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Motivating Diabetic and Hypertensive Patients to Increase Physical Activity: The Use of Photos and Group Dynamics

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Abstract

Aims: Photovoice is a strategy to allow people to express their views and concerns about health. This project aimed to promote physical activity (PA) among patients with chronic illness, identify facilitators and barriers for PA, enhance walking within the neighbourhood, and build up efficacy in doing exercise.

Design: A quasi-experimental study with waitlisted control and pre-and-post measures.

Setting: Community elderly centres.

Participants: A total of 204 older adults with diabetes and/or hypertension were recruited. They were assigned to either intervention group (IG) or waitlisted control group (CG).

Intervention: Under the supervision of a nurse, six weekly group meetings were arranged in community elderly centres in which the participants freely exchanged their views about the barriers and facilitators of regular physical activity. Participants were encourage to take photos in their neighbourhood or at homes, and brought these photos for sharing in the group meetings. The photos showed the barriers and the facilitators to PA. In the last meeting, each participant worked out a plan to perform PA in the coming four weeks.

Measures: PA referred to the number of steps taken per day and it was measured by Garmin Accelerometer at baseline, at Week 6 and Week 10. Other measures include the 9-item Self-efficacy Scale for Exercise - Chinese version (SEE-C), the 23-item Chinese Barriers to Exercise Scale and Senior Fitness Tests. General linear mixed model was used to compare the outcomes between IG and CG after the intervention.

Results: After the 6-week intervention, the average number of steps taken by the IG participants increased. At Week 10, there was a significant higher proportion of the IG participants who had increased at least 1,200 steps than that of the CG (Estimate=0.151,

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SE=0.066, $p<0.05$). The lower body strength of the IG participants was significantly higher than that of the CG (mean difference = 0.94, t=1.957, $p<0.05$) and the lower limb flexibility of the IG participants was also significantly higher than that of the CG (mean difference = 2.04, t=2.397, $p<0.05$) at Week 10.

Conclusion: Understanding older adults' views and thoughts about barriers to PA through photos and group discussion seemed to be a good strategy to motivate older adults with chronic illnesses to commit to regular physical activity. This photovoice intervention improved the participants' physical activity level and physical fitness, particularly in lower limb flexibility and body strength.

Keywords: photovoice, chronic illness, physical activity, barriers, facilitators

1. Introduction

Photovoice, a health literacy tool, has received growing attention in health promotion and health education since its development in the mid-1990s [1]. It is a community-based participatory method, using the social-ecological model of health, to uncover health problems [2]. Such method encourages participants to explore, consider how environment affects ones' health behaviour and share their views. Using photos or pictures, participants reflected on their own lifestyles, identified the pros and cons of the existing behaviour, eventually fostered positive attitude towards healthy lifestyles and made necessary changes in behaviour [2-4]. Photovoice has been used in various studies in a range of populations, for example, youth and older adults in Canada [4, 5], community-dwellers in America [6], rural older women[7], indigenous people [3] and new immigrants [8]. Various health topics were covered in previous photovoice studies, such as healthy eating and accessibility of healthy food choices [6, 7], and HIV/sexually transmitted disease [3]. After reviewing 37 papers on the use of photovoice in different health promotion settings, it was also concluded that photovoice contributed to the better understanding of individuals' behaviour and explained the relationship between behaviour and sociocultural context [9]. With the existing evidences, we were ascertained that photovoice could support individual growth and empowerment. Nonetheless, these previous studies were qualitative studies, which showed the process of the use of photos in behavioural change and its impacts on psychosocial health. Little is known about the effect of photovoice on physical health and actual behaviour in daily lives over time.

With the concept of photovoice [9] and the social-ecological model of health [2], the project team developed a health promotion programme titled 'Make a Change through Photovoice (MCPv): engaging diabetic and hypertensive patients in physical activity'. This programme aimed to motivate sedentary diabetic and/or hypertensive older adults to do physical activity regularly by identifying facilitators and barriers to physical activity. 'Facilitators' refer to the factors that made the participants engaged in physical activity while 'barriers' refer to the factors deterred for doing favourable physical activity [7]. We hypothesized that this intervention would increase the participants' physical activity level, physical fitness and self-efficacy to do exercise.

2. Materials and methods

2.1 Design and participants

This was a quasi-experimental study with a waitlist control and a pre-and-post design. Participants were recruited from four community elderly centres via their newsletters, monthly meetings and promotional booths in the neighbourhood from April 2014 to March 2016. Inclusion criteria of the participants were: 1) aged 55 or above; 2) diagnosed with type 2 diabetes mellitus and/or hypertension; 3) able to ambulate independently; and 4) able to communicate in Cantonese. The recruited participants were split into two groups: intervention group (IG) and control group (CG). Waitlist control design was used so that even the participants in the CG could also receive the intervention after completing all measurements in the study. This was a favourable strategy for community-based projects because the participants in the CG did not feel being discriminated or at disadvantage. In this study, both IG and CG participants received the 6-week intervention.

2.2 Six-Week Intervention

The intervention was six weekly group meetings which involved: 1) the introduction of the concept of photovoice, 2) stretching and muscle strengthening exercise, 3) capturing photos in the neighbourhood, 4) sharing the thoughts when the participants were review the photos, and 5) formulating action plans for physical activity commitment. The group meetings were arranged for three purposes: a) building up the participants' self-efficacy in exercise; b) enabling them to identify and review the facilitators and barriers to physical activities through discussion in a group; and c) setting individualized goals in exercise plan. Each meeting normally lasted for one hour and was arranged under the supervision of a nurse so that the participants could freely exchange their views about regular physical activity based on the pre-designed pictorial storybook and their own photos taken around their living environment. A health-and-fitness officer was also involved in one meeting to rectify the myths of physical exhaustion and guide the participants to do warm up exercise which prevented unnecessary injury in physical activity. In the last group meeting, participants set up individualized action plans (including goals and timetables) for physical activity in the next four weeks.

2.3 Outcomes and health assessment

The primary outcome was the number of steps taken per day. It was measured by accelerometers at baseline (Week 0), right after the six-week intervention (Week 6), and four weeks after the intervention (Week 10). Each participant was invited to wear an accelerometer for 5 days (with 24 hours per day) in each of the specific weeks. The data was automatically stored in a highly secured server. The trained research assistant retrieved the data by using a password.

There were three secondary outcomes: 1) Senior Fitness Tests: upper and lower body strength, lower body flexibility, and aerobic fitness; 2) self-efficacy for doing physical activity (measured by the 9-item Self-efficacy Scale for Exercise - Chinese version, SEE-C) [10], and 3) barriers to exercise (measured by the 23-item Chinese Barriers to Exercise Scale, CBES) [11]. These were measured by trained research assistants in the health assessments at Week 0 and Week 10. Demographics which include sex, age, marital status, educational level, employment status, districts in which they live in, living status, health literacy and types of chronic illnesses were collected.

2.4 Ethical statement

All subjects gave their informed written consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster (HKU/HA HKW IRB) (reference number: UW14-447)

2.5 Data analysis

Descriptive statistics, including numbers, percentages, means and standard deviation, were performed on demographics, number of steps taken daily, self-efficacy and barriers for doing exercise. Paired t-tests were used to compare the changes of mean scores of the physical fitness variables, the total score of SEE-C and CBES before and after the intervention within groups and between groups (IG and CG). General linear mixed models (GLMM) were used to assess the intervention effect on physical fitness variables. Considering participants' age has effects on physical fitness variables (except Arm Curl Test), we adjusted 'age' in the GLMM models except Arm Curl Test.

General linear mixed models (GLMM) were also used to assess the proportion of the participants who had raised their physical activity one level higher than the level at baseline after the intervention. A large number of pedometer-based studies, for example, Tudor-Locke

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and team's study [12] and Richardson and team's study [13], showed the feasibility of the use of pedometers among community-dwelling older adults. In Richardson and team's study [13], its population (persons with diabetes) was similar to the targeted population of the current study. It was reported that the average number of steps taken daily was increased by 1014 steps after the 6-week intervention, with Cohen's d=0.58 [13]. Therefore, the number of steps per day that was slightly higher than 1,000 seemed to be a reasonable cut-off point to determine whether a person with a chronic illness (for example, diabetes) had increased his/her physical activity intensity. With this consideration, we used GLMM with logistic link function to assess the intervention effect. A dummy variable was set up for this: for those who increased their average number of steps per day by 1,200 steps or more, it scored '1'; otherwise, it scored '0'.

3. Results

3.1. Descriptive statistics

Table 1 showed the demographics of the participants in this project. A total of 204 persons were recruited. Among these, 107 were assigned to IG. The mean age of the IG participants were 73.6 (SD = 7.5). The majority of the participants were females (81.4%), married (60.8%), had primary education or below (59.8%) and retired (90.7%). The mean score of health literacy was 37.8 (SD 10.5). There was no significant difference in demographics and their health literacy level between IG and CG (**Table 1**).

Table 1. Participants' Demographics

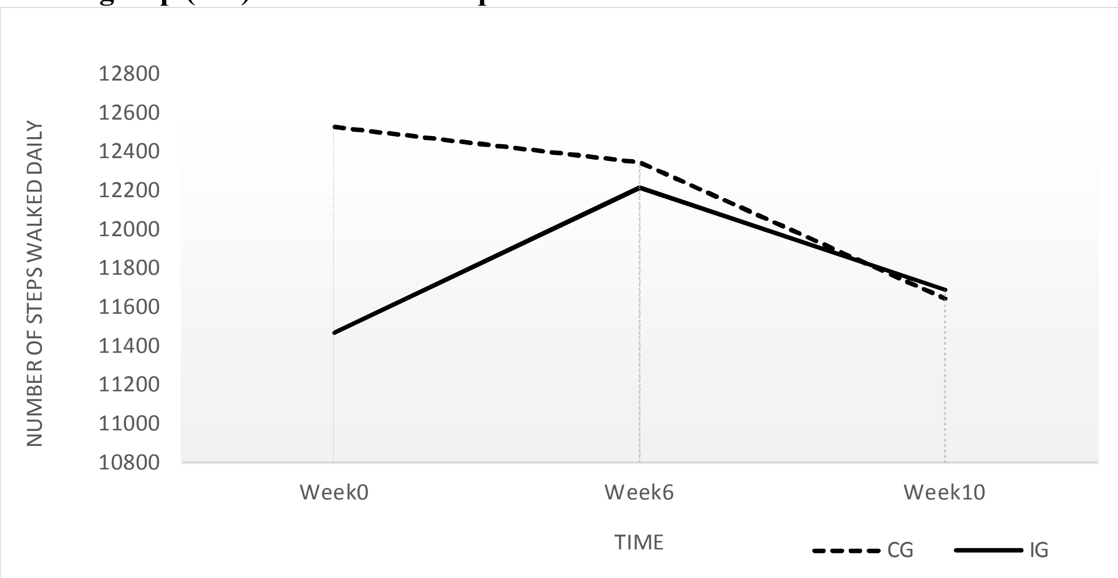
	Intervention (n=107)		Control (n=97)		
	Count	Mean (%)	Count	Mean (%)	p-value
Age		73.6 (SD 7.5)		73.1 (SD 7.5)	0.720
Sex					0.453
Female	79	(73.8%)	74	(76.3%)	
Male	28	(26.2%)	23	(23.7%)	
Marital Status					0.732
Single	7	(6.5%)	8	(8.2%)	
Married	59	(55.1%)	53	(54.6%)	
Others	41	(38.4%)	36	(37.2%)	
Education level					0.814
No formal education	24	(22.4%)	19	(19.6%)	
Primary	34	(31.8%)	32	(33.0%)	
Secondary	37	(34.6%)	33	(34.0%)	
Tertiary	10	(9.3%)	13	(13.4%)	
Missing	2	(1.9%)	0	(0%)	
Employment Status					0.780
Retired	88	(82.2%)	82	(84.5%)	
Others	19	(17.8%)	15	(15.5%)	
Districts					0.444
Western	14	(13.1%)	12	(12.4%)	
Others	93	(86.9%)	85	(87.6%)	
Living status					0.844
Living Alone	33	(30.8%)	30	(30.9%)	
Living with Spouses	25	(23.4%)	30	(30.9%)	
Living with Children	21	(19.6%)	14	(14.4%)	
Others	28	(26.2%)	23	(23.8%)	
Health literacy		37.8 (SD10.5)		39.7 (SD 9.1)	0.190
Chronic illness					
Hypertension	71	(73.2%)	68	(70.1%)	0.781
Diabetes	31	(32.0%)	23	(23.7%)	0.755

3.2 Evaluation of the MCPv program

3.2.1 Physical Activity (PA) – Average Number of Steps Per Day

The average number of steps taken per day was measured at three time points (Week 0, Week 6, and Week 10). At Week 0, the average number of steps taken by the IG participants were lower than that of CG (IG: mean (SD) = 11466 (440.47); CG: mean (SD) = 12526 (520.36)). After the intervention (at Week 6), the average number of steps taken by the IG participants increased, mean (SD) = 12211 (501.81) while the steps taken by the CG participants decreased, mean (SD) = 12343 (590.11). At Week 10, the average number of steps taken by the IG reduced, mean (SD) = 11686 (495.05) but we observed the drop of the average number of steps taken by CG was much deeper, mean (SD) = 11643 (558.64). **Figure 1** showed the change of the average number of steps per day between IG and CG at the three time points.

Figure 1. Mean number of steps walked daily between intervention group (IG) and control group (CG) in the three time points



Note. Accelerometers were worn by participants at Week 0 (baseline assessment), Week 6 (right after the intervention) and Week 10 (4 weeks after the intervention)

3.2.2 Results of GLMM: change of physical activity level

Table 2 showed the estimated intervention effect on the change of physical activity level (average number of steps per day) at different time points (Week 6 and Week 10) with reference to the baseline. At Week 10, there was a significant higher proportion of the IG participants who had increased at least 1,200 steps (the step criteria) than that of the CG (Estimate=0.151, SE=0.066, p=0.023). The F-statistic (F=3.992, p=0.047) also showed the overall significance of the intervention effect on the probability to achieve the step criteria.

Table 2. The association between groups and the probability of increasing the average number of steps per day by 1,200 steps or more at Week 6 and Week 10

Time	Estimates (IG – CG)	SE	t-value	p-value
Week 6	0.103	0.076	1.354	0.177
Week 10	0.151	0.066	2.281	0.023

Notes: IG stands for intervention group; CG stands for control group. Reference was made to the average number of steps taken per day at Week 0. Adjusted for age.

3.2.3 Physical fitness

Table 3 showed the differences in physical fitness parameters between IG and CG. After the intervention, lower body strength (30-second sit-to-stand) of the IG participants was significantly higher than that of the CG (mean difference = 0.94, t=1.957, p<0.05). In addition, lower limb flexibility (chair sit-and-reach) of the IG participants was significantly higher than that of the CG (mean difference = 2.04, t=2.397, p<0.05). **Table 4** showed the results of the GLMM models. Adjusted with age, the lower body strength (30-second sit-to-stand) of the IG participants was significantly higher than that of the CG (estimate = 0.967, SE = 0.484, t=1.997, p<0.05) and the lower limb flexibility (chair sit-and-reach) of the IG participants was also significantly higher than that of the CG (estimate = 2.068, SE = 0.858, t=2.411, p<0.05).

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Table 3. Results of Health Assessment between Intervention Group (IG) and Control Group (CG)

	Gp	HA1 Mean	HA2 Mean	Difference (HA2 - HA1) Mean	Difference (HA2 - HA1) SD	Mean Difference (IG - CG)	t	P-value
Physical Fitness Parameters								
6-min Walk Test (meters)	IG	408.19	418.78	10.60	38.59	-4.21	0.612	0.541
	CG	422.77	437.58	14.81	57.70			
30s Sit-to-Stand (reps)	IG	12.33	13.75	1.42	3.65	0.94	1.957	**0.047***
	CG	12.85	13.34	.48	3.05			
8 feet walking (seconds)	IG	7.14	6.67	-.47	1.63	-0.17	0.775	0.438
	CG	6.76	6.46	-.30	1.46			
Arm Curl Test (reps)	IG	14.00	14.37	.37	3.64	-0.35	0.746	0.456
	CG	13.63	14.34	.72	2.97			
Backstretch Test (cm)	IG	-9.66	-8.57	1.10	8.60	0.97	0.930	0.353
	CG	-8.84	-8.70	.13	5.67			
Handgrip Test	IG	20.17	19.85	-.32	1.82	0.51	0.580	0.563
	CG	20.94	20.11	-.83	8.79			
Chair Sit-and-Reach (cm)	IG	-2.89	-1.28	1.61	6.42	2.04	2.397	**0.017***
	CG	-1.22	-1.65	-.43	5.55			
Health-related Parameters								
Barriers to Exercise	IG	2.17	2.08	-.05	.76	-0.04	0.315	0.753
	CG	2.24	2.10	-.09	.83			
Self-efficacy to Exercise	IG	5.73	5.30	-.43	1.60	0.03	1.367	0.173
	CG	5.42	5.30	-.12	1.58			

Notes. HA1 stands for health assessment before the intervention. HA2 stands for health assessment after the intervention.

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Table 4. Comparison of Physical Fitness Parameters between Intervention Group (IG) and Control Group (CG) after the Intervention using GLMM Models

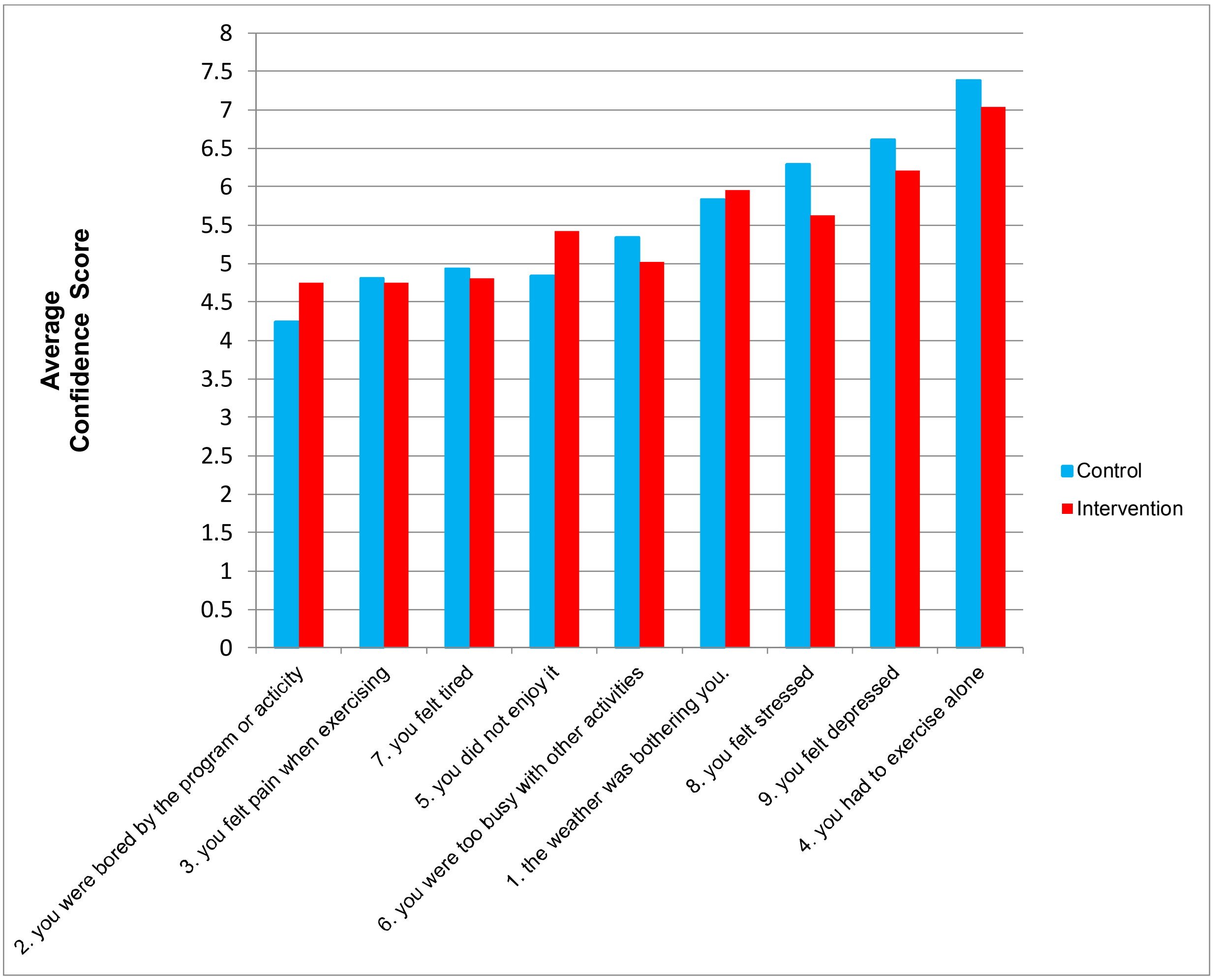
	Estimate	SE	t	P-value
6-min Walk Test (m)	-4.010	6.948	-0.577	0.564
30s Sit-to-Stand (reps)	0.967	0.484	1.997	**0.046***
8 feet walking (seconds)	-0.179	0.221	-0.811	0.418
Arm Curl Test (reps)	-0.44	0.475	-0.724	0.469
Backstretch Test (cm)	0.985	1.047	0.941	0.347
Handgrip Test	0.500	0.882	0.567	0.571
Chair Sit-and-Reach (cm)	2.068	0.858	2.411	**0.016***

Notes. Adjusted for age.

3.2.4 Self-efficacy

Compared to the figure at baseline, the mean total scores of SEE-C of the IG participants had no significant change after the intervention **(Table 3)**. There was no significant difference in the mean score difference of SEE-C between IG and CG after the intervention (mean difference = 0.031, t = 1.367, p>0.05). **Figure 2** showed the list of the situations where the IG participants felt that they had the least confidence to do physical activities, and the first top three situations were: 1) when they were bored by the program or activity, 2) when they felt pain when doing exercise, 3) when they felt tired when doing exercise.

Figure 2. Participants' self-efficacy to perform physical activity



4. Discussion

This 6-week photovoice intervention (the MCPv program) increased the IG participants' average number of steps taken daily at Week 6 and increased their physical activity level at Week 10. The performance of the IG participants outweighed that of the participants in the control group. After participating the intervention, the participants were able to raise their physical activity level (with at least 1,200 steps more than their baseline) at Week 10. This showed that this intervention had not only an immediate effect but also a shortterm effect on physical activity. After participating the intervention, the participants' lower body strength and flexibility were also improved. This finding showed that photovoice was an effective health promotion strategy to improve physical fitness of patients with diabetes or hypertension. Photo-taking, group discussion, self-reflection, skills training and action plans formed a comprehensive, effective strategy to encourage older adults with chronic illnesses to perform regular physical activities.

This intervention did not improve participants' self-efficacy to exercise or significantly reduced the barriers to physical activities. However, the findings of the current study provided some insights for developing physical activity programmes for older adults. The programme should be developed with fun elements so that participants would not feel bored. The instructors of the programme should observe participants' pain level during and after the programme, and monitor the duration of the programme to avoid the participants from exhaustion. With this monitoring, older adults with chronic illness would enjoy physical activities and be confident to participate in the activities

This MCPv programme had some unique features that were worthy to discuss. This programme showed multidisciplinary collaboration in which nurses, health-and-fitness officers, social workers, and community workers worked together to bring the older adults who had chronic illness to an environment that they felt safe to discuss about the barriers to physical activity and plan for individualized action plans. Social workers of the elderly community centers invited older adults who had diabetes or hypertension to attend health seminars so that they could understand the objectives and key contents of the MPCv programme. Nursing faculties highlighted the importance of regular physical activity in chronic illness management in the health seminars. A well experienced research nurse provided valuable knowledge about self-management of chronic diseases and supported self-reflection and group discussion based on the photos. The health-and-fitness officers educated participants how to do exercise safely in one of the weekly group meetings, and conducted physical fitness assessments in the health assessments. Project coordinator assisted the participants how to capture photos with digital cameras (to some older adults, digital cameras were a new technology) and planned a safe route for taking photos in the neighborhood. This multidisciplinary approach seemed to be a key contributing factor to the success of this photovoice intervention.

We also witnessed older adults' active participation in learning new technology. To our surprise, many of them were interested to learn how to read the accelerometers and how to interpret the figures shown in the accelerometers. To some participants, digital cameras were another kind of new technology. The challenges were: how to retrieve the photos, how to download the photos to the computer and how to project the photos to the screen for sharing. Project coordinator played an important role to support these activities. She talked to each participant, discussed which photos should be taken for sharing, and prepared all photos prior to the group meetings. This alleviated the participants' stress to share their photos within the group. This support seemed to be essential for operating a photovoice intervention for older adults in the community.

The use of accelerometers was evidenced to increase older adults' physical activity [14]. However, in the current study, we isolated the effect of accelerometers by asking the participants to use the accelerometers before and after the intervention, and these were used by other the intervention group and control group. The accelerometer effect was therefore balanced out due to this design. Thus, the change of physical activity was not related to the accelerometer effect.

This study showed that photovoice could be a good way to understand older adults' views about physical activities. A few photos taken by the participants indicated that road renovation or nearby construction site was one of the barriers to physical activities because they could not get access to the park for doing physical activities due to road block. In view of this comment, government should develop strategies to minimize the duration of road block and develop alternate pathway during renovation period. Although environmental factors may not be the sole barrier to physical activity among older adults [15], further investigation of the impact of environmental factors on physical activities is warrant.

The MCPv programme had several limitations. Firstly, the intensity of physical activities in 4 weeks did not seem to be enough and this may be part of the reasons why the participants' other physical parameters (such as blood pressure) did not change significantly. The National Institute on Aging recommended that older adults could gain huge benefit from at least 150-minute moderate-intensity endurance activity every week [16]. Thus, in future planning of the other photovoice intervention, emphasis should be made on the intensity of physical activity. Secondly, some data in accelerometers could not be collected because participants refused to wear the accelerometers due to skin irritation, uncomfortable feelings. Thirdly, wearing accelerometers may induce behavioural change so the effect of the intervention did not purely represent the effect of photovoice.

5. Conclusions

The MCPv programme successfully increased participants' physical activity level and physical fitness. Social network support was built and protocol of this invention could further

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support the development of other photovoice intervention in other health topics in Chinese community. The study provided evidence to health professionals that older adults were capable to express their views about the barriers and facilitators to physical activities. Upon knowing these stakeholders' views, health professionals could develop relevant health promotional activities for this population.

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Contributors

AYM Leung contributed to the intervention design, study design, data collection, data analysis, interpretation of the findings and finalizing the manuscript. PH Chau contributed to study design, data analysis, interpretation of the findings and drafting the manuscript. I Leung contributed to data collection, data analysis and drafting of the manuscript. M Tse contributed to intervention design, data collection, interpretation of the findings and drafting the manuscript. P Wong contributed to funding application and revision of the manuscript. Tam WM contributed to data collection and revision of the manuscript.

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Conflicts of interest

The authors declare no conflict of interest.

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