

Acupuncture as an Additional Method of Rehabilitation Post-COVID-19: a randomized controlled trial

Indira Omarova^{1,2*}, Assiya Akanova², Almagul Kurmanova², Gaukhar Kurmanova², Natalya Glushkova³, Amina Seidanova⁴, Kuatshan Turysbekov⁵

¹Faculty of Medicine, Asfendiyarov Kazakh National Medical University, Almaty, Republic of Kazakhstan

²Department of Clinical Subjects at High School of Medicine at Faculty of Medicine and Public Health, Al-Farabi Kazakh National University, Almaty, Republic of Kazakhstan

³Department of Epidemiology, Biostatistics and Evidence Based Medicine, Al-Farabi Kazakh National University, Almaty, Republic of Kazakhstan

⁴Department of Rehabilitation of the City Clinical Hospital №1, Almaty, Republic of Kazakhstan

⁵Rehabilitation Center “Kamenskoe Plato”, Almaty, Republic of Kazakhstan

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*Corresponding Author

Indira Omarova

Department of Clinical Subjects, Kazakh National University, Al-Farabi Avenue 71, Almaty 050069, Republic of Kazakhstan
Tel: +77-05-444-4611

E-mail: umm-abubakr@mail.ru

Objectives: The purpose of this study was to evaluate the effectiveness of complex rehabilitation with and without acupuncture in a hospital setting.

Methods: A randomized clinical trial was performed at Rehabilitation center “Kamenskoe Plato” in Almaty, Kazakhstan. 160 patients with Post COVID-19 condition were randomly equally divided into an acupuncture with complex rehabilitation methods and a only complex rehabilitation methods group in the period from March 1, 2022 to July 1, 2022. Either groups was performed for an 10-14 days period. The outcome measures were the Bartel index, the Borg scale, Modified Dyspnea Scale and the 6-minute walking test. Adverse events also were monitored and documented.

Results: We found statistically significant improvement after the rehabilitation course with acupuncture in the all scales. And in the group without acupuncture, only on two scales: MDS and Borg scale.

Conclusion: Rehabilitation with acupuncture is possible and effective in patients recovering from post-COVID-19. Our findings may be useful to guide clinicians taking care of patients with post-COVID-19.

Keywords: post-COVID-19, rehabilitation, acupuncture, outcomes

INTRODUCTION

The coronavirus disease (COVID-19) outbreak developed rapidly, with 592 million confirmed cases and more than 6 million deaths worldwide as of August 1, 2022 [1]. Many patients have experienced complications and residual effects of COVID-19. Doctors must provide timely and effective rehabilitation of patients who have been infected with SARS-CoV-2 (the causative virus of COVID-19). After almost 2 years of fighting against the SARS-CoV-2 pandemic, the number of patients enduring persistent symptoms long after acute infection is a matter of concern. Although this set of symptoms was initially termed “long COVID,” the World Health Organization recently

re-defined it as “post-COVID-19 condition” (PCC). PCC is a multisystem disease that develops regardless of the initial disease severity. The clinical spectrum of PCC comprises several symptoms, the most common of which is fatigue, affecting 58% of patients, followed by headache, attention disorder, hair loss, and dyspnea, as well as other rare life-threatening conditions (e.g., stroke, myocarditis) [2, 3].

Several clinical practice results have shown that acupuncture plays a significant role in treating COVID-19, bringing new hope for the prevention and rehabilitation of patients. Acupuncture, which is already established as a safe therapy, is practiced without the need for preclinical studies to document components, pathways of action, and safety. Acupuncture has many

established pathways of action and is already accepted by many as an effective therapy for numerous conditions, as well as being recommended for many others, including chronic fatigue, pain associated with myalgic encephalomyelitis, and chronic headaches, common symptoms of PCC [4]. One study proposed the use of acupuncture as a therapeutic or complementary option to psychotherapies or pharmacotherapies, such as those administered to patients suffering depression after COVID-19, where acupuncture is considered to have a high probability of improving therapeutic effects [5].

Previously randomized studies have shown that acupuncture can alleviate the symptoms of fatigue and shortness of breath in patients with cancer and people who do not suffer from cancer [6]. Traditional medicine has been proven as an effective additional treatment for acute SARS-CoV-2 infection [4, 7-14]. Reviews have been conducted on the mechanisms of action of acupuncture in PCC [15], rehabilitation of COVID-19 with physiotherapy [16], and the use of traditional medicine in post-viral olfactory dysfunction [17]. Based on these results, it will be interesting to establish the effectiveness and impact of traditional medicine on the rehabilitation of PCC, as well as on the quality of life and physical activity.

The aim of this study was to determine whether complex rehabilitation methods (CRMs) with and without acupuncture are effective in a hospital setting, as well as to evaluate the effectiveness of CRMs in PCC and their further widespread use to promote rapid recovery.

MATERIALS AND METHODS

In this randomized phase II study, we sought to investigate the effectiveness of acupuncture for the relief of long COVID-related fatigue. The study was initiated on March 1, 2022 and ended on July 1, 2022.

1. Participants

Participants were recruited from patients who were referred for PCC rehabilitation treatment at the rehabilitation center "Kamenskoe Plato." Patients were randomly assigned to groups using 160 opaque sealed envelopes that were serially numbered and stored by a researcher who was not involved in treatment procedures or data analysis. After receiving informed consent, the researcher opened the envelope in accordance with the order in which the participant was included in the study and re-

ceived the prescribed treatment. The patients were randomized into groups based on a random distribution sequence, in which 160 participants were assigned to either the CRM (n = 80) or CRM with acupuncture group (n = 80) at a ratio of 1:1. All participants completed at least 10 days of treatment. Acupuncture was performed once day for 10-14 days.

2. Inclusion criteria

The inclusion criteria were as follows: Older than 18 years; male or female; meet the criteria of critical diagnosis; suffered from COVID-19 in severe and non-severe forms; stable condition; conscious and willing to cooperate with the examination; voluntarily join the study and sign an informed consent form. Severe COVID-19 was defined as any of the following: Oxygen saturation < 90% on room air; signs of pneumonia; and signs of severe respiratory distress (e.g., accessory muscle use, inability to complete full sentences, respiratory rate > 30 breaths per min). Non-severe COVID-19 was defined as the absence of any criteria for severe or critical COVID-19 [18].

3. Exclusion criteria

The exclusion criteria were as follows: patients with serious mental illnesses; patients with cognitive dysfunction who cannot understand the research process and the content of rehabilitation; patients with respiratory insufficiency who require artificial ventilation of the lungs, or patients with shock or combined organ failure requiring observation and treatment in the intensive care unit; pregnant and lactating women; patients with acute infectious diseases; patients with an active stage of all forms of tuberculosis; patients with malignant neoplasms; patients complicated with cardiac arrhythmias, heart failure according to the IV functional class of the classification of the New York Association of Cardiologists; and patients who are also participating in other scientific research.

4. Intervention

The CRMs consisted of respiratory gymnastics, massage, myorelaxation, physical therapy, speleotherapy, exercise equipment, aerosol therapy, oxygen cocktail, magnetotherapy, amplitulse, ultrawave frequencies, ultrasound therapy, ultraviolet irradiation, shungite therapy, inhalation, and outdoor walks. The procedures and their number were prescribed by the phys-

iotherapist after examining the patient.

Patients in the acupuncture group received full-body dry acupuncture treatment, in which 10 points were applied: 9 basic points, and 1 point depending on the specific complaint (e.g., shortness of breath, cough, cognitive impairment, increased blood pressure, joint pain and headache). The names of the basic points from Standard Acupuncture Nomenclature were as follows: SP 6-bilateral, ST 36-bilateral, LU 5-bilateral, LI 4-bilateral, and GV 20-uni. Additional points included shortness of breath and cough –LU 7, cognitive impairment –HT 7, increased blood pressure –GB 20, joint pain –SP 10, headache –TE 23 [19]. The acupuncture needles were inserted into each acupuncture point at a depth of 10 mm. Following the introduction of the needle, rotational or lifting and pushing manipulations were used to obtain the “deqi” sensation, with manual needle stimulation. Bidirectional rotation, with the needle 90° relative to the skin for 18 s, was used to induce the Deqi sensation. Each acupuncture session lasted 30 min. Each treatment was limited to only 11 disposable needles (brand Mingyi 0.3 mm × 25 mm or 0.3 mm × 50 mm), with 7-10 treatment sessions conducted every day.

5. Measurements

The following clinical scales were used to evaluate the effectiveness of rehabilitation:

- 1) Modified Medical Research Council Modified Dyspnea Scale (MDS)
- 2) Bartel index (BI)
- 3) 6-minute walking test (6-MWT)
- 4) The Borg scale – to assess the patient’s exercise tolerance

Upon admission, the following data were collected: demographic data, anthropometric data, and the number and diagnosis of concomitant diseases according to the Cumulative Disease Assessment Scale. The duration of stay and initial laboratory parameters were also recorded.

The MDS, which has been used for many years to grade the effect of breathlessness on daily activities, was used to assess pulmonary function [20]. The MDS is a questionnaire that consists of five statements about perceived breathlessness: grade 1, “I only get breathless with strenuous exercise”; grade 2, “I get short of breath when hurrying on the level or up a slight hill”; grade 3, “I walk slower than people of the same age on the level because of breathlessness, or I have to stop for breath when walking at my own pace on the level”; grade 4, “I stop for breath

after walking 100 yards or after a few minutes on the level”; and grade 5, “I am too breathless to leave the house.” Patients selected the grade that best applied to them [21].

Motor performance was assessed by the BI. The proposed guidelines for interpreting Barthel scores are as follows: scores of 0-20 indicate “total” dependency, scores of 21-60 indicate “severe” dependency, scores of 61-90 indicate “moderate” dependency, and scores of 91-99 indicate “slight” dependency [22].

Exercise tolerance was assessed using the 6-MWT. For analysis, the initial value of patients who were unable to perform the test was considered as 0, I degree 426-550 m, II degrees 301-425 m, III degrees 151-300 m, and IV degrees < 150 m [23].

A modified Borg scale was used to assess the patient’s exercise tolerance. The Borg scale requires patients to rate the difficulty of their breathing, starting with “0,” which indicates no difficulty with breathing, and progressing up to 10, which indicates maximum difficulty breathing [24].

6. Statistical analysis

Statistical analysis was performed using SPSS Statistics 24. Continuous variables are presented as the mean ± standard deviations (SD), whereas categorical data are expressed in quantities and percentages. To analyze the normal distribution of quantitative variables, the two-sample t-test was used from baseline to the end of treatment. We applied an ANCOVA to measure the effect of pre-treatment scale values, with acupuncture as a covariate on post-treatment values. p-values < 0.05 were considered statistically significant.

7. Ethical approval and consent for participation

The study was approved on November 25, 2021 by the Local Ethics Committee of the Al Farabi Kazakh National University (ethical number: IRB-A342). All participants were asked to carefully read and sign an informed consent form, and the researchers provided for the protection of confidentiality and research procedures in accordance with the Helsinki Declaration and relevant national and international regulatory requirements.

RESULTS

A total of 160 participants were checked for compliance with the requirements. The basic characteristics of the participants

are shown in Tables 1 and 2, all of which were similar between the groups.

1. Patients who underwent CRMs without acupuncture

Eighty patients with PCC, with an average age of 60 (30-80) years, were included (25 men and 55 women). The average number of hospital days was 14 (12-16) days. Upon admission to the COVID-19 rehabilitation department, the patients demonstrated preserved cognitive abilities and were able to perform an individual rehabilitation protocol.

The demographic, anthropometric, and clinical characteristics of the included patients is presented in Table 1.

The two groups of patients showed no significant differences in the clinical features and methods of basic rehabilitation. The

average age of both groups was 61 years, with women comprising the majority (n = 121, 75.6%). The mean body mass index was 31 (obesity of the 1st degree). The most common complaint was shortness of breath (95%), and the most common concomitant diseases were chronic bronchitis (89.4%) and arterial hypertension (51.3%). Speleotherapy and massage were the most commonly used rehabilitation procedures (Table 2).

2. Patients who underwent CRMs with acupuncture

Eighty patients with PCC, with an average age of 62 (31-83) years, were included (14 men and 66 women). The average hospital stay was 12 (7-20) days. The average number of acupuncture sessions was nine. Upon admission to the COVID-19 rehabilitation department, the patients demonstrated preserved

Table 1. Demographic, anthropometric and clinical characteristics of patients (n = 160)

Characteristic	Total, n = 160	CRM without acupuncture, n = 80	CRM with acupuncture, n = 80
Age (years)*	61.3 ± 4.26	60.2 ± 3.91	62.4 ± 4.54
Sex, n (%)			
Male	39 (24.4)	25 (31.3)	14 (17.5)
Female	121 (75.6)	55 (68.8)	66 (82.5)
Weight (kg)*	82.7 ± 11.51	78.6 ± 13.92	86.7 ± 9.15
Height (m)*	1.6 ± 7.52	1.6 ± 8.01	1.6 ± 7.03
Body mass index*	31.1 ± 1.05	29.4 ± 0.22	32.7 ± 1.87
	Obesity 1st degree	Excess body weight	Obesity 1st degree
Saturation upon admission, %*	96.1% ± 0.89	96.2% ± 0.6	95.6% ± 1.18
Hospital stay (days)*	13.2 ± 1.99	14.3 ± 0.61	12.1 ± 3.37
Acupuncture (number of sessions)*	-	-	9.5 ± 0.95
Complaints, n (%)			
Shortness of breath	152 (95)	72 (90)	80 (100)
Cognitive impairment (weakness, sleep disturbance)	116 (72.5)	68 (85)	48 (60)
Increased blood pressure	74 (46.2)	36 (45)	38 (47.5)
Joint pain	29 (18.1)	9 (11.3)	20 (25)
Headaches	19 (11.8)	1 (1.3)	18 (22.5)
Cough	15 (9.3)	9 (11.3)	6 (7.5)
Concomitant diseases, n (%)			
Chronic bronchitis	143 (89.4)	66 (82.5)	77 (96.3)
Arterial hypertension	82 (51.2)	33 (41.3)	49 (61.3)
Coronary heart disease	76 (47.5)	31 (46.6)	45 (56.3)
Diseases of the motor system	33 (20.6)	6 (7.5)	27 (33.8)
Diabetes mellitus	22 (13.7)	11 (13.8)	11 (13.8)
Cerebrovascular diseases	6 (3.7)	3 (3.8)	3 (3.8)

*Data are expressed as mean and standard deviation.

Table 2. Rehabilitation methods (n = 160)

Method	CRM without acupuncture, n = 80	CRM with acupuncture, n = 80
	n (%)	n (%)
Massage	69 (86.3)	76 (95)
Breathing exercises	48 (60)	73 (91.3)
Speleotherapy	78 (97.5)	70 (87.5)
Aerosol therapy	58 (72.5)	52 (65)
Magnetic therapy	44 (55)	35 (43.8)
Oxygen cocktail	42 (52.5)	30 (37.5)
Hiking	36 (45)	29 (36.3)
Ultraviolet irradiation	28 (35)	24 (30)
Therapeutic physical education	21 (26.2)	23 (28.7)
Shungite therapy	16 (20)	22 (27.5)
Ultrawave frequencies	10 (12.5)	16 (20)
Amplipulse therapy	9 (11.2)	15 (18.8)
Ultrasound therapy	4 (5)	4 (5)
Kineziotherapy	1 (1.3)	1 (1.3)

cognitive abilities and were able to perform an individual rehabilitation protocol. The most common complaints were shortness of breath and cognitive impairment (weakness, sleep disturbance), while the most common concomitant diseases were chronic bronchitis and arterial hypertension. The most commonly used rehabilitation procedures included massage and breathing exercises (Tables 1 and 2 contain further information on the patients' basic characteristics).

We observed a significant difference within both groups in the dynamics of the average values before and after treatment on the MDS (2.3 ± 0.63 vs. 2.1 ± 0.37 ; $p < 0.002$ and 2.5 ± 0.76 vs. 1.5 ± 0.51 ; $p < 0.001$, respectively) and the Borg RPE scale (3.9 ± 0.36 vs. 3.6 ± 0.49 ; $p < 0.001$ and 3.1 ± 0.85 vs. 2.1 ± 0.68 ; $p < 0.001$, respectively). The 6-MWT and the BI scores were significantly improved in the acupuncture group only (2.7 ± 0.55 vs. 1.9 ± 0.57 ; $p < 0.001$ and 90.6 ± 3.62 vs. 92.7 ± 2.86 ; $p < 0.001$, respectively). The results of the paired t-test comparison before and after treatment showed significant differences between the groups. Therefore, in the next step, we implemented the ANCOVA test, taking into account the type of treatment as a covariate, and identified a significant difference between the two groups (Table 3).

DISCUSSION

The objective of the study was to assess the effectiveness of

CRMs with and without acupuncture in a hospital setting. We found a significant improvement in all scales examined after the rehabilitation course with acupuncture, whereas in the group without acupuncture, significant differences were only observed for the MDS and Borg scale.

Since the first report on the use of acupuncture for treating COVID-19 in 2020 [25], several other studies have also reported a good effect of acupuncture in the treatment and rehabilitation of patients with COVID-19 [26]. Unfortunately, there remains limited information about the use of acupuncture in PCC rehabilitation.

Cordani et al. published a Cochrane Systematic review of rehabilitation for people with PCC with cognitive impairment, anxiety, and depression, which included 17 reviews on cognitive impairment and 37 on anxiety and depression. As a result, they found that acupuncture was effective (very low- to moderate-quality evidence) for the rehabilitation of specific diseases [27].

In a case report on post viral olfactory dysfunction due to SARS-CoV-2 infection, reported effective treatment with a unique integrative approach combining Ayurveda and Traditional Chinese Acupuncture over a 6-month period. As a result, they reported that the patient achieved complete normalcy in olfactory function within 4 months of this. This integrative approach was later found to be safe and effective in treating post-COVID parosmia [28].

Another authors published a case report on a 50-year-old

Table 3. Differences in indicators of results with and without acupuncture, n = 160

Variables	Group		p-value ^a	p-value ^b
	CRM without acupuncture, n = 80	CRM with acupuncture, n = 80		
mMRC dyspnea scale, mean ± SD				
Before	2.3 ± 0.63	2.5 ± 0.76	0.025	< 0.001
After	2.1 ± 0.37	1.5 ± 0.51	0.018	< 0.001
p-value ^c	< 0.002	< 0.001	-	-
Borg RPE scale, mean ± SD				
Before	3.9 ± 0.36	3.1 ± 0.85	0.025	< 0.001
After	3.6 ± 0.49	2.1 ± 0.68	0.018	< 0.001
p-value ^c	< 0.001	< 0.001	-	-
MWT6, mean ± SD				
Before	2.9 ± 0.36	2.7 ± 0.55	< 0.001	< 0.001
After	2.8 ± 0.51	1.9 ± 0.57	< 0.001	< 0.001
p-value ^c	< 0.109	< 0.001	-	-
Barthel index, mean ± SD				
Before	86.8 ± 3.99	90.6 ± 3.62	< 0.001	< 0.001
After	86.9 ± 4.02	92.7 ± 2.86	< 0.001	< 0.001
p-value ^c	< 0.159	< 0.001	-	-

^aResults of paired t-test comparison before and after the treatment.

^bResults of ANCOVA test between groups.

^cStatistical procedure was t-test for dependent samples.

CRM, complex rehabilitation methods.

woman with PCC who had suffered fatigue, anosmia, chest pressure, palpitations, and other symptoms for 8 months following mild assay-confirmed SARS-CoV-2. In this case, the patient's chest pressure and palpitations resolved after one acupuncture treatment, while six additional treatments, spanning 9 weeks and overlapping with physical-therapist-led symptom-titrated physical activity, led to complete recovery and the ability to resume normal exercise [29].

Researches reported on a case study of three patients with PCC symptoms in the form of shortness of breath and fatigue. Acupuncture treatment was found to be crucial for all three patients and helped alleviate their shortness of breath. The response was impressive, with an immediate reduction in pressure pain in the left hypochondrium of the abdomen, as well as an immediate improvement in shortness of breath in all patients [30].

To date, there has been no randomized controlled study on PCC rehabilitation or the use of acupuncture in patients with PCC. Most previous publications were reports. Therefore, we conducted this study to evaluate the effectiveness of general rehabilitation measures and acupuncture. Because the healthcare

system in the Republic of Kazakhstan does not particularly support acupuncture, it was difficult to apply only acupuncture to patients in a state rehabilitation center, while in private medical centers, we could not find a sufficient number of patients for rehabilitation.

In our study, patients who underwent COVID-19 had the following clinical features: moderate and severe COVID-19; aged 18 to 90 years; prone to obesity; respiratory and cognitive system disorders; complaints of joint and head pain, and increased blood pressure; and a history of chronic diseases.

Our analysis revealed that women aged 60-62 years who complained of shortness of breath and had chronic lung diseases were most in need of rehabilitation. Speleotherapy and massage were the most commonly used rehabilitation methods in the Republic of Kazakhstan. Although we demonstrated the benefits of using acupuncture as an additional method, our data are insufficient to assert the effectiveness of acupuncture in rehabilitation for PCC.

In this RCT, we compared CRM with and without acupuncture. The use of acupuncture with CRM showed effectiveness on all scales examined, while the group without acupuncture

showed effectiveness only on the MDS and Borg scale. We assume that the value of the scale before treatment did not affect the final results after treatment, and that treatment (acupuncture) made a significant contribution to the therapeutic effect.

Rehabilitation for PCC showed good results in both patients, with significant improvements observed in both groups following rehabilitation compared to before treatment ($p < 0.05$). The CRM improved respiratory system function and increased exercise tolerance, while the use of acupuncture additionally increased the tolerance to physical exertion and improved the motor activity of patients. In the group without acupuncture, the MDS improved by 8.8%, the Borg scale improved by 7.6%, and the BI and 6-MWT results were not significantly different. In the group with acupuncture, the MDS improved by 40.2%, the BI improved by 2.2%, the 6-MWT improved by 29.5%, and the Borg scale improved by 35%. After rehabilitation in the group with acupuncture, the results were better on all four scales compared to the group without acupuncture. Therefore, we conclude that the use of acupuncture as an additional method served to improve the effectiveness of rehabilitation.

We also noted a significant improvement in primary outcomes after rehabilitation in combination with acupuncture, with significant improvements in disability (BI: 92.7 ± 2.86 vs. 90.6 ± 3.62 ; $p < 0.001$). Shortness of breath was still observed, although there was a statistically significant decrease compared to the baseline level on the MDS (2.5 ± 0.76 vs. 1.5 ± 0.51 ; $p < 0.001$). The use of acupuncture resulted in longer distances traveled in the 6-MWT (2.7 ± 0.55 vs. 1.9 ± 0.57 ; $p < 0.001$), while perceived fatigue, as assessed by the Borg scale during training, was also significantly reduced (3.1 ± 0.85 vs. 2.1 ± 0.68 ; $p < 0.001$). Our research can be used to assist with the widespread implementation of acupuncture in the field of PCC rehabilitation, which will contribute to the rapid and effective recovery of patients. Additionally, the data obtained during this study serve to advance knowledge in this field.

LIMITATIONS

This study has several limitations that warrant discussion. First, because the acupuncture group was a control group, no blinding was performed, which may have affected the results. The environment of the treatment room and repeated health education of acupuncturists can provide participants with positive psychological clues that can help to improve the effect. Additionally, the perceived effect of acupuncture may be related to

the psychological expectations of the subjects before treatment. These factors should be investigated in greater depth in future studies. Moreover, the use of acupuncture in combination with other rehabilitation procedures cannot show the exact effectiveness of acupuncture. Furthermore, there were no repeated observations of patients after a certain time, and there were no secondary results available to conduct accurate performance analysis. Longer follow-up evaluations are needed to better understand the effectiveness of rehabilitation in patients with PCC.

CONCLUSION

Our results show that a CRM with acupuncture improves respiratory system function, daily activity, and exercise tolerance in patients hospitalized with PCC. However, it is impossible to say with certainty that the use of acupuncture with CRM is more effective than the CRM alone. Therefore, further studies using acupuncture only are necessary to better understand its effectiveness.

CONFLICTS OF INTEREST

The authors declare no conflict of interests.

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ORCID

Indira Omarova, <https://orcid.org/0000-0001-8312-0558>

Assiya Akanova, <https://orcid.org/0000-0002-3929-5411>

Almagul Kurmanova, <https://orcid.org/0000-0002-1859-3903>

Gaukhar Kurmanova, <https://orcid.org/0000-0002-5768-0209>

Natalya Glushkova, <https://orcid.org/0000-0003-1400-8436>

Amina Seidanova, <https://orcid.org/0009-0007-0031-6936>

Kuatzhan Turysbekov, <https://orcid.org/0009-0008-9070-5413>

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