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## Research Article

# Effect of Animal-Assisted Therapy (AAT) on Social Interaction and Quality of Life in Patients with Schizophrenia during the COVID-19 Pandemic: An Experimental Study<sup>☆</sup>

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## SUMMARY

**Purpose:** Most patients with schizophrenia exhibit low willingness to return to society because of negative social experiences. The COVID-19 pandemic led to severe social isolation for schizophrenia patients. However, animal-assisted therapy (AAT) can improve individuals' empathy, social functions, and quality of life. The study aimed to evaluate the effectiveness of AAT in improving social interactions and quality of life in patients with chronic schizophrenia during the COVID-19 pandemic.

**Methods:** An experimental study was conducted, with six institutions for psychiatric rehabilitation in Taiwan as the case institutions. Patients in these institutions were randomly allocated to the experimental group, which received 60 minutes of AAT once a week for 12 weeks, or the control group, which engaged in routine discussion groups and watched short films about animals. Comparisons between the two groups were made before and after the intervention on social function, social adaptive function, and quality of life. Data were collected before the intervention (T1), immediately after the intervention (T2), and 3 months after the intervention (T3).

**Results:** Comparison between groups showed that social functioning was significantly higher in the experimental group than in the control group at T2. However, there was no sign of improvement in social adaptive functions of the experimental group. The experimental group exhibited significantly higher quality of life than the control group at T2 and T3.

**Conclusions:** There was an impact of COVID-19 on the studied effects. AAT improved social functioning and quality of life in patients with chronic schizophrenia. The effect on quality of life lasted only up to 3 months after the intervention. AAT should be promoted for use as a community-based rehabilitation tool in patients with chronic schizophrenia.

**Trial registration:** Chinese Clinical Trial Registry, ChiCTR2200061715. <https://www.chictr.org.cn>.

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## Introduction

The restoration of patients suffering from psychiatric disorders to society has been a crucial topic given recent trends toward deinstitutionalization. Patients with psychiatric disorders who

receive long-term institutional treatment may experience an impaired quality of life and face challenges in returning to and living in society [1]. The possession of beneficial social skills is crucial for patients with psychiatric disorders to return to a community and may improve their quality of life and increase their satisfaction with social support. However, during their return to society, patients with psychiatric disorders may be less willing to interact with others because of their previous experiences with stigmatization and ostracism [2,3]. In particular, patients with schizophrenia experience discrimination and misunderstanding most frequently. Patients who take medication regularly may still exhibit residual psychotic symptoms. When others do not understand their disease condition, they can easily misunderstand and

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**Table 1** Framework of the 12 Week Animal-Assisted Therapy Program.

Goal	Proposal content
Building relationship	Week 0 Introducing the group
	1. Introduce the content of the group activity to the participants
	2. Finish the distribution and measurements of the pretest questionnaires
	Week 1 Meet the puppies
	1. Introduce the participants to each other and start building relationship
	2. Increase participants' willingness to continue engaging in these activities
Brief interaction	Week 2 Get to know the puppies—"touching"
	1. Guide the participants to try to get along with the service dogs
	2. Guide the participants to touch the service dogs to induce their confidence of making social connections and also build trust between each other
	Week 3 Get to know the puppies—"stand up, sit down"
	1. Stimulate the participants' sense of autonomy by establishing simple instructions to the service dogs
	2. The success of establishing instructions to the service dogs impacts the participants by increasing their confidence in their problem solving skills
Deeper interaction	Week 4 "embrace and admire"
	1. The service dogs will lay down beside the participants, making the participants feel secure and trusted
	2. Reflecting on the participants' emotional dilemmas by sharing one's thoughts and listening to others' advices
	Week 5 "Take a walk together"
	1. From walking the service dogs, the participants get to improve their social interaction skills
	2. The activity can increase the participants' physical flexibility and also increase their ability to get along with other people
Deeper interaction	Week 6 Feeding
	1. Increase the participants' feeling of being able to control matters and boost their confidence by the sense of accomplishment after feeding process to the service dogs
	2. Let every participant experience the achievement felt through feeding and commanding
	Week 7 Groom and talk
	1. Train the participants' communication and social interaction skills through group activities and talking to each other
	2. Foster the participants' confidence during social interactions
	Week 8 Repeat week 1–7
	1. Hold competitive games to help increase the participants' confidence, sense of accomplishment, and self-efficacy
	2. Increase the time of physical activities to train the participants' physical coordination and flexibility through group activities
	Week 9 Go through the tunnel together
	1. Improve interactive skills between both participants and service dogs through group activities
	2. The use of competitive games can provoke the participants' aggressiveness and increase their sense of accomplishment and confidence, hence accumulate their feelings of self-efficacy
Week 10 Touching puppies without seeing	
1. Increase the participants' awareness to others' sound and concentrate through the game	
2. The participants are able to feel other people physically by touching the service dogs, at the same time practice the appropriate way to control their strength during physical interactions with others	
Week 11 Depict the puppy in their most beautiful way	
1. Deepen the impression of other participants and the service dogs through painting	
2. By holding a group talk session, the participants can share their inner thoughts, receive feedback, and encourage each other	
Week 12 Wave goodbye	
1. Enhance positive emotions when the participants think back about the memories of group activities	
2. Stimulate harmonious relationship between the participants by group activities	

become upset with the patients. The patients thus face setbacks in interpersonal relationships, experience distress, and feel a sense of worthlessness and helplessness [3]; these factors can lower their intention to engage in social interaction [4,5]. When patients with schizophrenia exhibit increased levels of loneliness and social isolation, they are likely to develop illusions and delusions [6]. Social isolation is not only a critical predictor of both positive and negative symptoms but also a risk factor for suicidal behavior and intention [7,8]. Since the outbreak of the COVID-19 pandemic in 2019, human interactions have decreased significantly, worsening the social isolation of schizophrenia patients. Ma et al. [9] conducted a study on schizophrenia patients dwelling in psychiatric facilities and concluded that, after their close contact with COVID-19 patients, there was an obvious increase in social isolation compared to those who did not interact with COVID-19 patients, showing that COVID-19 leads to severe mental burden.

To improve the social interaction skills of patients with schizophrenia, professionals in healthcare institutions should establish stable and positive therapeutic relationships with patients before initiating treatment. However, interpersonal relationships are subjective experiences, even for well-trained professionals; unconditional acceptance of a relationship with other people cannot be achieved easily. Relationships with animals, however, can mitigate

this difficulty. The enthusiasm of dog could motivated and engaged participants and help improving participants' social interaction despite their age and diseases [10]. Animal-assisted therapy (AAT) involves the appropriate introduction of animals that satisfy certain criteria into healthcare scenarios with the guidance and assistance of professionals to achieve goal-oriented intervention measures [11]. Animals show unconditional acceptance and companionship, thereby helping reduce depression and anxiety symptoms in older adults [12] and aiding teenagers in understanding their behavioral problems and increasing empathy [13]. Among studies concerning the use of AAT to help patients with psychiatric disorders, Calvo et al. [14] conducted a randomized clinical trial to study the application of AAT to patients with schizophrenia. The results revealed that patients in the experimental group not only improved significantly in terms of both positive and negative symptoms but also exhibited fewer negative symptoms and problematic behaviors, such as social withdrawal after discharge from the hospital. Chang et al. [15] conducted 24 weeks of AAT group activity for patients with schizophrenia and recorded the therapeutic process with respect to 20 patients. The content analysis results indicated that positive activity design and social interaction among participants created supportive group atmospheres, improved participants' willingness to challenge themselves, and increased their self-efficacy. These research results

**Table 2** Demographic Data ( $n = 90$ ).

Variables	Participants ( $n = 90$ )	Experiment group ( $n = 45$ )	Control group ( $n = 45$ )	$\chi^2$	$p$
	$n$ (%)	$n$ (%)	$n$ (%)		
Sex				0.04	.833
Female	45 (50.00)	23 (51.11)	22 (48.89)		
Male	45 (50.00)	22 (48.89)	23 (51.11)		
Marriage				0.05	.829
Single	55 (61.11)	28 (62.22)	27 (60.00)		
Married/divorced	35 (38.89)	17 (37.78)	18 (40.00)		
Educational level				0.00	.999
Below high school	58 (64.44)	29 (64.44)	29 (64.44)		
University or above	32 (35.56)	16 (35.56)	16 (35.56)		
Religious belief				0.73	.677
No	6 (6.67)	4 (8.89)	2 (4.44)		
Yes	84 (93.33)	41 (91.11)	43 (95.56)		
Employment				0.56	.455
No	69 (76.67)	33 (73.33)	36 (80.00)		
Yes	21 (23.33)	12 (26.67)	9 (20.00)		
Family visiting				4.87	.027*
No	16 (17.78)	4 (8.89)	12 (26.67)		
Yes	74 (82.22)	41 (91.11)	33 (73.33)		
Experiencing side effects				1.11	.292
No	45 (50.00)	25 (55.56)	20 (44.44)		
Yes	45 (50.00)	20 (44.44)	25 (55.56)		
	$M \pm SD$	$M \pm SD$	$M \pm SD$	$t$	$p$
Age	50.2 $\pm$ 9.6	49.5 $\pm$ 9.5	51.0 $\pm$ 9.7	-0.74	.459
Age of morbidity	30.6 $\pm$ 11.0	29.7 $\pm$ 11.1	31.4 $\pm$ 10.9	-0.75	.457

Note:  $M$  ( $SD$ ) Continuous variables used Independent t test;  $n$  (%) Categories variables used Chi-square test or Fisher's exact test; \* $p < .05$ .

suggest that AAT can substantially improve the physical conditions, psychological status, and quality of life of patients with schizophrenia.

To date, only a limited amount of research has been conducted concerning the application of AAT to patients with schizophrenia. In particular, the social interaction between patients with schizophrenia and other individuals has rarely been explored during the COVID-19 pandemic. Most relevant studies have focused on positive and negative symptoms, depression and anxiety, and quality of life. The objective of the present study was to explore the effectiveness of AAT with respect to improving the social interaction and quality of life of patients with chronic schizophrenia during the COVID-19 pandemic.

## Methods

### Research site and recruitment

This longitudinal, single-blind experimental study mainly recruited participants from institutions for psychiatric rehabilitation in northern Taiwan. A small psychiatric rehabilitation institution generally has an average of 15–30 residents in Taiwan. This study needed to recruit 4–6 institutions. A lot-drawing method using Microsoft Excel was employed to provide a random selection of all institutions for participant recruitment. After approvals were obtained from six institutions by the selection list, coin tosses were used to assign an institution randomly to the experimental or control group, with three institutions per group. Participants of the control group and the experimental group were not in contact throughout the intervention, avoiding interference to the results. The intervention activities in both groups involved the participation of researchers, and animals were featured in the intervention activities of both groups. Participants and institution personnel were blinded to the grouping. Recruitment took place between January 29 and February 7, 2021. The researchers introduced and highlighted the benefits of the objectives and contents of the study to residents at the institutions' activity halls. Individuals who satisfied the inclusion criteria were recruited after signed consent forms were obtained.

The researchers wanted to investigate the changes over time. Referencing Olsen et al. [16]'s research design. Data were collected before the intervention (T1), immediately after the intervention (T2), and 3 months after the intervention (T3).

### Inclusion and exclusion criteria for participant recruitment

The inclusion criteria were as follows: patients diagnosed with schizophrenia according to the *Diagnostic and Statistical Manual of Mental Disorders*, 5th edition; patients who resided in the institution for psychiatric rehabilitation throughout the research period (at least 3 months); patients with ages between 20 and 65 years; and patients who were able to listen to, speak, and write Mandarin or Taiwanese. The exclusion criteria were patients with cognitive impairment, alcoholism, brain injury, mental retardation, personality disorders, or allergies to or fears of dogs.

### Sampling

The study used G-power to calculate the sample size. Utilizing the work of Virués-Ortega et al. (2012) on the meta-analysis of AAT on elderly populations and patients with psychiatric disorders, outcome indicators including depression, anxiety, and behavior disturbances. The range of the effect size is 0.29–0.34 [17] and is small to medium ES [18]. The criteria set by this study are rigorous, while ES was set at 0.25, with  $\alpha$  being set at 0.05 and power at 0.8. Repeated-measures statistical tests were used at three time points. The total sample size was 86 participants. To account for possible withdrawals, this study recruited 90 patients. After the study has concluded, doing post hoc power analysis by G-power and we found that the calculating power is 81.9%.

### Research ethics

This study was reviewed by the Institutional Review Board of National Yang Ming Chiao Tung University on January 29, 2021 (Approval no. YM1091XXF). Participants were informed that they could withdraw any time without affecting their rights. All personal

**Table 3** Effectiveness of AAT on Social Function (MHSFS), Social Adaptive Function (SAFS) and Quality of Life (WHOQOL) among Patients with Schizophrenia (N = 90).

Variables	Control group (n = 45)			Experimental group (n = 45)		
	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
Social function $M \pm SD$	54.09 ± 13.80	55.18 ± 14.34	54.81 ± 12.97	50.56 ± 11.89	52.80 ± 11.93	46.07 ± 14.36
Social adaptive function $M \pm SD$	11.87 ± 7.67	10.51 ± 8.21	10.16 ± 7.46	11.56 ± 7.66	9.87 ± 7.69	9.30 ± 8.73
Quality of life $M \pm SD$	78.38 ± 11.89	81.02 ± 16.82	75.16 ± 13.81	79.33 ± 13.40	86.42 ± 17.98	86.64 ± 15.92
Social function $t^1/t^2$		2.45*	1.20		4.12**	-1.85
Social adaptive function $t^1/t^2$		-2.52*	-2.95**		-4.18**	-1.60
Quality of life $t^1/t^2$		1.85	-1.83		4.10**	3.08**
	<i>B</i>			<i>SE</i>		
Group (reference: control group)						
Experimental group	-2.88 <sup>a</sup> /-0.34 <sup>b</sup> /1.23 <sup>c</sup>			2.84 <sup>a</sup> /1.71 <sup>b</sup> /3.26 <sup>c</sup>		
Time (reference: baseline)						
T <sub>2</sub>	1.09 <sup>a</sup> /-1.36 <sup>b</sup> /2.64 <sup>c</sup>			0.39 <sup>a</sup> /0.40 <sup>b</sup> /1.40 <sup>c</sup>		
T <sub>3</sub>	1.14 <sup>a</sup> /-1.91 <sup>b</sup> /-3.48 <sup>c</sup>			1.80 <sup>a</sup> /1.13 <sup>b</sup> /2.48 <sup>c</sup>		
Group × time (reference: control group × baseline)						
Experimental group × T <sub>2</sub>	1.16 <sup>a</sup> /-0.33 <sup>b</sup> /4.44 <sup>c</sup>			0.55 <sup>a</sup> /0.57 <sup>b</sup> /1.98 <sup>c</sup>		
Experimental group × T <sub>3</sub>	-5.37 <sup>a</sup> /-0.52 <sup>b</sup> /11.06 <sup>c</sup>			2.53 <sup>a</sup> /1.59 <sup>b</sup> /3.50 <sup>c</sup>		
Family visiting Yes vs. No	-3.67 <sup>a</sup> /0.14 <sup>b</sup> /-1.56 <sup>c</sup>			3.34 <sup>a</sup> /2.00 <sup>b</sup> /3.60 <sup>c</sup>		
				<i>P<sub>adj</sub></i>		
Experimental group				.116 <sup>a</sup> /.649 <sup>b</sup> /.021 <sup>c</sup> *		
T <sub>2</sub>				<.01** <sup>a</sup> /<.01** <sup>b</sup> /<.01** <sup>c</sup> *		
T <sub>3</sub>				.478 <sup>a</sup> /.043 <sup>b</sup> /.536 <sup>c</sup>		
Experimental group × T <sub>2</sub>				.043 <sup>a</sup> /.671 <sup>b</sup> /.044 <sup>c</sup> *		
Experimental group × T <sub>3</sub>				.037 <sup>a</sup> /.734 <sup>b</sup> /.007 <sup>c</sup> **		
Family visiting Yes vs. No				.101 <sup>a</sup> /.841 <sup>b</sup> /.578 <sup>c</sup>		

Note: T<sub>1</sub>: baseline; T<sub>2</sub>: postintervention; and T<sub>3</sub>: post 3 months follow-up.

$t^1$ : baseline and postintervention comparison;  $t^2$ : baseline and post 3 months follow-up comparison.

$P_{adj}$ : *P*-value must be adjusted for the multiple comparisons by Bonferroni.

\* $p < .05$ ; \*\* $p < .01$ .

<sup>a</sup> Social function.

<sup>b</sup> Social adaptive function.

<sup>c</sup> Quality of life.

data were coded for privacy protection. All data were used for research purposes only.

#### Research instruments

##### Demographics

Demographic data included sex, age, education level, marital status, employment, religion, and age of diagnosis. The demographic data were used as control variables to understand the intervention effectiveness of AAT on residents' social interaction and quality of life.

##### Mental health-social functioning scale (MHSFS)

This study used the MHSFS developed by Song [19] to measure participants' social competence and abilities in daily life. The MHSFS comprises 36 items across 7 subdimensions, namely, social/withdrawal, interpersonal communication, independence-ability, independence-performance, entertainment, sociality, and occupation/employment. Each item is scored from 0 to 3, except for items in the "occupation/employment" subdimension. The total score ranges between 0 and 100. Higher scores indicate better social functioning. The MHSFS exhibited good internal consistency with respect to patients with psychiatric disorders; Cronbach's alpha coefficient of the overall dimension was 0.80. MHSFS can be filled by patients with psychiatric disorder or their caregivers [19], for this study to reach the same level of evaluative criteria, it would be filled by the regular institutional staff. The scale was completed by institutional staff who evaluated the social functioning of residents over the last 3 months.

##### Social adaptive function scale (SAFS)

This study used the SAFS developed by Li and Tsai [20] to measure participants' day-to-day living abilities, social functioning, and occupational abilities. SAFS is used by mental health workers to assess patients with psychiatric disorder's social life. The scale was completed by institutional staff. The SAFS contains 15 items and is scored on a 4-point (0 to 4) Likert scale. Higher scores indicate worse adaptive functions. Cronbach's alpha coefficients of each

factor were 0.88 for day-to-day living abilities, 0.90 for social functioning, and 0.90 for occupational abilities. The internal consistency of the scale was 0.94.

##### Taiwanese version of the world health organization quality of life brief version WHOQOL-BREF

The WHOQOL-BREF, Taiwanese version [21], the scale is measuring participants' subjective feelings toward their life quality, was completed by participants. This questionnaire consists of four dimensions: physical, psychological, social, and environmental. It contains 28 items, each of which is scored on a 5-point Likert scale. Higher scores indicate better quality of life. Cronbach's alpha coefficients of the dimensions ranged between 0.70 and 0.77. The overall Cronbach's alpha coefficient of the questionnaire was 0.91, suggesting good internal consistency [22].

##### AAT program

This study developed a 12-week AAT program, with one 60 min session of group activity per week. The program was designed considering the labor and economic cost and was also based on previous studies [15]. The intervention program was implemented through support groups to help participants develop their skills in social interaction and emotional expression (Table 1). The expert validity of the intervention was determined by five nurses and social workers who had more than 3 years of experience providing clinical care in the Psychiatry Department and by two AAT experts. The scale-level content validity index was calculated to be 0.976, implying that the overall program demonstrated good content validity.

The AAT program proceeded as usual, being held in the reception hall. Activities were carried out by the researchers and social workers, along with the participation of two service dogs and two professional AAT therapists. The dogs had received training for at least 3 months and were amicable. The AAT therapists had undergone at least 6 months of dog-related training and professional courses and had experience providing services to people with disabilities. The control group participated in discussion groups once per week, sharing their thoughts about life; these activities

were led by the researchers and social workers. For the blinding of the participants, short films about animals were provided for the members of the control group to watch. Videos of cute animal documentaries were 10–15 minutes length each. Participants will then share their thoughts afterward. The intervention duration and frequency were identical for both groups.

#### Data analysis

All statistical analyses were conducted using SPSS V23.0 (IBM Corporation, Armonk, NY, USA). Participants who did not attend the first and last sessions or were absent for  $\geq 2$  sessions were excluded from the analysis. Data are presented as the mean ( $M$ )  $\pm$  standard deviation ( $SD$ ) or frequency ( $n$ ) and percentage (%). Chi-square tests and independent-samples  $t$  tests were used to compare demographic variables between the two groups. The effectiveness of the intervention with respect to social functioning, social adaptive functions, and quality of life was compared using paired  $t$  tests for within-group comparisons and a generalized estimating equation (GEE) for between-group repeated comparisons. According to “Goodness of fit,” the best QIC value is “unstructured” correlation structure in the study. Using the matrix, a GEE analysis was conducted.

#### Results

The research period for this study was from January 31, 2021, to September 12, 2021. A total of 98 residents met the inclusion criteria, eight of whom refused to participate in the study. Ninety participants completed the study and were included in the data analysis.

#### Participant demographics

The experimental group and the control group each consisted of 45 participants. The participants of two groups have even gender distribution. The mean age in experimental group was 50.2 years and 49.5 years in control group. Table 2 shows that both groups had no significant differences in terms of eight demographic attributes, including sex, marriage, and education. Participants in the experimental group received significantly more family visits than those in the control group ( $p = .03$ ).

#### Effectiveness of MHSFS

Within-group comparison (Table 3): In the experimental group, the MHSFS scores of participants were significantly higher at T2 ( $M = 52.80, SD = 11.93$ ) than at T1 ( $M = 50.56, SD = 11.89$ ) ( $p < .01$ ), but the MHSFS scores at T3 ( $M = 46.07, SD = 14.36$ ) were not significantly different from those at T1 ( $p > .05$ ). Participants in the control group had significantly higher MHSFS scores at T2 ( $M = 55.18, SD = 14.34$ ) than at T1 ( $M = 54.09, SD = 13.80$ ) ( $p < .05$ ), but their MHSFS scores at T3 ( $M = 54.81, SD = 12.97$ ) were not significantly different from those at T1 ( $p > .05$ ). The results revealed that both groups improved their social functioning after the intervention; however, this effect was not permanent.

Repeated measurements were conducted with respect to both groups. At T2, MHSFS scores increased significantly, indicating improved social functioning in both groups. The interaction of group  $\times$  time indicated that the MHSFS scores of the experimental group at T2 were significantly higher than those of the control group at T1 ( $B = 1.16, p < .05$ ). However, the MHSFS scores of the experimental group decreased significantly at T3 ( $B = -5.37, p < .05$ ). The results suggested that the social functioning of the experimental group improved significantly immediately after the

intervention; however, their social functioning decreased significantly 3 months after the intervention. Inclusion of the only dissimilar demographic variable between the two groups—family visits—into the analysis did not yield a significant difference.

#### Effectiveness of SAFS

Within-group comparison (Table 3): In the experimental group, the SAFS scores of participants at T2 ( $M = 9.87, SD = 7.69$ ) were significantly lower than those at T1 ( $M = 11.56, SD = 7.66$ ) ( $p < .01$ ). However, the decrease in SAFS scores at T3 ( $M = 9.30, SD = 8.73$ ) did not indicate a significant difference ( $p > .05$ ). The control group had significantly lower SAFS scores at T2 ( $M = 10.51, SD = 8.21$ ) and T3 ( $M = 10.16, SD = 7.46$ ) than at T1 ( $M = 11.87, SD = 7.67$ ) (both  $p < .05$ ). Thus, social adaptive functions improved in both groups after the intervention, and the effectiveness of the intervention on the control group persisted 3 months after the intervention.

Repeated measurements were conducted with respect to both groups (Table 3). At T2 and T3, SAFS scores decreased significantly ( $p < .01$  and  $p < .05$ , respectively), indicating that both groups achieved significant improvement in terms of their social adaptive functions. The interaction of group  $\times$  time indicated that the experimental group did not achieve a significant decrease in SAFS scores at T2 and T3 as compared with the control group ( $p > .05$ ). The results suggested that the experimental group did not exhibit a significant difference in terms of the level of improvement in their social adaptive functions as compared with that of the control group. Inclusion of the demographic variable of family visits into the analysis did not yield a significant difference.

#### Effectiveness of WHOQOL-BREF

First, a within-group comparison was conducted (Table 3). The WHOQOL scores of the experimental group at T2 ( $M = 86.42, SD = 17.98$ ) and T3 ( $M = 86.64, SD = 15.92$ ) were significantly higher than their scores at T1 ( $M = 79.33, SD = 13.40$ ) (both  $p < .01$ ). The WHOQOL scores of the control group increased at T2 ( $M = 81.02, SD = 16.82$ ) and decreased at T3 ( $M = 75.16, SD = 13.81$ ); however, none of these differences were significant (all  $p > .05$ ). The results revealed that the quality of life of the experimental group improved significantly after the intervention and that such improvement persisted for 3 months.

Repeated measurements and comparisons of the experimental and control groups were conducted. At group, WHOQOL scores of the experimental group were significantly higher compared with the control group. At T2, WHOQOL scores increased significantly, indicating improved quality of life in both groups. The interaction of group  $\times$  time indicated that the experimental group exhibited a significant difference in terms of the level of increase in their WHOQOL scores at T2 and T3 compared with the changes exhibited by the control group ( $p < .05$ ). The inclusion of the demographic variable of family visits did not yield a significant difference in terms of quality of life.

#### Discussion

The objective of this study was to explore the positive effects of AAT for patients with chronic schizophrenia. The research results see great improvements in social function, experimental group at postintervention, but a clear downward trend 3 months after the intervention. However, we saw no great improvements in both social adaptive function and experimental group at post-intervention until 3 months later. In terms of the quality of life, the experimental group saw significant improvement at post-intervention until three months later. The positive effects on social

function and quality of life meant that through animal interactions schizophrenia patients can build social skills and improving their quality of life. Meanwhile, the lack of improvement in social adaptive function is unprecedented considering previous studies [23,24], and there will be related discussed on said topic.

The effects on social function in our study, there was no significant difference in the social function between the experimental group ( $M = 54.09$ ) and control group ( $M = 50.56$ ) in the pretest, meaning that the two groups have the same social function level. At T2, both groups exhibited increased social functioning scores. The control group might have been subjected to the Hawthorne effect [25]. During the AAT activities, researchers participated in the activities of both groups to maintain blindness. The control group engaged in routine discussion groups and watched short films about animals, which were not part of their original discussion group. This change may have caused residents to believe that they were of an experimental group and affected their postintervention behavioral performance, thereby leading to a significant effect. In repeated measurements and comparisons between the two groups, the T2 scores of social functioning exhibited by the experimental group increased significantly compared with those of the control group. The intervention effectiveness indicated that the AAT intervention improved participants' social functioning. O'Haire et al. [23] used 8 weeks of AAT to improve the social functioning of people with autism spectrum disorder. Wesenberg et al. [24] demonstrated AAT to 17 dementia patients, and we saw great increase in patients' social interaction and positive emotion (pleasure). The results of that study revealed that AAT not only improved patients' social skills but also reduced their social withdrawal. During the AAT process used in the present study, interactions between residents and service dogs helped residents understand their internal emotional changes and develop a trusting and interactive relationship with the dogs. Consequently, residents could practice the capabilities required to develop mutual trust and social skills with people, thereby increasing their social functioning. However, at T3, the social functioning of the experimental group decreased significantly, possibly because of the effects of the COVID-19 pandemic. After May 2021, the Taiwan Center for Disease Control announced that no visitors were allowed to enter hospitals, nursing centers, and institutions for psychiatric rehabilitation, including family members. During the study, the researchers found that compared to the control group, the participants in the experimental group received visits from family significantly more frequently. However, the no-visiting regulation was established during T2 to T3. For participants in the experimental group whose family did not visit, the lack of social interactions could lead to the degeneration of their social function. There is negative influence to social function when patients with Schizophrenia lack familial support [26]. The situation is shown and proved by previous experimental results by Ma et al. [9]. At the same time, to reduce contact between residents of psychiatric rehabilitation and other people, two of the institutions in the experimental group limited the outdoor time of residents (no such limitations were reported by the other four institutions); residents decreased their amount of time spent on outdoor activities and lacked normal social interactions with others in the institutions. Since MHSFS scores were calculated using staff's evaluation of the residents' social life over the last 3 months, the scores of the experimental group decreased significantly. The results were similar to those reported by studies of COVID-19. The pandemic reduced social interaction and social support [27]. Thus, the present study assumed that the results were caused by the limitation of residents' interactions by institutions to mitigate the effects of the pandemic.

The social adaptive functions of the experimental group improved significantly at T2 compared to T1, which corresponds to

the results found by Chang et al. [15]. However, no significant improvement was noted at T3, possibly because of the larger SD (8.37) of the T3 sores in experimental group, which indicated marked inter-individual differences. This result may be explained by the stricter pandemic prevention measures implemented by two of the institutions in the experimental group. Some residents remained in their rooms by themselves most of the time. The staff evaluation of the residents' day-to-day living abilities at T3 changed from "active completion" to "needs reminders by others." When the social interaction of institutional residents is reduced, their social adaptive functions can easily decrease [28]. The between-group comparison results revealed that the experimental group did not exhibit significant improvement at T2 and T3. There are other reasons that could have influenced the effect of the intervention—social function and social adaptation are both subjective perceptions, leading to the potential for different perceptions due to their analysis from different aspects. For instance, it is very challenging for residents and experts to evaluate social adaptation and communication about the forced migration issue from their perspectives; hence, subjective perceptions need to be evaluated [29]. In addition, Ortega et al. [30] performed a follow-up on social function for a year after the first onset of psychosis and used a self-report questionnaire. Considering the objectiveness of the evaluation, the MHSF and SAFS in this study were completed by institutional staff. The study was limited by the lack of consideration on differences in perceptions that would influence the results, so it is recommended that researchers collect information from both participants and staff for reference in future studies.

The quality of life of participants in the experimental group at T2 and T3 significantly improved compared with preintervention. The quality-of-life scores of the experimental group at T2 and T3 were significantly higher than those of the control group. The results implied that AAT not only benefited participants immediately after the intervention but also had persistent effects 3 months after the intervention. The positive effect on quality of life described in other studies were also proven [16,31]. Moreover, the quality of life of the experimental group was not affected by the pandemic. Smolarczyk-Kosowska et al. [32] explored the effects of a rehabilitation program on patients with psychiatric disorders during the COVID-19 pandemic and identified positive effects on their emotions and quality of life that are consistent with the results of the present study. The present study used AAT to improve the quality of life of patients with schizophrenia significantly. During the AAT process, group activities and the development of supportive environments, including physiological, psychological, social, and environmental aspects, were fundamental factors influencing the quality of life of patients with psychiatric disorders [15]. Thus, the present study identified the positive effects of AAT with respect to improving the quality of life of patients with chronic schizophrenia.

During the COVID-19 pandemic, the regulations established by institutions to mitigate the effects of the pandemic affected residents' social functioning and social adaptive functions. These regulations were environmental factors that could not be eliminated, and they serve as limitations for the present study. Another limitation was randomization in one institution and each group. The effects of intervention is easily influenced by the environment of the institutions, random assignment is a method that can be considered in future studies.

## Conclusion

Because of the COVID-19 pandemic, institutions for psychiatric rehabilitation established stricter regulations that interfered with the results of this study. The AAT program effectively improved the social interaction and quality of life of patients with chronic

schizophrenia. In the case of the quality of life, the effectiveness of the intervention lasted for only up to 3 months after the intervention. Nevertheless, the proposed intervention program can assist patients with chronic psychiatric disorders in returning to social life and can serve as a reference for personnel working in community institutions for psychiatric rehabilitation. This intervention can help improve patients' physiological and psychological health, strengthen their social functioning and social adaptive functions, and promote their return to a healthy life.

### Data availability

The data that support the findings of this study are openly available in ResMan clinical trial management public platform at <http://www.medresman.org.cn>, Reg number ChiCTR2200061715.

### Q8 Author contributions

Study conception and design: Chieh-An Shih, Man-Hua Yang. Data collection: Chieh-An Shih. Data analysis and interpretation: Chieh-An Shih, Man-Hua Yang. Drafting of the article: Chieh-An Shih, Man-Hua Yang. Critical revision of the article: Man-Hua Yang.

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### Conflicts of interest

The authors declare that we do not have any commercial or associative interest that represents a conflict of interest in connection with the work submitted.

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