

Can occupational therapy manpower be replaced with social robots in a singing group during COVID-19?

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Abstract.

BACKGROUND: Prior to the COVID-19 global health emergency, reducing direct contacts between therapists and patients is an important issue, and could be achieved by using robots to perform certain caring activities.

OBJECTIVE: This study compares therapeutic factors of singing group activities directed by social robots and by occupational therapists at elderly care centers during this COVID-19 outbreak.

METHODS: This project has a quasi-experimental research design, based on a pilot study of 14 subjects aged above 65 years. They received eight sessions of singing group therapy given by a social robot or an occupational therapist. Completed copies of a therapeutic-factor questionnaire were then collected.

RESULTS: At the 4th week, the scores for 8 therapeutic factors were higher in sessions with the occupational therapist than the robot-directed sessions, reaching a statistically significant level; at the 8th week, the scores for 3 therapeutic factors, including imparting of information, were higher in sessions with the occupational therapist than in sessions with the robot. The top scoring therapeutic factor in the robot sessions was group cohesiveness.

CONCLUSIONS: Social robots may be good companion tools for elderly care during this COVID-19 outbreak, but group therapy sessions supervised by real-person therapists still have higher therapeutic factor scores than those conducted by robots. The number of subjects needs to be increased to enhance the validity of future study results.

Keywords: Occupational Therapist, social distancing, group therapy, therapeutic factors, pandemic, COVID-19

1. Introduction

During this COVID-19 outbreak, epidemic prevention and social distancing is an important issue for long-term care institutions, and measures

to reduce contact infection are therefore worthy of consideration and study [1]. COVID-19 will inevitably have an impact on the intervention methods of future occupational therapy [2]. Using robots to carry out certain caring activities is likely to lower direct contact between therapists and patients amid the epidemic, while also maintaining mental health. Medical staff have prevented the spread of COVID-19 more successfully in Taiwan than in other countries [1]. This research article thus presents a study of the application of social robots

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to assist occupational therapists with singing group therapy under COVID-19.

Robots are still mainly adopted for physiological applications, such as surgical operations and post-stroke habilitation [3–5], and not much for psychological care or reducing contact infections. A study of 23 cases at a veterans' center found that using social robots for companion care could improve the subjects' expression of emotions and reduce their negative emotions, and identified robotic care as a significant non-drug therapy intervention for mental health [6]. Another study used companion robots to care for five senior-center patients, and found that the curative effects varied among the patients. Nevertheless, social robotics still merit further development [7].

Group therapy is very common method of psychological care for senior people. The effectiveness of social robots in conducting group and recreational activities is worthy of study when considering the therapeutic effectiveness of group therapy.

Another previous study found that a social robot as a companion can increase a patient's sense of comfort, and that even brief, daily robotic companionship can bring positive improvements to physical and mental health for patients with mental illness. [8]. However, due to the relatively small number of related research articles so far, the use of social robots for senior care and mental care certainly merits further study [7, 8].

Yalom identified factors that can affect it, called "therapeutic factors". Kanas created a list of 12 such factors [9, 10], and scored them based on patients' feedback from and feeling about their group-therapy sessions. These 12 factors, which are often adopted to assess the effectiveness of group therapy [10], are altruism, group cohesiveness, universality, interpersonal learning, development of socializing techniques, imparting of information, catharsis, imitative behavior, the corrective recapitulation of the primary family group, self-understanding, instillation of hope and existential factors [9, 10].

Using robots can reduce COVID-19 contact infections and enable flexibility in the use of medical manpower. The application of robotics to health care is now being taken increasingly seriously. However, studies about the benefits of robotic care focus more on physiological than psychological care. Whether robots can take over the psychological effects brought about by real-person occupational therapists remains a very worthy research issue in this era of manpower shortage for long-term care.

Previous studies about applications of social robots in long-term care have focused on the field of physiology, while few study the effectiveness of group therapy based on therapeutic factors. Additionally, due to the limited number of test cases, persuasive evidence for robotic care's effectiveness is lacking. The purpose of this research project is to compare the therapeutic factor scores of group therapy activities at an elderly care center directed by social robots and by occupational therapists, for use as reference for the distribution of medical manpower during the next pandemic.

2. Method

2.1. Research design

This project adopted quasi-experimental research design. Real-field sample cases were accumulated, to ensure that the study reflected clinical reality. The subjects, most of whom were residents of an elderly care center, received eight sessions of group singing therapy activities, supervised by either social robots or occupational therapists. The differences in therapeutic factors between these two groups were analyzed using a therapeutic-factor questionnaire immediately after the fourth and eighth activities. This study took place between May and July 2020.

2.2. Participants

The 14 subjects of this study were aged 65 or over, from a New Taipei City senior care center, healthy or sub-healthy, had no diagnosis of dementia, and had MMSE scores above 28. They all understood instructions, with no communication problem or hearing loss. As volunteers were solicited, these residents had come forward to act as subjects of this study.

2.3. Research tools

This project adopted the following tools.

- (1) The a assessment tool for therapeutic factors: the therapeutic factor questionnaire in this study is taken from the therapeutic factor flashcards of the Chinese Association of Group Psychotherapy. The assessment method was the same as that adopted by previous investigators. The highest score was 10 points, and the lowest score was 2 points [11, 12].

- 139 (2) This study adopted the Zenbo[®] social robot
140 (ASUS Company, Taipei, Taiwan), which can
141 play songs and music, lead a singalong and
142 play videos.

143 2.4. Procedure

144 A social robot and an occupational therapist each
145 ran a singing therapy group once a week for 40
146 minutes, for eight weeks. The combined number
147 of sessions for both groups was thus 16. Each
148 singing-group therapy session included 5–10 min-
149 utes of warm-up activities, 40 minutes of main group
150 activities, and then 10 minutes of group report and
151 discussion. The subjects had been selected to meet
152 our choice criteria, and given their consent. The study
153 process had the following steps:

154 Step 1: Volunteers were divided into two groups,
155 in which every group member signed a consent form.
156 Over the 8-week intervention process, both the exper-
157 imental and control groups engaged in different types
158 of activities; but received the same environmental
159 control condition and related care.

160 Step 2: At the 4th week, all subjects in both groups
161 were asked to answer the therapeutic-factor question-
162 naire.

163 Step 3: At the 8th week, all subjects in both groups
164 were asked to answer the therapeutic-factor question-
165 naire.

166 2.5. Data analysis

167 Data analysis was performed using the SPSS 20.0
168 statistical software, with SPSS 25.0 adopted for fur-
169 ther data statistics and analysis. The differences in
170 therapeutic factors between experimental group and
171 control group were tested using the nonparametric-
172 statistics Mann-Whitney U Test and the Wilcoxon
173 signed-rank test. The latter test was adopted to cal-
174 culate the changes in displayed strength, level of
175 significance of differences, and the influence of indi-
176 vidual therapeutic factors on the singing group.

177 3. Results

178 This analytical results were as follows:

179 *Comparison of therapeutic factors of singing ther-*
180 *apy sessions conducted by social robot between week*
181 *4 and week 8*

182 The scores were higher in week 8 than in week 4
183 in 11 of the 12 therapeutic factors. However, only the
184 “interpersonal learning” factor reached a statistically
185 significant value (0.017).

186 *Comparison of therapeutic factors of singing ther-*
187 *apy sessions conducted by occupational therapists*
188 *between week 4 and week 8:*

189 Scores for group cohesiveness, universality, inter-
190 personal learning, recapitulation of the primary
191 family group, self-understanding and installation of
192 hope were lower in week 8 than in week 4, with
193 the “interpersonal learning” factor reaching statistical
194 significance (value 0.017).

195 *Comparison of therapeutic factors between*
196 *singing therapy sessions supervised by robot and*
197 *occupational therapist in week 4*

198 The occupational therapist’s sessions scored better
199 in all therapeutic factors than the robot’s sessions in
200 week 4. Eight factors — universality, interpersonal
201 learning, development of socializing techniques,
202 imparting of information, catharsis, imitative behav-
203 ior, the recapitulation of the primary family group
204 and installation of hope — reached the statistically
205 significant level.

206 *Comparison of therapeutic factors between*
207 *singing therapy sessions supervised by robot and*
208 *occupational therapist in week 8*

209 The occupational therapist’s sessions scored bet-
210 ter than robot’s sessions in imparting of information,
211 catharsis and imitative behavior, with differences in
212 scores reaching the statistically significant level.

213 4. Discussion

214 Prior to the COVID-19 global health emergency,
215 reducing direct contacts is an important issue for
216 occupational therapy during COVID-19 outbreak [2,
217 13]. Many residents of long-term care institutions
218 are living under psychological stress. Due to condi-
219 tions like epidemic outbreaks, for the sake of reducing
220 direct contact infections, occupational therapists may
221 not always be able to lead group-therapy activities in
222 person. Therefore, the capability of robots to take over
223 part of occupational psychotherapy is worth further
224 study. This investigation thus took singing-therapy
225 groups as objects, and found that the scores of robot-
226 directed singing therapy sessions in week 8 were
227 higher than or equal to those in week 4 in 11 of the 12
228 therapeutic factors. This finding indicates that test-
229 takers’ acceptance of singing therapy directed by a
230 robot increased during the process. However, only

Table 1

Therapeutic factors of singing therapy sessions conducted by social robot between week 4 and week 8 ($n = 7$)

	Average		Sig.
	Week 4	Week 8	
Altruism	7.429	8.571	0.102
Group cohesiveness	7.857	8.714	0.180
Universality	5.143	6.000	0.462
Interpersonal learning	4.286	6.571	0.017*
Development of socializing techniques	5.000	7.429	0.088
Imparting of information	3.714	3.714	1.000
Catharsis	4.571	4.571	1.000
Imitative behavior	3.286	3.286	1.000
Corrective recapitulation of the primary family group	4.143	4.714	0.496
Self-understanding	5.286	4.429	0.197
Instillation of hope	5.714	6.000	0.527
Existential factors	7.429	8.000	0.461

* $p < 0.05$, ** $p < 0.01$; *** $p < 0.001$, using t-test between week 4 and week 8.

Table 2

Therapeutic factors of singing therapy sessions conducted by occupational therapists between week 4 and week 8 ($n = 7$)

	Average		Sig.
	Week 4	Week 8	
Altruism	7.714	8.143	0.854
Group cohesiveness	8.571	7.571	0.197
Universality	7.429	6.143	0.248
Interpersonal learning	7.286	5.857	0.233
Development of socializing techniques	7.286	7.286	1.000
Imparting of information	6.286	6.286	1.000
Catharsis	7.714	7.714	1.000
Imitative behavior	6.714	6.714	1.000
Corrective recapitulation of the primary family group	7.857	4.143	0.017*
Self-understanding	5.571	5.000	0.670
Instillation of hope	8.143	6.286	0.058
Existential factors	7.571	8.429	0.216

* $p < 0.05$, ** $p < 0.01$; *** $p < 0.001$, using t-test between week 4 and week 8.

the “interpersonal learning” score had a statistically significant difference.

At the 4th week, the scores of all 12 therapeutic factors in the occupational therapist’s sessions were higher than or equal to those in the robot’s sessions. The differences in scores of eight factors — universality, interpersonal learning, development of socializing techniques, imparting of information, catharsis, imitative behavior, the recapitulation of the primary family group and installation of hope — all reached the statistically significant value.

Table 3

Comparison of therapeutic factors between singing therapy sessions supervised by social robot and occupational therapist in week 4

	Average		Sig.
	Social robot	Occupational therapist	
Altruism	7.429	7.714	0.277
Group cohesiveness	7.857	8.571	0.473
Universality	5.143	7.429	0.027*
Interpersonal learning	4.286	7.286	0.006*
Development of socializing techniques	5.000	7.286	0.029*
Imparting of information	3.714	6.286	0.050*
Catharsis	4.571	7.714	0.030*
Imitative behavior	3.286	6.714	0.003*
Corrective recapitulation of the primary family group	4.143	7.857	0.005*
Self-understanding	5.286	5.571	0.449
Instillation of hope	5.714	8.143	0.047*
Existential factors	7.429	7.571	0.344

* $p < 0.05$, ** $p < 0.01$; *** $p < 0.001$, using t-test between week 4 and week 8.

Table 4

Comparison of therapeutic factors between singing therapy sessions supervised by robot and occupational therapist in week 8

	Average		Sig.
	Social robot	Occupational therapist	
Altruism	8.571	8.143	0.294
Group cohesiveness	8.714	7.571	0.137
Universality	6.000	6.143	0.398
Interpersonal learning	6.571	5.857	0.231
Development of socializing techniques	7.429	7.286	0.422
Imparting of information	3.714	6.286	0.050*
Catharsis	4.571	7.714	0.030*
Imitative behavior	3.286	6.714	0.003*
Corrective recapitulation of the primary family group	4.714	4.143	0.237
Self-understanding	4.429	5.000	0.219
Instillation of hope	6.000	6.286	0.448
Existential factors	8.000	8.429	0.367

* $p < 0.05$, ** $p < 0.01$; *** $p < 0.001$, using t-test between week 4 and week 8.

Some therapeutic factors of singing therapy sessions supervised by robot scored higher than the occupational therapist’s sessions in week 8, but none of the differences were statistically significant. Conversely, three therapeutic factors had higher scores in the occupational therapist’s sessions than in the robot’s sessions — imparting of information, catharsis and imitative behavior, and the difference was statistically significant. Accordingly, the therapeutic effect scores indicate that the robot-assisted group

252 sessions still cannot replace the occupational thera-
253 pist's sessions.

254 Robot-assisted singing group therapy sessions had
255 the highest scores in group cohesiveness, altruism
256 and existential factors, at both weeks 4 and 8. One
257 possible interpretation is that robot-led singing ther-
258 apy sessions can most easily develop these three
259 factors. Future work to develop these three factors
260 with limited manpower could adopt robots in place
261 of therapists to perform therapy.

262 The COVID-19 pandemic has created great chal-
263 lenges to the lives of people with disabilities and
264 occupational therapists, the creative work patterns of
265 maintaining social distance is an important issue [14].
266 This pilot study used social robot to perform singing
267 activities to maintain the social distance between the
268 therapist and the patient, and compare the therapeu-
269 tic factor between therapist and social robot at elderly
270 care centers.

271 This study has some limitations. First, the num-
272 ber of sample cases is too small, at only 14 sample
273 cases divided into two groups. Second, this inves-
274 tigation used only singing group therapy, and the
275 results may not apply to other types of group therapy.
276 Third, the only social robot adopted in this investiga-
277 tion was Zenbo[®]. Other types of social robots may
278 very well bring about different conclusions in future
279 studies.

280 5. Conclusion and Suggestion

281 Concerns about reducing direct contact infec-
282 tions and therapist shortage in rural areas during
283 epidemic outbreaks have led to consideration of
284 robot-enhanced group therapy as an alternative to
285 therapist-led sessions. This study has taken group
286 singing as an example, and draws the following con-
287 clusions.

- 288 1. Social robots may replace manpower for parts
289 of group activity. Three therapeutic factors
290 — group cohesiveness, altruism and existen-
291 tial factors — have shown higher effectiveness
292 scores when singing group therapy is conducted
293 by the robot.
- 294 2. In most cases, singing group therapy sessions
295 supervised by real-person therapists still score
296 higher than those conducted by robots in terms
297 of therapeutic factors.
- 298 3. Future research should use more sample cases.
299 Studies could then be run to compare the scores

300 of therapeutic factors for person-led and robot-
301 led sessions of other types of group therapy, and
302 of sessions led by different robots. Analytical
303 results of these wider studies would be useful
304 for clinical reference.

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Conflict of interest 312

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