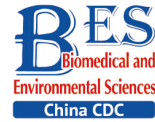


Letter to the Editor

**Quality of Life in Terms of Mental Stress and Physical Activities among Community Elder Residents in Shenzhen in the Post-COVID-19 Period**

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Coronavirus disease 2019 (COVID-19) is a deadly infectious disease that has caused a total of 318 million cases and 5.5 million deaths as of January 14, 2022^[1]. A series of preventive measures such as border restrictions, quarantine and isolation, and social distancing were implemented by the government, which resulted in a substantial disruption of daily life, reduced physical activity (PA), increased stress, and compromised quality of life (QoL)^[2]. Previous studies have reported that long-term isolation or home confinement may have negative effects on psychosocial and mental health^[3], immune system, and physiological dysfunction^[4].

PA is important for healthy aging, which is associated with various health-related outcomes^[5]. Notably, decreased PA levels in different age groups have been reported globally during the COVID-19 pandemic^[6].

Worldwide, the general population has been in constant fear of being infected and experienced stress associated with infringed personal freedoms, disrupted normal living activities, and economic turbulence resulting from the imposition of these preventive measures and the COVID-19 pandemic. Besides the stress prevalence, other psychiatric symptoms, such as anger and somatic symptoms, are remarkably high among the general population^[7].

QoL is a socially relevant construct and should be understood through the lens of contemporary social circumstances. The COVID-19 pandemic and its associated preventive strategies are influential worldwide and may induce a vicious cycle of “restricted physical activities—chronic stress”^[8]. This

vicious cycle may further suppress the immune system and increase the risk of contracting COVID-19.

In Shenzhen, the effect of the COVID-19 pandemic on PA and stress is largely unknown, especially among the older general populations who are vulnerable to infection and at a higher risk of severe complications from COVID-19. In this cross-sectional survey (using the Internet application Questionnaire Star, <https://www.wjx.cn>, designed according to the self-administered WHO Quality of Life Instrument-Short Form [WHOQOL-BREF]), we aimed to investigate the levels of PA, stress, and QoL of community-dwelling older adults during the post-COVID-19 period, discuss whether PA and stress independently contribute to the QoL, and quantify the relative contributions of PA and stress on QoL when sociodemographic variables are considered.

As of December 2021, 234 Shenzhen residents aged > 60 years were individuals. They also met the following inclusion criteria: 1) not using alcohol, drugs, or other substances; 2) no comorbidities and/or orthopedic limitations. Participants were excluded if they were living in nursing care homes or institutions and were not compliant with government guidelines for home isolation during the COVID-19 pandemic. The participants completed the online questionnaires after they signed a free and informed consent form. Participants aged 60–93 years who had cognitive deficits, were illiterate, or had vision problems can be included with the help of their kinsfolk.

Local institutional ethical approval was obtained for this study. The study was conducted in

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accordance with the Declaration of Helsinki. The Physical Activity Scale for the Elderly (PASE), Perceived Stress Scale (CPSS-10), European Quality of Life Questionnaire Five-Level Scale (EQ-5D-5L), and the converted Chinese version EQ-5D-5L were used to assess QoL levels.

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA).

In total, 109 male (46.4%) and 125 female (53.6%) participants completed the online survey (Supplementary Table S1 available in www.besjournal.com). Their mean age was 71.82 (SD = 7.07) years, ranging from 60 to 93 years. Most participants were living with others (67.2%), whereas the remaining participants were living alone (32.8%). Half of the participants had received a primary education or below (49.6%), whereas 10.3%, 31.6%, and 8.5% of the participants had not received an education, had secondary education or below, or had undergraduate education or above, respectively.

Table 1 summarizes the variables of interest. Based on data from the PASE-C, the most frequent PA was light housework (19.98 ± 10.04), and the least frequent PA was muscle strength and endurance activities (1.03 ± 3.52). Stratified comparisons (Table 2) revealed no significant differences in the PASE-C, CPSS-10, EQ-5D-5L utility, and EQVAS mean scores between men and women. For participants with different living states, no significant differences were found in PASE-C household activity and work-related activity subscales, CPSS-C, and EQ-5D-5L utility mean scores. However, a significant difference was found in the PASE-C leisure time activity subscale and EQVAS mean scores.

Regarding educational levels, significant differences were found in the PACS-C leisure time activity domain, CPSS-10, EQ-5D-5L utility, and EQVAS mean scores. Our post hoc analysis revealed that participants who had received primary education or below were significantly different from those participants who had received secondary education. Moreover, our post hoc analysis revealed significant differences in mean EQ-5D-5L utility scores between those who had no education (0.49 ± 0.46) and those who had secondary education or below (MD -0.37 ; CI $-0.57, -0.17$; $P < 0.001$) or undergraduate education or above (MD -0.34 ; CI $-0.60, -0.81$; $P < 0.01$). Life scenarios before and after the outbreak vary greatly.

Supplementary Table S2 (available in www.besjournal.com) presents the correlations of

sociodemographic data with the PASE-C, CPSS-10, and EQ-5D-5L scores. Among the analyzed sociodemographic data, age showed significantly negative correlations with PASE-C, EQ-5D-5L index, and EQVAS mean scores and significantly negative correlation with CPSS-10 mean scores. While living status showed significantly positive correlations with the EQ-5D-5L index and EQVAS, educational level demonstrated significantly positive correlations with the EQ-5D-5L index, EQVAS, and CPSS-10 mean scores. No significant correlations were found between sex and PASE-C, CPSS-10, EQ-5D-5L index, and EQVAS mean scores, and no significant correlations were found between the PASE-C and CPSS-10 mean scores. Nonetheless, partial significant correlations were found between PASE-C ($r = 0.292, P < 0.001$), CPSS-10 ($r = -0.56, P < 0.001$), and EQ-5D-5L index scores after controlling for age,

Table 1. Mean and standard deviation of PASE-C, CPSS-10, EQVAS, and EQ-5D-5L

Parameters	Mean	SD
PASE-C overall score	91.77	60.92
Leisure time activity	24.91	27.40
Walk outside home	13.70	13.39
Light sports and recreational activities	3.85	7.54
Moderate sports and recreational activities	3.57	8.31
Severe sports and recreational activities	2.76	11.53
Muscle's strength and endurance activities	1.03	3.52
Household activity	56.57	34.62
Light housework	19.98	10.04
Heavy housework	15.71	12.11
Home repairs	1.41	6.36
Lawn work and yard care	2.62	9.36
Outdoor gardening	3.85	7.90
Caring for another person	13.01	16.95
Work-related activity		
Paid work	7.40	26.80
CPSS-10	15.97	7.19
EQVAS	74.34	10.30
EQ-5D-5L index	0.73	0.34

Note. PASE-C, Chinese version of Physical Activity Scale for the Elderly; CPSS-10, Chinese version of the Perceived Stress Scale; EQVAS, European quality of life visual analogue scale; EQ-5D-5L, European Quality of Life Questionnaire 5 level scale.

Table 2. Comparisons by groups

Parameters	Women (n = 125)	Men (n = 109)	t or U, P-value	Living alone (n = 77)	Living with others (n = 157)	t or U, P-value	Not educated (n = 24)	Primary level or below (n = 116)	Secondary level (n = 74)	Undergraduate or above (n = 20)	F (3, 230) or H, P-value
PASE-C	81.41 ± 52.45	83.57 ± 56.93	0.30, 0.76	83.88 ± 65.15	95.63 ± 58.56	-1.34, 0.18	79.62 ± 53.76	77.94 ± 57.08	86.84 ± 48.20	95.37 ± 62.13	0.82, 0.48
Leisure time activity, mean ± SD	22.39 ± 20.94	27.80 ± 33.18	1.47, 0.15	19.25 ± 28.36	27.69 ± 26.57	-2.18, 0.03	28.33 ± 36.90	20.50 ± 25.11	26.81 ± 25.78	39.37 ± 28.72	3.19, 0.02
Household activity, mean ± SD	59.67 ± 35.60	53.01 ± 33.26	-1.48, 0.14	51.14 ± 30.94	59.23 ± 36.08	-1.78, 0.08	59.54 ± 30.80	53.68 ± 35.67	62.72 ± 35.15	47.00 ± 28.16	1.63, 0.18
Work-related activity, mean ± SD	6.10 ± 25.02	8.89 ± 28.74	0.79, 0.43	5.61 ± 20.82	8.27 ± 29.31	-0.80, 0.43	2.75 ± 8.48	9.72 ± 31.75	4.82 ± 20.83	9 ± 29.36	0.78, 0.51
CPSS-10, mean ± SD	15.70 ± 6.47	16.29 ± 7.95	0.63, 0.53	17.36 ± 8.97	15.29 ± 6.05	1.83, 0.07	21.25 ± 8.32	16.43 ± 7.17	13.68 ± 6.37	15.50 ± 5.11	7.62, < 0.001
EQ-5D-5L utility, mean ± SD	0.76 ± 0.29	0.70 ± 0.39	-1.34, 0.18	0.62 ± 0.41	0.78 ± 0.29	-1.58, 0.12	0.49 ± 0.46	0.68 ± 0.36	0.86 ± 0.18	0.83 ± 0.33	10.18, < 0.001
EQVAS, mean ± SD	74.22 ± 9.64	74.49 ± 11.06	0.20, 0.84	72.84 ± 10.01	75.08 ± 10.39	-3.14, 0.002	68.96 ± 12.27	73.81 ± 10.61	76.54 ± 8.10	75.75 ± 10.30	3.66, 0.013

Note. PASE-C, Chinese version of physical Activity Scale for the Elderly; CPSS-10, Chinese version of the Perceived Stress Scale; EQVAS, European quality of life visual analogue scale; EQ-5D-5L, European Quality of life.

living status, and educational level (Supplementary Table S3 available in www.besjournal.com).

Multiple linear regression analysis that included age, living status, educational level, PASE-C scores, and CPSS-10 scores predicted 51.0% ($F_5, 228 = 47.423, P < 0.001$) of the variance in the EQ-5D-5L index values (Table 3). After adjusting for other variables, the PASE-C and CPSS-10 scores remained independently associated with the EQ-5D-5L index, accounting for 30.6% of the variance, and the model prediction performance significantly improved (F change, 110.686; $P < 0.001$). The CPSS-10 scores were the best predictor of the EQ-5D-5L index, as indicated by the magnitude of the standardized regression coefficient ($\beta = -0.508$; model 3 in Supplementary Table S3) and Pearson's correlation coefficient ($r = 0.190, P = 0.004$) of the predictive model (Supplementary Table S2).

The PASE-C scores (Mean = 91.8; SD = 60.9) suggested an approximately 12% decrease in the PA level of community-dwelling older adults during the post-COVID-19 period (Mean = 104.4; SD 47.1). These findings are consistent with those of previous studies^[9] that reported a 26.5% decrease in the PA of community-dwelling older adults, as measured using the International Physical Activity Questionnaire. However, the decrease in the PA level in the present study was smaller than that of the above report. A possible reason is that the present study was conducted just 1 year after the initial COVID-19 outbreak. Thus, older adults may be less prepared to live with the outbreak and may experience a less reduction in PA levels. Our findings also suggest that older adults living with others engaged in PAs, such as walking outside their homes, repairing their homes, and caring for another person, more than those living alone.

The stratified group analyses suggested that older adults with a higher educational level and who lived with others were more likely to perform leisure time activities, such as light sports, recreational activities, and walking outside their homes, and had less perceived stress and a higher QoL than those with a lower educational level. One possible explanation for this phenomenon is that older adults with a higher educational level who live with others perceived less stress as the number of COVID-19 cases remained at a low level, and their daily lifestyle was less disrupted by adopting preventive measures, such as wearing masks and maintaining social distancing. Thus, their leisure time activities, stress levels, and QoL were less affected during the post-COVID-19 period. Additional support, such as the

promotion of light indoor sports activities through social media, may be needed in the post-COVID period for older adults with a low educational level who are living alone.

Correlation analyses revealed that younger study participants living with others and having a higher educational level, higher PA level, and lower stress level had a better QoL, as measured using the EQ-5D-5L index and EQVAS mean scores, and this finding was consistent with those of a previous study^[10].

Although living status was found to be correlated with QoL, as measured using the EQ-5D-5L index, no such correlation was observed when the EQVAS score was used to quantify QoL. This discrepancy may be due to the use of different measures of QoL captured by the EQ-5D-5L index and EQVAS. While the EQ-5D-5L index reflects the QoL based on mobility, self-care, usual activities, and mood disturbances (anxiety or depression), assessment using the EQVAS requires participants to project their overall QoL on a visual analog scale. The participants may have interpreted their overall QoL to include some issues not limited to the five domains covered in the EQ-5D-5L dimensions. Study participants may or may not be satisfied with living alone; thus, living status or social isolation was not

necessarily associated with a needs satisfaction-based QoL assessment.

Moreover, we found no correlation between PA and perceived stress. This study was conducted 1 year after the pandemic; thus, it is reasonable to hypothesize that community-dwelling older adults in Shenzhen had adapted to the preventive measures and minimized the associated negative effects on PA, such that there were no serious disruptions to their daily lifestyle. Thus, the stress level reported by the participants may be a result of other issues not related to the COVID-19 pandemic and its associated preventive measures.

The final regression model explained 51.0% of the QoL of our participants. In view of the strength of their correlations with the EQ-5D-5L index (Table 3), the PASE-C score was included in model 2, and the CPSS-10 score was then added to model 2 to formulate the final model. Both PA and perceived stress were independent predictors of the EQ-5D-5L index, and the PASE-C and CPSS-10 scores accounted for 30.6% of the variance in the final model. The PASE-C score accounted for 6.8% of the explained variance in model 2, and the CPSS-10 score accounted for 23.8% of the explained variance in model 3. To investigate the QoL of community-dwelling older adults during the post-COVID-19

Table 3. Multiple linear regression analyses (forced entry) of the relationship of the EQ-5D-5L index with other variables

Model No.	Independent variables	R ² (R ² adjusted)	R ² change	B (SE)	β	P
Model 1		0.204 (0.193)	0.204			
	Age			-0.15 (0.003)	-0.312	< 0.001
	Living status			0.083 (0.045)	0.114	0.069
	Educational level			0.079 (0.028)	0.182	0.005
Model 2		0.272 (0.259)	0.068			
	Age			-0.12 (0.003)	-0.247	< 0.001
	Living status			0.072 (0.043)	0.099	0.100
	Educational level			0.081 (0.027)	0.187	0.003
	PASE-C			0.002 (< 0.001)	0.269	< 0.001
Model 3		0.510 (0.499)	0.238			
	Age			-0.009 (0.002)	-0.190	< 0.001
	Living status			0.052 (0.036)	0.072	0.146
	Educational level			0.040 (0.022)	0.093	0.074
	PASE-C			0.001 (< 0.001)	0.246	< 0.001
	CPSS-10			-0.024 (0.002)	-0.508	< 0.001

Note. PASE-C, Chinese version of physical Activity Scale for the Elderly; CPSS-10, Chinese version of the Perceived Stress Scale; EQ-5D-5L, European Quality of Life Questionnaire 5 level scale.

period, we further considered the roles of PA and perceived stress. As expected, higher levels of physical inactivity and perceived stress predicted poorer QoL in community-dwelling older adults.

Regarding public health, the current findings are highly relevant to the COVID-19 pandemic because they add to the current knowledge and provide evidence that decreased PA and increased stress levels induced by infectious pandemics and their associated preventive measures are independent factors that influence the QoL of community-dwelling older adults, especially those who are older, live alone, and have a low educational level. Fortunately, COVID-19 vaccinations are available, and the number of cases continues to be at a low level as this report was written. To ensure a high QoL in the post-COVID-19 period, it is important for healthcare workers and gerontologists to identify possible ways to promote PA and reduce stress brought about by the pandemic and its associated preventive measures to promote healthy aging. The authors advocate for upgrading household leisure-fitness routines designed exclusively for older people. This will help maintain the PA level, reducing the detrimental effects of COVID-19 on their physical and emotional well-being.

This study has several limitations. First, the participants were recruited from social media or online platforms on a convenience basis, which may limit the representativeness of the sample. Our findings should not be generalized to those with non-intact cognitive status (e.g., those with mild cognitive impairment or dementia) or who have poor coping skills. Second, our regression model only accounted for 51.0% of the total variance in the EQ-5D-5L index values. Approximately half of the variance remained unexplained; therefore, future studies should also consider other elements such as social support and level of physical functioning. Third, all the variables analyzed were measured by self-reported questionnaires, which may be subject to participant bias.

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Contributions YJS and LZW; Data curation: ZXY, DS, LS, ZXC, NTS, and YJS; Formal analysis: ZXY, DS, and

ZXC; Investigation: ZXC, ZXY, LS, NTS, and YJS; Methodology: ZXY, ZXC, and YJS; Resources: ZXC, LS, NTS, and ZXY; Software: ZXY, DS, ZXC, and NTS; Supervision: YJS and LZW; Validation: YJS and LZW; Original draft and writing: ZXY, LS, ZXC, and YJS; Review and edit: YJS and LZW.

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Supplementary Table S1. Sample characteristics

Characteristics	<i>n</i> = 234	Percentage (%)
Age (mean ± SD)	71.82 ± 7.07	
Gender		
Male	109	46.4
Female	125	53.6
Living condition		
Living alone	77	32.9
Living with others	157	67.1
Educational level		
Not educated	24	10.3
Primary level or below	116	49.6
Secondary level	74	31.6
Undergraduate or above	20	8.5

Supplementary Table S2. Correlations between sociodemographics, PASE-C, CPSS-10, and EQ-5D-5L scores

Variables	Age	Sex	Living status	Educational level	PASE-C	CPSS-10
PASE-C	$r = -0.25, P < 0.001$	$r = 0.06, P = 0.33$	$r = 0.09, P = 0.17$	$r = 0.08, P = 0.26$	–	$r = -0.09, P = 0.16$
CPSS-10	$r = 0.19, P = 0.004$	$r = 0.04, P = 0.53$	$r = -0.14, P = 0.04$	$r = -2.4, P < 0.001$	$r = -0.09, P = 0.16$	–
EQ-5D-5L index	$r = -0.39, P < 0.001$	$r = 0.09, P = 0.17$	$r = 0.23, P = 0.001$	$r = 0.32, P < 0.001$	$r = 0.43, P < 0.001$	$r = -0.41, P < 0.001$
EQVAS	$r = -0.23, P < 0.001$	$r = -0.01, P = 0.84$	$r = 0.10, P = 0.12$	$r = 0.19, P = 0.005$	$r = 0.27, P < 0.001$	$r = -0.41, P < 0.001$

Note. PASE-C, Chinese version of Physical Activity Scale for the Elderly; CPSS-10, Chinese version of the Perceived Stress Scale; EQVAS, European quality of life visual analogue scale; EQ-5D-5L, European Quality of Life Questionnaire 5 level scale.

Supplementary Table S3. Partial correlation coefficients (controlling for age, living status and educational level) between EQ-5D-5L index and other variables

Variables	-Partial Correlation Coefficients with EQ-5D-5L index	<i>P</i>
PASE-C	0.292	< 0.001
CPSS-10	-0.56	< 0.001

Note. PASE-C, Chinese version of Physical Activity Scale for the Elderly; CPSS-10, Chinese version of the Perceived Stress Scale; EQ-5D-5L, European Quality of Life Questionnaire 5 level scale.