes of each participant in the process of exercise intervention, that is, to observe the performance of exercise intervention in different periods, and the benefit analysis.

2. Materials and methods

2.1. Research object

This study is based on the 「2022 Taiwan Senior Citizens Fitness Club Subsidy Plan」 for a community to be studied by a person over 65 years old and diagnosed by a doctor to determine whether their physical condition is suitable to participate, excluding frail seniors. There are taking a community in Taiwan as the research object.

2.2. Research design and procedures

2.2.1. Directing, choreographing, and designing group sports for senior

Considering that the elderly participants are less likely to receive group exercise instruction, and the physical activity and mobility of each participant are different, at the beginning of the formal start of the course, the safer “isokinetic training machine” is the primary training, the main objective is to strengthen the neurological adaptability, through the machine to operate the correct track to enhance older people’s motor stability and muscle fitness, and gradually improve the ability to control the movement with bare hands, various assistive devices and simple equipment. In addition, the ratio of sitting and standing time during exercise was adjusted in each session, from the initial need for assistive devices to gradually move away from dependent assistive devices and finally to physical flexibility as the physical ability performance goal.

This course is designed to be a group course for seniors with approximately 2 h of content. Different stages are adjusted to gradually enhance physical abilities and include cognitive function and memory training to prevent and delay aging ([Fig. 1](#)). In addition to the basic aerobic movements, this course adds simple elements of boxing, ballet muscle strength training, etc. It has upper limbs, torso, lower limbs, and other whole-body training, which helps improve daily functional

activities. Depending on the level and training period, the movement technique can be adjusted, or the combination and number of combinations and times can be decomposed. Paying attention to the participants’ muscle and consciousness control is necessary. During the course, there will be a preset short break time.

2.2.2. Cognitive and memory performance training

Regarding cognitive function and memory training, simple, intuitive motor responses combined with physical adaptive movements increase their interest and stimulate immediate memory and response. The primary examples are as follows:

The design code name memory represents the combination of action and physical fitness. Code 1: Move as the right hand on the right shoulder, Code 2: Move as the left hand on the left shoulder, Code 3: Move as the hands cross on the shoulder, Code 4: Move as the hands apart and put the same shoulder on the same side (right hand on the right shoulder; left hand on the left shoulder), Code 5: Move as both hands on the thighs, Code 6: Act as both hands to clap, Code 7: Move as the right scissor feet, Code 8: Move as the left scissor feet, Code 9: Move as the feet open, and code 10: Move with your feet together.

The game method gives each code number a gradual representation of the action. It is necessary to gradually accumulate actions to give memory reaction time rather than teaching 10 code actions directly. Can use the aerobic teaching methods of one-by-one addition, pyramid, and connection (decomposition/combination). Finally, you can use the fun of beating, such as 1,122,565 and 3466556.

After practicing numbers 1–10, first memorizing separately, then combining the sequential and random methods, and finally sitting on the chair with scissor feet and jump jacks, strengthening the hip flexion and leg lifting ability and lower body agile movement. Elders can stimulate memory and immediate response in the game and try “low-impact” movements safely on the chair, which will help promote cardiopulmonary and muscular fitness.

2.2.3. Physical activity analysis by post-event observation

The evaluation method of this study adopts the post-event action observation and analysis method, using the video taken in the classroom as a record, and four team sports coaching experts respectively use three observation time points (1st week, 6th week, and 12th week) to evaluate the motor ability and give scores, which are divided into 21 indicators. The scores are provided by 1–10 points (the primary evaluation is based on the actions that have been presented) and are divided into three levels of assessment: if the action presentation is poor, it is between 1 and 3 points; the medium action presentation is between 4 and 6 points.; the best motion presentation is between 7 and 10 points. Refer to Appendix A for the definitions of 21 indicators ([AFAA, 2019](#)).

2.2.4. Integrated Care for old people (ICOPE)

The National Health Administration of Taiwan has launched a pilot service program to provide personalized health management advice and

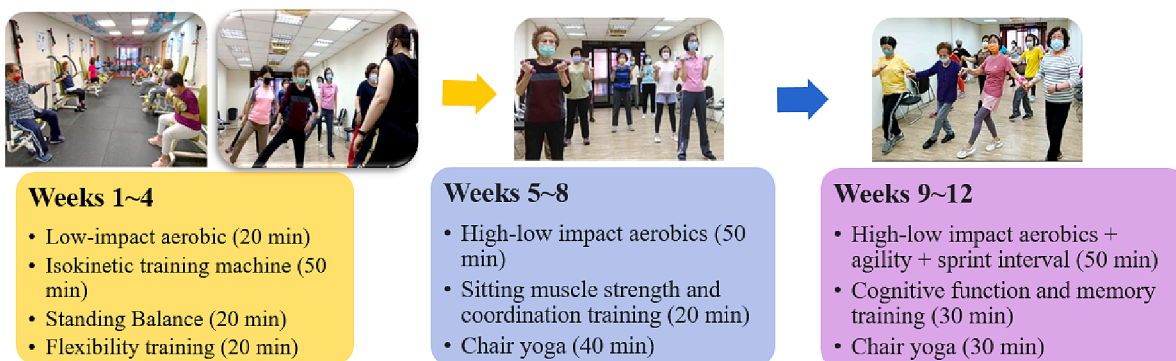


Fig. 1. Exercise Prescription Illustration.

referral to intervention resources that meet the needs of the WHO Integrated Care for Older People (APPENDIX B) guidelines and provide functional assessment services for seniors over 65 years old, including “cognition, mobility, nutrition, hearing, vision and depression” Six aspects to help older people detect functional problems early and intervene in exercise and nutrition as early as possible (Ministry of the Welfare, 2023). In this study, program participants were provided to fill in this assessment scale before and after the exercise intervention to analyze whether there was a significant difference.

2.3. Data processing

In this study, the SPSS Windows 25.0 software suite was used for data processing and analysis, and data collection will be from January to May 2023. All data will be presented as mean ± standard deviation. In this study, the motor ability of the participants at three different times was used to understand the consistency of the repeated observation performance (Shrout & Fleiss, 1979). In addition, effect size was used to analyze the effect size of each indicator before and after testing. Cohen’s d values are given in the following ways: < 0.2, 0.2–0.5, 0.5–1.1, 1.2–1.9, > 2.0, and > 4.0 represent extremely small, small, medium, large, very large, and extremely (Hopkins et al., 2009).

3. Results

3.1. Basic information of the subject

A total of 15 participants (Age = 71.53 ± 5.06 yrs., Gender (Male: 2, Female: 13), height = 159.6 ± 8.69 cm., weight = 56.60 ± 5.11 kg.) completed the 48 sessions within 12 weeks. Table 1 shows the descriptive information by group.

3.2. Ex-post observation and movement analysis

The analysis of motor ability in the three periods (Table 2) showed that all indicators were significantly better than those in week 1 at week 6. All indicators at week 12 were significantly better than those in week 1 and week 6 (p < .001), and all indicators had the extreme (Cohen’s d: 2.79–5.11). Still, the “alternative movement” indicator was better than that of the 6th week and 12th week in the first week, indicating that the choice of alternative action in the later period decreased; that is, the physical activity ability improved. In addition, the reliability of each index is ICC (0.73 – 0.94).

3.3. Integrated Care for old people (ICOPE)

To analyze the effectiveness of the participants’ elderly function before and after the intervention exercise, the analysis after completing the ICOPE (APPENDIX C) showed a significant improvement in mobility function (p = .004, d = 1.29); it showed that he was previously worried that he would fall, or that he had to hold onto objects to stand up while sitting. However, his concerns about these risks have improved after the exercise intervention. Regarding nutritional assessment, the perception of poor appetite improved after exercise intervention (p = .041, d = .83). Regarding melancholy evaluations, those who had previously felt bored

Table 1 Descriptive statistics for a sample of 15 elderly from the study (September to November 2022) in Taiwan.

Variable items	Mean ± SD	Minimum	Maximum
Age (year)	71.53 ± 5.06	65	81
Height (cm)	159.60 ± 8.69	148	180
Weight (kg)	56.60 ± 5.11	43	65
Systolic blood pressure (mmHg)	118.87 ± 13.50	96	139
Diastolic blood pressure (mmHg)	67.20 ± 8.75	55	88

Table 2

15 elderly from the study (September to November 2022) in Taiwan, comparison of 21 indicators at three observed time of movement scores and ICC analysis.

Variable items	Week 1	Week 6	Week 12	p-value	Cohen’s d	ICC
Body centerline	3.57 ± 0.86	5.28 ± 0.77#	6.88 ± 0.77*	.001*	4.06	0.89
ROM	3.53 ± 0.89	5.35 ± 0.91#	7.22 ± 0.69*	.004*	4.63	0.87
Direction	4.02 ± 1.10	5.75 ± 0.89#	7.62 ± 0.72*	.007*	3.88	0.88
Rhythm	3.68 ± 1.21	5.68 ± 0.94#	7.55 ± 0.77*	.013*	3.81	0.89
Repeat times	4.48 ± 0.99	6.02 ± 0.75#	7.55 ± 0.82*	.003*	3.36	0.90
Displacement	4.95 ± 0.73	6.42 ± 0.65#	7.75 ± 0.65*	<.001*	4.05	0.86
Bilateral	4.35 ± 1.07	6.02 ± 0.80#	7.62 ± 0.85*	.007*	3.37	0.91
Action plane	5.82 ± 0.42	6.95 ± 0.49#	8.22 ± 0.52*	<.001*	5.11	0.78
Low impact	3.88 ± 1.03	5.15 ± 0.83#	7.22 ± 1.04*	.009*	3.22	0.94
High impact	4.08 ± 0.78	5.73 ± 0.91#	6.22 ± 0.74*	.048*	2.79	0.91
Endurance	3.82 ± 0.42	4.82 ± 0.42#	6.22 ± 0.74*	<.001*	3.98	0.88
Interval	3.98 ± 0.49	4.98 ± 0.49#	6.43 ± 0.79*	<.001*	3.74	0.72
Isokinetic	4.88 ± 0.48	5.88 ± 0.48#	7.55 ± 0.82*	<.001*	3.97	0.90
Isotonic	4.42 ± 0.79	5.82 ± 0.70#	7.62 ± 0.86*	.001*	3.83	0.91
Isometric	4.48 ± 0.73	5.62 ± 0.72#	7.02 ± 0.84*	.001*	3.22	0.91
Flexibility	3.82 ± 0.68	5.15 ± 0.81#	6.15 ± 0.60*	<.001*	3.64	0.83
Balance	3.62 ± 0.97	5.48 ± 0.80#	7.42 ± 0.75*	.003*	4.38	0.89
Correction	4.22 ± 1.03	5.82 ± 0.73#	7.82 ± 0.73*	.002*	4.05	0.88
Alternative	6.48 ± 0.84\$	6.28 ± 0.85	5.62 ± 0.88	.001*	-1.01	0.91
Reaction	4.88 ± 0.72	6.02 ± 0.53#	7.82 ± 0.68*	.004*	4.20	0.86
Agility	4.22 ± 0.81	5.42 ± 0.79#	7.35 ± 0.81*	.007*	3.87	0.90

p-value: Repeated measures analysis of variance was used to compare changes in participants’ exercise ability and scores at the three-time.

means that the week 6 test is better than the week 1.

* means that the week 12 test is better than the week 1 and the week 6.

\$ means that the week 1 needs more assistance than week 6 and week 12.

or had reduced many activities and things they were interested in in the past two weeks improved after exercise intervention (p = .009, d = 1.12). The remaining assessment items had no significant differences.

4. Discussion

4.1. The effect of progressive exercise prescription for physical fitness and ICOPE

Kimura and Hozumi (2012) found that aerobic dance positively affects cognition in older adults. Bai et al. (2022) The benefits of aerobic exercise for older adults include reducing the loss of strength, mobility, balance, and endurance due to inactivity, essential for older adults to carry out their daily activities safely. The combination of diverse training contributes to the overall improvement of the physical fitness of the elderly, thus preventing them from losing their balance and reducing the likelihood of injury. Shigematsu et al. (2002) Aerobic dance exercises designed for older women can improve balance and agility, reducing the risk of falls. Leung et al. (2022) The relationship between intrinsic ability, social participation, and self-care ability in daily living

activities was positively correlated, consistent with the results of ICOPE's motor function and reduction of depression and social interaction.

Based on the above literature, the results of this study are consistent. Participants had improved rhythmic response, body coordination, reflexes, cognition and memory, dynamic balance, body control, muscle endurance, and flexibility. The improvement was found in the ability to hear the rhythm immediately and react to the action immediately: it can also correct itself when there is a wrong rhythm. The number of people who choose to hold a chair for the movement decreases sharply, and the ability to memorize the next movement to achieve a continuous and fluid movement. After six weeks, more training equipment was used to strengthen resistance training and movement control. The proportion of alternative movements was reduced, indicating that the body's ability to withstand the intensity of exercise increased, and after eight weeks, the body began to add in-place interval running training, and coordination and body control improved.

4.2. Video important observation and the concept of motor ability analysis

This study uses videos to analyze the overall movement abilities of older people. The concept is derived from the expert evaluation during the physical fitness test. Although it is a subjective judgment and scores are given, the examiners who are acted by professional physical fitness units specialize in group fitness guidance. They have strict operational definitions for evaluation in all technical examination movements. They have extensive experience in technical examinations, such as various sports that require subjective judgment and scoring, such as gymnastics, skating, diving, ball games, martial arts, etc. (Dosseville et al., 2011; Lee, 2008; Russell et al., 2022; Waguespack & Salomon, 2016), there are still public rules and evaluation indicators, so the scoring reliability among the four experts needs to be analyzed through ICC. The reliability of each indicator in this study is 0.73 ~ 0.94; only One indicator (interval-cardiopulmonary training) has "moderate" reliability, and the remaining indicators are all "better" or above.

Furthermore, no matter what training mode or type, have all been proven to be effective in promoting human health (Chang et al., 2017). However, from the physical fitness perspective, more emphasis is placed on safety and effectiveness in the training process. So, not all training models are suitable for exercise guidance for older people (even if they are known to be effective). In other words, if the exercise guidance only blindly applies a specific training model directly, it will likely cause poor exercise adaptability in the elderly, or difficulty keeping up with movements will likely occur and lead to the risk of injury (Donath et al., 2014). It is worth reflecting and paying attention to the original intention of encouraging older people to participate in sports is to promote health. However, suppose the training is improper, or the level most suitable for the current situation is not adjusted in time. If you have other chronic diseases or musculoskeletal injuries, the risk of secondary injuries will increase. Then, if older people reduce their participation in sports due to maladaptive fear and fear, they will also lose the promotional significance of encouraging exercise to strengthen their bodies.

4.3. Limitations and strengths

One of the limitations of this study is the small number of samples, but has particular strengths. This study is not an experimental method. Instead, during the implementation of the project, it was gradually discovered that the overall exercise ability was significantly improved. Therefore, through the retrospective method, we use post-even observation to analyze and observe the exercise prescription design and training process during the retrospective process through videos on how to improve the participants' physical activities and cognitive functions.

The critical observation of this study is that how to safely and effectively enhance the physical activity ability of seniors, progressive

and diversified guidance may be a more suitable method, and the weekly course design and intensity should be adjusted according to the overall ability of the participants to develop various The body's ability to adapt to its environment. The most challenging part is the aerobic dance type because aerobic dance is when everyone's movements must be in rhythm simultaneously. This requires building up the body's flexibility and agility in advance. It helps to keep up with the rhythm of the movements and respond immediately; it is even necessary to memorize the movements to train to decompose multiple movements into combinations. It can be observed from the video that an 81-year-old can also keep up with the music's rhythm. The music rhythm in this study is 126 bpm, which is more suitable for novices to get started. Or the rhythm of strength training (AFAA, 2019).

5. Conclusions

This study analyzes the benefits of group sports intervention in seniors using post-observation and the exercise prescription design and training process in the retrospective process through the video, especially the overall rhythm of the music, the combination of high-low impact, displacement, dynamic and static balance control, interval training to improve sports performance and improve flexibility and extensibility, etc. It is suggested that in the future, relevant researchers can combine physical fitness training, functional training, and cognitive function training when providing exercise guidance for seniors. When designing fun activities, more attention should be paid to combining the design of exercise prescriptions to improve physical activity ability and achieve the benefits of health promotion.

6. Ethics statement

This study is an application for the Taiwanese government's community exercise guidance subsidy program for older people, so it only has the plan name/number and participant consent form. Therefore, the plan was already completed, and we used videos to analyze these processes retrospectively, so we did not obtain relevant approval from the ethics committee.

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CRediT authorship contribution statement

Ying-Ting Hsueh: Writing – original draft, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Yen-Kuang Lin:** Writing – review & editing, Supervision, Conceptualization. **Shih-Chung Cheng:** Writing – review & editing, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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Appendix A. . Definition of 21 indicators

Variable items	Description
1. Body centerline	The human body needs to maintain its correct posture when it is in static posture and dynamic movement, such as standing, forward-leaning, lunging, kneeling, sitting, prone and supine posture.
2. Range of motion (ROM)	Movements that need to be controlled within the maximum range of motion during the movement.
3. Direction	Refers to the movement in which the body is facing the direction, such as forward, backward, right, left, right oblique front, right diagonal back, left diagonal front, left diagonal back, clockwise rotation, and counterclockwise rotation.
4. Rhythm	Changing movements using the beat of music, such as changes in movement that are on a normal beat, slower than a normal beat, or twice as fast as a normal beat.
5. Repetitions	Refers to the number of movements repeated when the body is on the same side, such as the number of consecutive knee lifts with the right foot.
6. Displacement	Refers to the change in the distance of the body from the original place, which needs to be different from the definition of direction.
7. Unilateral and bilateral movements	Unilateral movements are used as sequential movements of both limbs, and bilateral movements are used as simultaneous movements of both limbs.
8. Action plane	Refers to the sagittal plane, frontal plane, and horizontal plane of the human body.
9. Low-impact maneuvers	Movements in which at least one foot touches the ground during the movement, meaning that both feet are not off the ground at the same time, such as stepping.
10. High-impact movements	Movements in which both feet are lifted off the ground at the same time during the movement, such as running.
11. Continuous cardiorespiratory endurance	Refers to a continuous and uninterrupted cardiopulmonary training pattern of moderate exercise intensity.
12. Intermittent cardiorespiratory endurance	Refers to intermittent temporary interruptions for a short period, and the cardiopulmonary training mode is based on higher exercise intensity.
13. Isokinetic training	Under special equipment with constant speed, the movement speed is maintained at the same speed, no matter how much strength is too small or how the joint angle changes, the maximum muscle strength can be exerted at the same speed.
14. Isotonic training	To generate tension, the muscles need to overcome resistance to move one limb segment towards or away from the other limb with the joint as the fulcrum.
15. Isometric training	A way of contraction in which the muscles are not changed in length, but the joints and bones do not move.
16. Flexibility	The ability of the body to maintain correct posture despite the maximum range of motion of the joints and the extension of the muscles.
17. Balance	The ability to maintain body stability in various postures or action states.
18. Correction	The ability of the participant to self-correct after receiving instructions that require correction of the action.
19. Alternative	When the participant is unable to complete the intensity change, the change in intensity is replaced by a reduced intensity change.
20. Reaction	Visual and auditory stimuli allow the brain to receive information and reflect the speed at which it reacts to action.
21. Agility	The ability to generate speed at maximum force and react to body changes of position, including acceleration, deceleration, and change direction.

Appendix B. . Integrated Care for old people scale

Variable items	Question	Result
Cognitive function	1. Have you experienced significant memory loss in the past year?	Yes? No?
Mobile function	2. Do you experience any of the following situations? . Extremely worried that you will fall? . Have you had a fall in the past year? . While sitting, do you have to hold onto something to get up from your chair?	Yes? No?
Malnutrition	3. Without deliberately losing weight, have you lost 3 kg or more in the past three months?	Yes? No?
Visual impairment	4. In the past three months, have you ever had a bad appetite? 5. Do you have difficulty seeing far, near, or reading? (If you answer “Yes” to this question, please answer question 5–1. If you answer “No” to this question, please skip to question 6.)	Yes? No?
Hearing impairment	5–1. Have you ever had an eye examination in the past year? 6. Does your hearing suffer from any of the following conditions? . Can’t hear clearly when talking on the phone or cell phone, or often misses the phone because of not hearing the ringtone talk? . When watching TV/listening to the radio, do your family or friends often tell you that the volume is too loud? . When talking to someone, do you often need the other person to speak louder or speak again? . Don’t want to go to friends’ gatherings or events because of hearing problems?	Yes? No?
Melancholy	7. In the past two weeks, have you often felt bored or like life was hopeless? 8. In the past two weeks, have you reduced a lot of activities and things you were originally interested in?	Yes? No? Yes? No?

Appendix C. . Integrated Care for old people scale statistical results in 15 elderly from the study (September to November 2022) in Taiwan

Variable items	Question	Pre-test	Post-test	p-value	Cohen’s d
Cognitive function	Q1	1.93 ± 0.26	2.00 ± 0.00	.334	0.37
Mobile function	Q2	1.53 ± 0.52	2.00 ± 0.00*	.004	1.29
Malnutrition	Q3	1.93 ± 0.26	2.00 ± 0.00	.334	0.38
	Q4	1.73 ± 0.46	2.00 ± 0.00*	.041	0.83
Visual impairment	Q5	1.93 ± 0.26	1.93 ± 0.26	1	0
	Q5-1	1.93 ± 0.26	1.93 ± 0.26	1	0

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Variable items	Question	Pre-test	Post-test	p-value	Cohen's d
Hearing impairment	Q6	2.00 ± 0.00	2.00 ± 0.00	–	–
Melancholy	Q7	1.80 ± 0.41	2.00 ± 0.00	.082	0.68
	Q8	1.60 ± 0.51	2.00 ± 0.00*	.009	1.12

p-value: A paired samples *t*-test was used to compare the pretest and posttest of self-rated ICOPE among 15 elderly people in Taiwan. *: Improvement in the post-test was better than the pre-test.

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