

# Simulation-based holistic education in physiotherapy interns to increase empathy toward older adults and individuals with disabilities: a feasibility prospective study

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## Research Article

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# Abstract

**Background:** With the annually increasing ratio of individuals with disabilities in an aged society, clinical clerkships for physiotherapy interns should provide more than just knowledge and skills. The cultivation of interns' empathy and positive attitudes toward patients to meet future job requirements is essential. In this study, we explored the effect of simulation-based holistic health-care education on physiotherapy interns' empathy, attitudes, and knowledge.

**Methods:** A parallel-group design. Thirty physiotherapy interns in a medical institution were enrolled as participants. The experimental and control groups each had 15 participants. Both groups received standard clinical training. However, the experimental group participated in an additional simulation-based empathy enhancement program. The pretest and posttest measured the Jefferson Scale of Empathy, Kogan's Attitudes toward Old People Scale, Attitudes Towards Elderly Scale, Knowledge about Aging scale, Knowledge of Situation of Older People, Perceptions of Working with Older People, and Care Willingness scale.

**Results:** After the experimental group received 9 weeks intervention, the experimental group had a 6.4 points improvement on the Jefferson Scale of Empathy ( $p=0.001$ ), a 7.7 points improvement on the Kogan's Attitudes toward Old People Scale ( $p=0.002$ ), a 3.5 points improvement on the Attitudes Towards Elderly Scale ( $p=0.002$ ), a 2.5 points marginal improvement on the Knowledge about Aging ( $p=0.055$ ), a 4.5 points nonsignificant improvement on the Knowledge of Situation of Older People ( $p<0.001$ ), a 2.1 points nonsignificant improvement on the Perceptions of Working with Older People ( $p=0.046$ ), and a 0.5 points nonsignificant improvement on the CW ( $p=0.723$ ),

**Conclusion:** The simulation-based holistic health-care education intervention significantly improved physiotherapy interns' empathy, knowledge, and attitudes.

## Background

The World Health Organization (WHO) defines a population aged over 65 years as an elderly population. The statistics released by the Ministry of the Interior indicates that by the end of April 2021, the number of people aged 65 years or older had reached 3.804 million [1], which meets the WHO's definition of an aged society, that is, people aged over 65 years accounting for 16.4% of the total population (Department of Statistics, Ministry of the Interior, 2021). Older adults often have degenerative diseases, such as degenerative arthritis, cataract, and hearing loss, all of which affect daily life functions and may even cause disability. The National Development Council (2020) estimated that Taiwan has approximately 760,000 people with disabilities. With the populations of older adults and individuals with disabilities increasing year by year, physiotherapists' empathy and attitudes toward them must be effectively improved. Older adults and individuals with disabilities often feel that because professional caregivers lack empathy, listening skills, and communication skills, they cannot receive dignified care [2]. By wearing simulation teaching aids and taking situational simulation courses, students can experience the

difficulties faced by older adults and individuals with disabilities through experiential learning. Situational simulation increases perceptual awareness and induces emotions. Studies have discovered that simulation training courses can enhance cognitive and emotional benefits through internalized learning about multiple roles [3] and improve the quality of care for older adults [4].

Physiotherapy intern emphasizes holistic health care, which covers not only patient-centered care after illness but also the promotion of a holistic health care system. Holistic health care includes physical, mental, social, and spiritual care. In addition to the provision of accurate diagnosis and suitable treatments, the convenience, safety, immediacy, appropriateness, comfort, and comprehensiveness of medical service should be considered. Through clinical simulation, students can estimate the effect of diseases on multiple aspects (e.g., patients, their family, and society) and consider how they can provide comprehensive care and cultivate the knowledge, skills, attitudes, and effective and individualized care skills that are required in a professional workplace.

Studies have applied methods such as a flipped classroom [5], guided self-study [6], gamification teaching [7], pain neuroscience education [8], digital learning [9, 10], and virtual reality [11] to professional knowledge transfer and absorption. However, no study has discussed the effect and benefit of holistic teaching on empathy. Physiotherapy intern students often must care for older adults and patients with disabilities in the workplace. Traditionally, students learn relevant skills by observing and emulating how their clinical instructors conduct evaluations, implement interventions, and cope with patients. However, the empathy they develop is still insufficient. By participating in aged and disability simulation courses, wearing a simulation suit to perform daily tasks, observing and experiencing the physical inconvenience and perception of older adults and individuals with disabilities, students simulate their difficulties in life caused by physical degeneration. This critical thinking teaching strategy enables students to perceive patients' feelings and develop empathy, such that they can apply their knowledge to provide better medical care quality through the internalized feelings they experienced during their observations and, eventually, provide approximate treatment. Physiotherapy students in Taiwan apply for hospital intern during their senior year of university to meet the requirements for their future job. They are expected to integrate and utilize the knowledge they learned in school in clinical practice. In addition, they should engage in care discussions conducted by a holistic and interdisciplinary team to enhance their knowledge, skills, and attitudes. The simulation training model for medical and nursing students has already been established. Research indicated that students exhibit improved attitudes, empathy, and willingness to provide care after attending an aged simulation course. However, the results are still inconclusive, probably because of the differences in intervention methods and time [12–15].

In the present study, we applied a simulation-based holistic care teaching intervention to physiotherapy intern students. These students developed improved empathy, attitudes, knowledge, and willingness to provide care relative to those who only received standard physiotherapy clinical training.

## Methods

## ***Study design***

We enrolled participants from a physiotherapy team of the Department of Physical Medicine and Rehabilitation, Taipei Municipal Wanfang Hospital. A parallel-group pretest–posttest design was adopted. The participants were divided into experimental and control groups to compare changes in empathy, knowledge, and attitudes toward older adults and individuals with disabilities after the implementation of the simulation-based holistic care teaching intervention. The Institution Review Board of Taipei Medical University (N202006001) reviewed and approved the research protocol in the spirit of the Helsinki Declaration. All participants gave written informed consent before data collection began.

## ***Subjects***

We enrolled 30 physiotherapy interns between July 2020 and April 2021. The inclusion criterion was being older than 20 years. Students were excluded if they could not fill out the questionnaire or had physical disabilities and injuries and could not participate in the simulation course. A pretest was conducted on the first day of the participants' intern. They were assigned to the experimental and control groups at a 1:1 ratio (15 in each group). Both groups underwent an 18-week standard clinical training program. However, from the ninth week onward, the experimental group received additional simulation-based holistic health-care education. In the tenth week, a posttest was conducted to compare the difference in empathy, knowledge, and attitudes toward older adults and individuals with disabilities between the two groups. The process of recruitment, intervention, assessment, and data analysis is presented in figure 1.

## ***Intervention***

The simulation-based empathy enhancement program pertaining to older adults and individuals with disabilities was implemented in three stages. During the first stage, face-to-face holistic health-care education lasting 60 min was provided. In the second stage, a 120-min aged and disability simulation activity was conducted. Participants wore an aged simulation suit (Yagami, Nagoya, Japan) and a hemiplegia simulation suit. The suits consisted of a presbyopia eyeshade that created blurred vision, a sound-blocking earmuff that restricted hearing, a humpback simulation strap, restraint belts that limited elbow and knee movements, weight-bearing sandbags, restraint gloves that limited hand movements and tactile sensation, special shoes with varying weights in each foot, a crutch, and a hemiplegic vest that limited upper limb movements on one side. To simulate the daily life scenarios of older adults and individuals with disabilities, participants were asked to complete designated tasks at four checkpoints; the tasks are (1) dining, (2) undressing and showering, (3) walking and stair climbing, and (4) shopping and registration (table 1). Each participant played multiple roles to observe and experience the physical and mental perspectives of older adults and individuals with disabilities. They played a role of an activity participant who wore simulation suits to complete the designated tasks, an assistant who helped to maintain the safety of other activity participants, a supervisor who accompanied other activity participants to complete the tasks, and an observer who observed and empathized with the mental and physical inconveniences of the older adults and individuals with disabilities. In the third stage, a 30-min

after-class sharing session was conducted, during which participants shared their reflections on the role-playing experience and their feelings about the roles they played during the simulation.

## **Outcome measures**

### ***Primary outcome***

We employed the Chinese version of the Jefferson Scale of Empathy-Health Profession Students (JSE-HPS) [16] to measure participants' empathy for older adults and individuals with disabilities. The scale comprised the following three dimensions: perspective taking (10 items), compassionate care (8 items), and standing in the patient's shoes (2 items). The 20 items were scored from 1 point (strongly disagree) to 7 points (strongly agree), with a total score ranging from 20 to 140 points. A higher score indicated a higher level of empathy. The internal consistency was found to be 0.78 and 0.84 [17,18].

### ***Secondary outcomes***

The Chinese version of the Kogan's Attitudes toward Old People Scale (KAOPS) was applied [19]. The scale comprised 34 items (17 reverse and 17 direct questions) [20] that were scored on a 6-point scale from 1 point (strongly disagree) to 7 points (strongly agree), with 4 points being given when a participant failed to respond to an item. The total score ranged from 34 to 238 points. A higher score indicated a higher level of empathy. The Cronbach's alpha was 0.82 for the total scale [19]. The Attitudes Towards Elderly Scale (ATES) was used to measure participants' attitudes to provide care. The scale consisted of 23 items (11 reverse and 12 direct questions). Direct items were scored on a scale from 4 points to 1 point (strongly agree, 4 points; agree, 3 points; disagree, 2 points; strongly disagree, 1 point), whereas reverse items were scored on a scale from 1 point (strongly agree) to 4 points (strongly disagree), with a total score ranging from 23 to 92 points. A higher score indicated a higher level of attitudes to provide care. The Cronbach's alpha was 0.84 for the total scale [21].

The knowledge about aging (KA) scale [21] was adopted to estimate participants' care knowledge. The scale encompassed 50 items that were divided into four dimensions (i.e., physical and illness care, mental changes, social changes, and vital statistics). One point was given for a correct answer, and no point was given for a wrong or uncertain answer. The total score ranged from 0 to 50 points. A higher score indicated a higher level of knowledge. The Cronbach's alpha was 0.77 for the total scale. The Knowledge of situation of older people (KSOP) scale was adopted to estimate participants' care knowledge. The scale consisted 13 items. One point was given for a correct answer, and no point was given for a wrong or uncertain answer. The total score ranged from 0 to 13 points. A higher score indicated a higher level of knowledge. Cronbach's alpha coefficients were 0.63 for the total KSOP score [22].

The Perceptions of working with older people (PWOP) scale was used to measure participants' perceptions to provide care. The 11 items were scored from 1 point (strongly disagree) to 5 point (strongly agree), with a total score ranging from 11 to 55 points. A higher score indicated a higher level of

perceptions to provide care. The Cronbach's alpha was 0.81 for the total scale [23]. The care willingness (CW) scale was used to measure participants' willingness to provide care. The scale consisted of 13 items. The first 12 items comprised an equal number of reverse and direct questions. Direct items were scored on a scale from 4 points to 1 point (strongly agree, 4 points; agree, 3 points; disagree, 2 points; strongly disagree, 1 point), whereas reverse items were scored on a scale from 1 point (strongly agree) to 4 points (strongly disagree), with a total score ranging from 12 to 48 points. For Item 13, participants were asked to describe how much they enjoyed taking care of older adults by giving a score from 0–100. A higher score indicated a higher level of willingness to provide care. The Cronbach's alpha was 0.78 for the total scale [21].

### ***Statistical analysis:***

The recorded measurements were coded for data processing and analysis using IBM SPSS v. 20.0 for Windows. The continuous data were assumed in means and standard deviations, and number and percentage for categorical data. independent t-test was used to compare continuous data and chi-square for categorical data. Inferential statistics were performed using a generalized estimating equations [13] to estimate the intervention effectiveness of the simulation course. The significance level was set to 0.05.

## **Results**

### **Participants**

In total, 30 participants met the inclusion criteria and consented to participate in the present study. They were evenly assigned to the experimental and control groups. All of them completed the pretest and posttest. No significant differences between the two groups were observed with respect to general information and demographic characteristics ( $p > 0.05$ ; table 2).

### **Primary outcome**

#### ***Empathy***

After the implementation of the simulation-based holistic health-care education intervention in the ninth week, the comparison of the two groups' empathy toward older adults and individuals with disabilities based on the JSE-HPS revealed the following results. The experimental group achieved a 9.4-point improvement (from  $42.6 \pm 9.8$  to  $52.0 \pm 11.9$ ), which was a significant improvement ( $p = 0.001$ ), whereas the control group achieved a 3.0-point improvement (from  $42.1 \pm 12.2$  to  $45.1 \pm 12.9$ ), which was a marginal improvement ( $p = 0.057$ ). This indicated that the simulation-based holistic health-care education had a limited effect on improving participants' empathy (table 3).

Generalized estimating equations [13] were used to analyze the interaction between groups and time (pretest vs. posttest). A comparison of the two groups revealed that the experimental group achieved a 6.4-point improvement in the posttest relative to the pretest, which represented a significant improvement

relative to the control group ( $p = 0.001$ ). This suggested that the simulation-based holistic health-care education intervention increased empathy effectively (table 4).

## **Secondary outcomes**

### ***Attitude***

After the implementation of the simulation-based holistic health-care education intervention in the ninth week, the comparison of the two groups' attitudes toward older adults and individuals with disabilities based on the KAOPS revealed the following results. The experimental group achieved a 13.8-point improvement (from  $93.8 \pm 10.7$  to  $107.6 \pm 7.4$ ), which was a significant improvement ( $p < 0.001$ ), whereas the control group achieved a 6.2-point improvement (from  $101.8 \pm 13.7$  to  $108.0 \pm 13.1$ ), which was also a significant improvement ( $p = 0.001$ ; table 3). The ATEs revealed the experimental group achieved a 5.4-point improvement (from  $61.7 \pm 4.2$  to  $67.1 \pm 4.1$ ), which was a significant improvement ( $p < 0.001$ ), whereas the control group achieved a 1.8-point improvement (from  $63.0 \pm 4.1$  to  $64.8 \pm 4.3$ ), which was a significant improvement ( $p = 0.022$ ; table 3).

GEE were used to analyze the interaction between groups and time (pretest vs. posttest). A comparison of the two groups revealed that the experimental group achieved a 7.7-point improvement in the posttest relative to the pretest KAOPS, which represented a significant improvement relative to the control group ( $p = 0.002$ ). A comparison of the two groups revealed that the experimental group achieved a 3.5-point improvement in the posttest relative to the pretest ATEs, which represented a significant improvement relative to the control group ( $p = 0.002$ ). This indicated that the simulation-based empathy enhancement program pertaining to older adults and individuals with disabilities improved attitudes effectively (table 4).

### ***Knowledge***

After the implementation of the simulation-based holistic health-care education intervention in the ninth week, a comparison of the two groups' knowledge about older adults and individuals with disabilities based on the KA revealed the following results. The experimental group achieved a 5.0-point improvement (from  $37.3 \pm 4.1$  to  $42.3 \pm 4.3$ ), which was a significant improvement ( $p = 0.001$ ), whereas the control group achieved a 2.3-point improvement (from  $35.7 \pm 3.3$  to  $38.2 \pm 2.9$ ), which was also a significant improvement ( $p = 0.002$ ; table 3). The KSOP revealed the experimental group achieved a 5.2-point improvement (from  $3.1 \pm 2.5$  to  $8.3 \pm 2.8$ ), which was a significant improvement ( $p < 0.001$ ), whereas the control group achieved a 0.7-point improvement (from  $3.7 \pm 2.7$  to  $4.4 \pm 2.5$ ), which was not a significant improvement ( $p = 0.065$ ; table 3).

GEE were used to analyze the interaction between groups and time (pretest vs. posttest). A comparison of the two groups revealed that the experimental group achieved a 2.5-point improvement in the posttest KA relative to the pretest KA, which represented marginal improvement relative to the control group ( $p = 0.055$ ). A comparison of the two groups revealed that the experimental group achieved a 4.5-point

improvement in the posttest KSOP relative to the pretest KSOP, which represented a significant improvement relative to the control group ( $p < 0.001$ ). This indicated that the simulation-based empathy enhancement program pertaining to the older adults and individuals with disabilities enhanced knowledge about older adults and individuals with disabilities effectively (table 4).

### ***Willingness to care***

After the implementation of the simulation-based holistic health-care education intervention in the ninth week, a comparison of the two groups' willingness to provide care based on the PWOP scale revealed the following results. The experimental group achieved a 3.6-point improvement (from  $36.4 \pm 2.6$  to  $40.0 \pm 3.5$ ), which was a significant improvement ( $p < 0.001$ ), whereas the control group achieved a 1.3-point improvement (from  $35.4 \pm 3.2$  to  $36.7 \pm 1.3$ ), which was not a significant improvement ( $p = 0.065$ ). The experimental group on the CW scale achieved a 3.4-point improvement (from  $31.9 \pm 3.1$  to  $35.3 \pm 3.2$ ), which was a significant improvement ( $p < 0.001$ ), whereas the control group achieved a 3.8-point improvement (from  $29.6 \pm 6.1$  to  $33.4 \pm 6.0$ ), which was also a significant improvement ( $p = 0.003$ ). The control group achieved a significant improvement because the participants received standard holistic care clinical training (table 3).

GEE were used to examine the interaction between groups and time (pretest vs. posttest). A comparison of the two groups indicated that the PWOP of experimental group achieved a 2.1 –point improvement in the posttest relative to the pretest, which did a significant improvement relative to the control group ( $p = 0.046$ ; Table 4); the CW of experimental group achieved a 0.5-point improvement in the posttest relative to the pretest, which did not represent a significant improvement relative to the control group ( $p = 0.723$ ; table 4).

## **Discussion**

To the best of our knowledge, this is the first study to incorporate an immersive simulation course into physiotherapy clinical intern for the purpose of improving students' empathy, attitudes, knowledge, and willingness to care for older adults and individuals with disabilities. The results indicated that the simulation-based holistic health-care education implemented in this study was feasible and effective.

## **Empathy**

After the implementation of standard clinical training, we incorporated simulation-based holistic health-care education in the ninth week. According to the result of the JSE-HPS, for empathy, the experimental group achieved a 9.4-point improvement (22.1%), whereas the control group achieved a 3.0-point improvement (7.1%); the difference between the two groups' scores was 6.4, with the experimental group achieving a score that was 15% higher. This findings corresponded to those of other studies that applied simulation teaching interventions to medical, nursing, and pharmaceutical students; these studies reported that the interventions, which had intervention periods ranging from 2–12 h, improved empathy by 0.7–9.68 points (5–16.3%) [24–28]. A 22.1% improvement was achieved in the present study, which

was higher than those reported by other studies. A possible reason is that the simulation course was supplemented by an after-class sharing component, which could have further enhanced participants' empathy.

## **Attitude**

After the intervention, the KAOPS scale results indicated that the experimental group achieved a 13.8-point improvement (14.7%), whereas the control group achieved a 6.2-point improvement (6.1%). The ATE scale results indicated that the experimental group achieved a 5.4-point improvement (8.8%), whereas the control group achieved a 1.8-point improvement (2.9%). This was consistent with the results of other studies, which reported that simulation teaching improved attitudes by 0.32–19.6 points (4–15.4%) [15, 27, 29–33]. The difference in the level of improvement could be attributed to the differences in the content of the intervention courses, simulation teaching aids that were applied, total teaching time (which ranged from 45 min to 2 days), assessment time (ranging from 2–4 weeks), and assessment scales that were applied. In the present study, the duration of the simulation-based holistic health-care education was 4 h, and the posttest was conducted in the tenth week during the midpoint of their clinical intern. This design could have revealed the effectiveness of the simulation-based teaching in improving students' attitudes toward older adults and individuals with disabilities, which could have developed from their reflection and feelings during the simulation.

## **Knowledge**

After the intervention, the KA scale results indicated that the experimental group achieved a 5.0-point improvement (13.4%), whereas the control group achieved a 2.3-point improvement (6.4%). The KSOP scale results indicated that the experimental group achieved a 5.2-point improvement (168%), whereas the control group achieved a 0.7-point improvement (18.9%). This corresponded to the results of other studies, which reported that simulation teaching improved knowledge about the older adults and individuals with disabilities by 5.9–15.7 points (21.5–73.8%) [29, 32, 34–36]. In these studies, the intervention duration ranged from 50 min to 6 h. Furthermore, various assessment scales were applied, and participants included students (from gerontology health management, medicine, pharmacy, and nursing schools) and household staff. After the implementation of the simulation-based empathy enhancement program in the present study, the participants exhibited an increase in knowledge of aged care. However, this improvement was limited. A possible reason was that the 4-h intervention only allocated 1 h to the teaching of knowledge about aged and disabled care. The remaining 3 h were allocated to simulation activity and after-class sharing. Further programs are recommended to increase students' specific knowledge or provide knowledge about older adults through online methods that improve students' knowledge about aged care.

## **Willingness to care**

After the intervention, the PWOP scale results indicated that the experimental group achieved a 3.6-point improvement (9.9%), whereas the control group achieved a 1.3-point improvement (3.7%). The CW scale results indicated that the experimental group achieved a 3.4-point improvement (10.6%), whereas the

control group achieved a 3.8-point improvement (12.8%). This was consistent with the results of other studies, which reported that simulation teaching improved willingness to provide care by 0.5 points (9.4–10%) [14, 33]. Studies have also indicated that participating in aged-care-related courses can increase willingness to provide care [37, 38]. In the present study, after the two groups received standard holistic health-care clinical training for 9 weeks, the experimental group received additional simulation-based holistic health-care education. Both groups exhibited an improved willingness to provide care, which could be attributed to the clinical training that they received for aged care. However, the difference between the two groups was nonsignificant.

With the populations of older adults and individuals with disabilities increasing year by year, the promotion of patient-centered care, care quality, and empathy toward older adults and individuals with disabilities is essential. The present study is the first to incorporate simulation-based holistic health-care education in standard clinical training conducted during a physiotherapy intern. This intervention was implemented to enable intern students to understand the effects of the physical changes that older adults and individuals with disabilities experience. To improve students' empathy, knowledge, and attitudes, they were asked to experience the constraints experienced by older adults and individuals with disabilities in their daily lives through immersive simulation and after-class sharing sessions.

## **Recommendations for Follow-up Studies**

First, the experimental group in the present study participated in both face-to-face teaching and simulation activity. Future studies can include more intervention groups to explore the effects of the face-to-face teaching intervention when it is implemented alone. Second, the simulation activity lasted for approximately 2 h. Follow-up studies can increase the time allocated for students to wear the simulation suits. For example, students can be asked to wear a restraint belt for an entire day to help them understand the physical and mental discomfort experienced by individuals with disabilities. Third, four checkpoints were designed for the simulation activity. Follow-up studies can add more checkpoints to explore the effects of various interventions. Fourth, we did not examine the cognitive dysfunction factor of the situational simulation. Dementia is also a topic that warrants further examination. Finally, the participants enrolled in the present study were physiotherapy intern students in the senior year of their university studies. Future studies can enroll students in their freshman, sophomore, or junior year to explore whether year of study has a positive effect on future intern performance after an intervention.

## **Study Limitations**

The research limitations of the present study are as follows. First, a limited number of participants were enrolled. Future studies can increase their sample size to observe the benefits of simulation activities on willingness to provide care. Second, we did not adopt a randomized controlled trial to verify the differences between the experimental and control groups. In addition, the differences associated with the cohabitation of study participants and individuals with disabilities should be considered. Third, future studies can conduct follow-up tests to observe the effects of interventions over a longer period of time.

## Conclusion

The simulation-based holistic health-care education intervention improved physiotherapy intern students' empathy, knowledge, and attitudes toward older adults and individuals with disabilities. The results of the present study could serve as a reference for physiotherapy intern units. Simulation teaching could be added to the teaching content for intern students to cultivate their empathy and improve their care attitudes, such that the quality of their care and service can be improved.

## Declarations

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### Authors' information (optional).

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### Authors' contributions.

IHL, CYW and LFL contributed to the study conception and design, interpretation of data, and critical revision of the manuscript. IHL and LFL were involved in the literature review, data collection, data analysis, and manuscript drafting. YNL was involved in the study design and critical revision of the manuscript. HCC was involved in data analysis and critical revision of the manuscript. All authors reviewed the manuscript.

### Funding.

Not applicable.

### Declaration of interest statement.

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Availability of data and materials. The data and materials were submitted to Taipei Medical University. However, the coresponding author can be contacted at reasonable.

## Declarations

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

Ethical approval for this study was obtained from the Institution Review Board of Taipei Medical University. The registration number is N202006001. Informed consent was obtained from participants upon agreeing to participate and confidentially was assured. They were informed there is no risk involved in this study. All methods were carried out in accordance with relevant guidelines and regulations.

## **Consent for publication.**

Consent for publication was obtained from the Institution Review Board of Taipei Medical University.

## **Competing interests.**

All authors report no financial and non-financial competing interests. The authors alone are responsible for the content and writing of this article.

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## Tables

**Table 1**

Simulation activity tasks.

Checkpoint	Task	Activity
1	Dining	Use the nondominant hand to pick up beans with chopsticks, scoop up round objects with spoons, and drink water while wearing a simulation suit
2	Undressing and showering	Put on and take off clothes, get in and out of a bathtub, and shower while wearing a hemiplegia simulation suit
3	Walking and stair climbing	Stand up, push open a door, step over obstacles, and climb stairs while wearing a simulation suit
4	Shopping and registration	Register at a counter and take a health insurance card and change out of a purse or wallet

**Table 2**

Participants' demographics.

General characteristics	Experience	Control	<i>p</i>
Participants (number)	15	15	
Age (Mean ± SD, years)	22.1(1.4)	21.9(2.0)	0.78
Gender (n, %)			
Males	9(60%)	7(46.7%)	0.45
Females	6 (40%)	8 (53.3%)	
Religious belief (n, %)			
Christian	4(26.7%)	0 (0%)	0.19
Taoism	8(53.3%)	11 (73.3%)	
Buddhism	1(6.7%)	2(13.3%)	
Other	2(13.3%)	2(13.3%)	
Living with older adult (n, %)			
Yes	4 (26.7%)	3 (20%)	0.67
No	11 (73.3%)	12 (80%)	
Received similar courses in the past (n, %)	3/27		
Yes	1 (6.7%)	2(13.3%)	0.54
No	14 (93.3%)	13(86.7%)	

**Table 3**

Change in JSE-HPS, KAOPS, ATES, KA, KSOP, PWOP and CW after the intervention

Variable (score)	Experience		Control	
	Mean $\pm$ SD		Mean $\pm$ SD	
	(N = 15)		(N = 15)	
Primary outcome				
JSE-HPS	Mean	SD	Mean	SD
Pre-intervention	42.6	9.8	42.1	12.2
Post-intervention	52.0	11.9	45.1	12.9
Within change	9.4	6.3	3.0	4.7
P value	0.001		0.057	
Secondary outcomes				
KAOPS	Mean	SD	Mean	SD
Pre-intervention	93.8	10.7	101.8	13.7
Post-intervention	107.6	7.4	108.0	13.1
Within change	13.8	7.1	6.2	7.1
P value	<0.001		0.001	
ATES				
Pre-intervention	61.7	4.2	63.0	4.1
Post-intervention	67.1	4.1	64.8	4.3
Within change	5.4	3.8	1.8	2.2
P value	<0.001		0.022	
KA				
Pre-intervention	37.3	4.1	35.7	3.3
Post-intervention	42.3	4.3	38.2	2.9
Within change	5.0	4.5	2.3	2.8
P value	0.001		0.002	
KSOP				
Pre-intervention	3.1	2.5	3.7	2.7
Post-intervention	8.3	2.8	4.4	2.5
Within change	5.2	2.4	0.7	1.2

P value	<0.001		0.065	
PWOP				
Pre-intervention	36.4	2.6	35.4	3.2
Post-intervention	40.0	3.5	36.7	3.2
Within change	3.6	2.1	1.3	3.3
P value	<0.001		0.065	
CW				
Pre-intervention	31.9	3.1	29.6	6.1
Post-intervention	35.3	3.2	33.4	6.0
Within change	3.4	2.6	3.8	4.5
P value	<0.001		0.003	
SD : Standard Deviation ; JSE-HPS : Jefferson Scale of Empathy-Health Profession Students ; KAOPS : Kogan's Attitudes toward Old People Scale ; ATES : Attitudes Towards Elderly Scale; KA : Knowledge about Aging ; KSOP : Knowledge of Situation of Older People; PWOP : Perceptions of Working with Older People; CW : Care Willingness.				

**Table 4**

JSE-HPS, KAOPS, ATES, KA, KSOP, PWOP and CW with interactions of group x time by using GEE models.

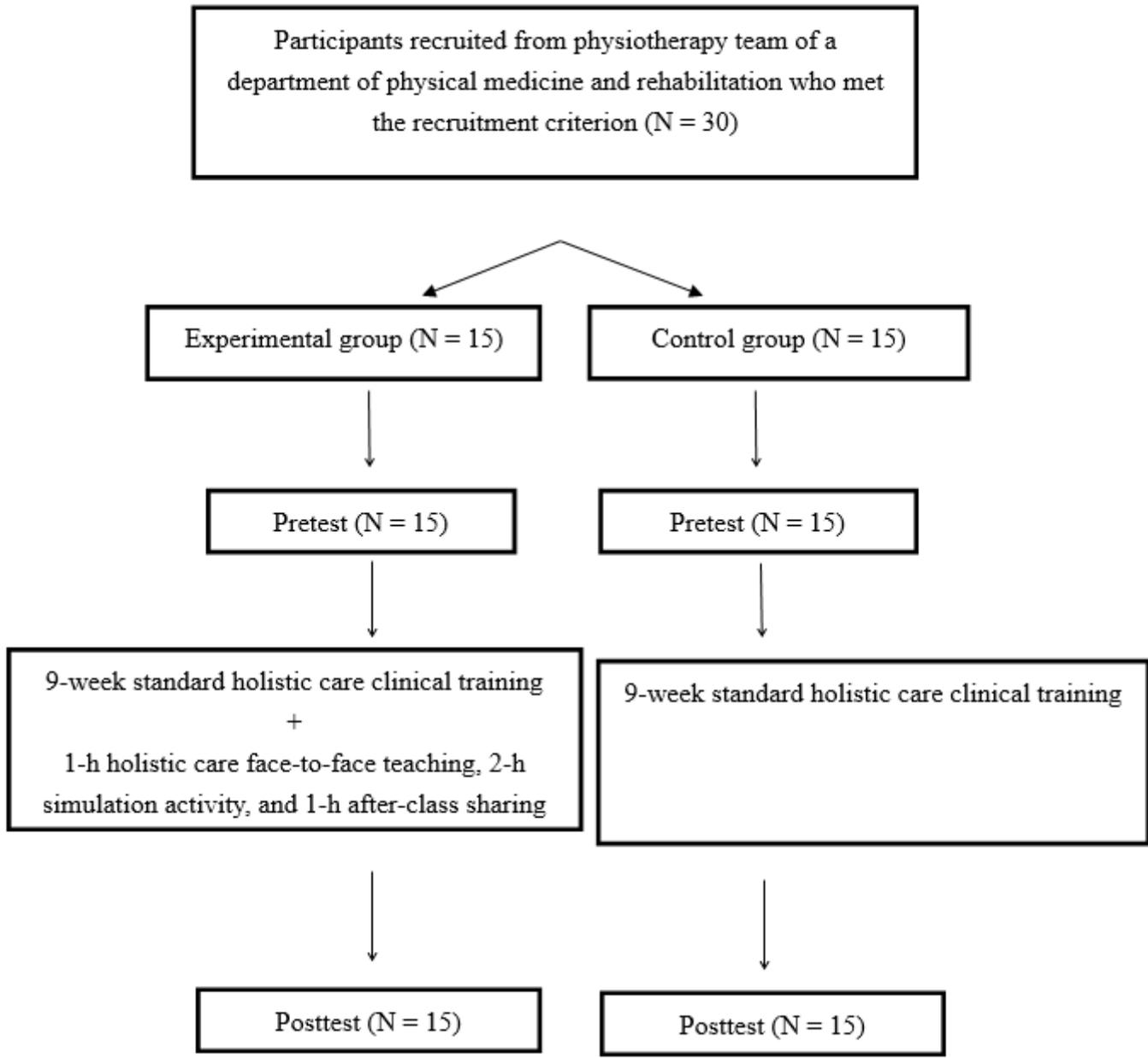
Parameter (score)	Estimate	SE	95 % CI		wald	p value
			lower	upper		
JSE-HPS						
Group <sup>a</sup> x time <sup>b</sup>	6.4	1.9	10.2	2.5	10.3	0.001
KAOPS						
Group <sup>a</sup> x time <sup>b</sup>	7.7	2.5	2.7	12.7	9.2	0.002
ATES						
Group <sup>a</sup> x time <sup>b</sup>	3.5	1.1	5.6	1.2	9.7	0.002
KA						
Group <sup>a</sup> x time <sup>b</sup>	2.5	1.3	5.1	0.1	3.7	0.055
KSOP						
Group <sup>a</sup> x time <sup>b</sup>	4.5	0.7	5.8	3.1	43.7	<0.001
PWOP						
Group <sup>a</sup> x time <sup>b</sup>	2.1	1.0	4.1	0.1	3.9	0.046
CW						
Group <sup>a</sup> x time <sup>b</sup>	0.5	1.3	2.1	3.0	0.1	0.723

JSE-HPS : Jefferson Scale of Empathy-Health Profession Students; KAOPS: Kogan's Attitudes toward Old People Scale; ATES : Attitudes Towards Elderly Scale; KA : Knowledge about Aging ; KSOP : Knowledge of Situation of Older People; PWOP : Perceptions of Working with Older People; CW : Care Willingness;

SE : Standard Error; CI: Confidence Interval.

<sup>a</sup> Group: intervention vs. control group; <sup>b</sup> Time: pretest vs. posttest

## Figures



**Figure 1**

Study flowchart