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Association between Proactive Health Behaviour and Health Status among Elderly Migrants in China: A Cross-Sectional Study

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Abstract

Background

Population aging has become one of the most complex social problems in the world. In order to reduce the adverse impact of aging on the health level of the population and promote successful aging,researching the determinants of health level of the elderly group has become essential. More importantly, on the whole, compared with the permanent elderly population, the elderly migrants face some challenges in living environment and social communication, which may affect their health level.

Objectives

The aim of this study is to examine the associations between proactive health behaviour (including exercise, health care service utilization, close relationship) and health status among migrants aged above 45 in China.

Methods

The cross-sectional study data are obtained from the 2015 Migrant Population Dynamic Monitoring Survey, which include 6885 Chinese elderly migrants in this study. We use descriptive statistical analysis and multiple logistic regression to evaluate the association between exercise, health care service utilization, close relationship and health status among all sample. Moreover, we conducted group-level regressions for the elderly migrants of different ages, including 45–59 years old, 60–74 years old, 75–89 years old and over 90 years old.

Results

On the average, the elderly migrants' daily exercise duration is more than an hour. Most of them have not used the health service provided by the community health center and other health organizations.On the whole, the number of children and friends is more than 2 and 8 respectively, which gives them a good foundation of social relationships. There are great significance in the association of exercise, health examination and friendship and health respectively. We also find the association varies in different age groups. Migrants who are between 45 and 59 years old need friendship more than exercise while people between 60 and 90 years old need exercise most. When people are above 90 years old, exercise, close relationship and health care service utilization proved to have no association with health status.

Conclusion

Exercise, friendship and health examination are greatly associated with health status among the elderly migrants, which requires more attention should be paid to the elderly migrants group.

1. Introduction

Nowadays, population aging has become one of the most complex and essential problems in the world. Since the 1990s, China's aging process has accelerated. With the rapid growth of people's living standard, residents' average life expectancy is continuously rising. And with the expanding elderly population, at present China has transformed into an old-age society. At the same time, the elderly aged 80 and over are increasing at a rate of 5% a year, which brings great challenges to China's medical services, social security and elderly care services.

There is no denying that health is greatly related to age [1]. However, although the life expectancy is on the rise, but there is little evidence that the health of older people is also rising [2]. With increasing aging, the physical and mental health of older adults and the determinants are receiving more and more attention. However, there are significant differences in the level of health of older people between developing and developed countries [3]. In order to improve the health level of the elderly, there are many articles on the determinants of the health status of them [4–13], among which we suppose exercise, health care service utilization and close relationship are essential to people's both physical and mental health conditions.

Exercise is beneficial to health outcome. Optimal mobility, which was defined as relative ease and freedom of movement, is central to "healthy aging" goal [4]. Regular activity can help to improve the older people's physical and mental health and to keep them mobile and independent [14]. Experimental studies have also proven that proper exercise can improve the health of the elderly [15].Insufficient exercise is proved to be linked to adverse health conditions, such as coronary heart disease, type 2 diabetes, shorter life expectancy and so on [16].

Health care service utilization remains critical for improving health status for migrants [17]. Compared with local residents, migrants or immigrants from other districts or countries show worse health conditions and utilize fewer preventive measures [18]. Previous research has proved that health policies and prevention programs or preventive health services should be implemented to protect the vulnerable population to enhance their health [19]. But meanwhile the poor physical health conditions may also influence health service utilization frequency [20].

Older people who experience high levels of loneliness are at increased risk of becoming physically frail which proved the significance of close relationships [21]. Compared with the young people, social isolation is strongly associated with the poor health conditions among the older population [22]. Loneliness is proved to be a risk factor for morbidity and mortality [23, 24]. Lack of contact with friends, family, and children is proved to be associated with a greater risk of multiple health-risk behaviors and worse health status [25].

Although much work so far has focused on health status and the determinants, to our knowledge, there is no study had explored the relationship between exercise, health care utilization, close relationship and the health income [26]. The aim of our study was to examine the associations between health care utilization (such as health examination), close relationship (the relationship between family members and friends) and health status (the overall status and illness status) among migrants aged above 45 in China. We proposed three hypotheses: The first one is that there is significant positive relationship between exercise and health status among Chinese elderly migrants. The second one is that there is significant positive relationship between health care service utilization and health status among Chinese elderly migrants. The third one is that there is significant positive relationship between close relationship and health status among Chinese elderly migrants.

2. Methods

2.1 Study Design and Data

Data from 2015 Migrant Population Dynamic Monitoring Survey (MDMS), a nationally survey of migrants conducted by National Health and Family Planning Commission of the People's Republic of China (NHFPC) are used in this study. This survey is intended to understand the health conditions, health services supply status, employment situation and so on of the migrants. The probability proportional scale size (PPS) sampling method is used in this survey, which is a stratified, multistage and proportional scale sampling [23]. In order to ensure the progress of the investigation, all investigators were issued with *on-site work guidelines and personnel responsibilities*, which stipulates the preparation before investigation, the requirements during household investigation, the inspection after investigation, the treatment of special situations and so on before the investigation [27].

In this survey, we use data collected in 2015 for the monitoring of the elderly migrants, which include medical and health services variables for the elderly migrants. This part of information is answered by the elderly migrants themselves. But if

they are unable to respond, other family members would answer on behalf of them.

The total sample size of this survey is 9886. In order to examine the health situation and the associated factors among the elderly, we dropped the sample whose age was below 45 years old. What is more, since there are missing data of some variables, we dropped data with missing value. Finally, we got 6885 Chinese elderly migrants as our study sample (Fig. 1).

2.2 Measures

In this survey, we use health status of the respondents as our dependent variable and exercise, health care utilization and close relationship as our independent variables. Meanwhile, the demographic characteristics, socioeconomic characteristics, diseases and other variables as our control variables.

2.2.1 Proactive health behaviour

2.2.1.1 Exercise

In this study, people's physical activity is measured by "How long do you exercise every week (minutes)?". The answer to this question is a continuous variable, and people's answers range from 0 to 90 minutes.

2.2.1.2 Health care service utilization

In previous study, health care service utilization is measured by the use of physical examination and doctor follow-up. Specifically, we use "Have you received a physical examination in the past year" and "Have you received chronic disease follow-up of doctors in the past year" to measure the utilization degree of health care services. The two variables are both evaluate by yes or no.

2.2.1.3 Personal relationship

Close relationship is always referred to the relationship with family members and friends. We use the number of friends and children to test the relationship. As to friendship, the respondents are asked "How many friends do you have?". And the children situation is measured by "How many children do you have?", and we divided this variable into four categories: 0 child; 1 child; 2 children and three or more children.

2.2.2 Health status

In this survey, people's health status is divided into four categories: healthy, almost healthy, unhealthy but can take care of him/herself and unhealthy and cannot take care of him/herself. However, the sample size of these four answers varies greatly, which would affect the final analysis process. Therefore, we put almost healthy, unhealthy but can take care of him/herself and unhealthy and cannot take care of him/herself into one category called unhealthy group. Then we got two categories called healthy group and unhealthy group.

2.2.3 Control variables

We add demographic characteristics, including gender (male/ female); age; marital status (married/having a relationship, single/divorced/widowed); nationality (Han nationality or others); registration (rural or urban) and district (north-east zone, east zone, middle zone and west zone). The socioeconomic variables include income source (subsistence allowances/others, other family members, labor income and pension/savings); education attainment (middle school or below, high school and university or above); economy zone (Pearl River Delta, Yangtze River Delta and others); health insurance (yes or no). The hypertension or diabetes disease condition is also added into the control variable part.

2.3 Analysis

Descriptive analysis is used to access the percentage, median and standard deviation of all variables. Multivariate logistic regressions are used to estimate the association between exercise, health care utilization, close relationship and health

status among all the respondents. The odds ratio (OR) and 95% confidence interval (CI) are obtained from the logistic regressions. We also use step-by-step regression to test the association between these independent variables, control variables and dependent variables.

All analyses are performed using STATA 15.0. And the statistical tests are at a two-tailed significance level of $p < 0.05$.

3. Results

Table 1 showed the descriptive analysis results of all characteristics. A total of 6885 participants completed this survey. And there are 3951 male respondents (57.29%) and 2934 female respondents (42.61%), which is nearly similar to China's population structure. We divide the age into four groups and we have found that the elderly between 60 and 74 years old took up the largest proportion which is more than 55%. Respondents in 45 to 59 years old and 75 to 89 years old show similar proportions, while the number of elderly migrants above or equal to 90 years old are only 64 (0.93%). Migrants with Han nationality take up for almost 91 percent which is basically same as the whole country. While there are 2468 elderly migrants living on pension or savings, other people can only rely on the relief from other family members (29.95%), labor income of themselves (26.35%) and subsistence allowances or others (7.86%). When regarding to education, almost 80 percent respondents have an education background of middle school or below, and only 1424 elderly migrants have gone to high school or college.

Table 1
Characteristics of sample (N = 6885)

Characteristics	N	%	Mean	Std. Dev
Demographic characteristics				
Gender			0.57	0.49
Male	3951	57.39		
Female	2934	42.61		
Age			67.12	10.91
45–59	1601	23.35		
60–74	3793	55.09		
75–89	1427	20.73		
>=90	64	0.93		
Nationality			0.91	0.29
Han	6260	90.92		
Others	625	9.08		
Marital status			0.85	0.36
Married/ Having a relationship	5863	85.16		
Unmarried	1022	14.84		
District			2.41	1.09
East district	2207	32.06		
Central district	677	9.83		
West district	2958	42.96		
East-north district	1043	15.15		
Socioeconomic characteristics				
Income			1.90	0.98
Subsistence allowances/ others	541	7.86		
Other family members	2062	29.95		
Labor income	1814	26.35		
Pension/ savings	2468	35.85		
Education attainment			0.28	0.58
Middle school or below	5461	79.32		
High school	940	13.65		
University or above	484	7.03		
Registration			0.36	0.48
Agricultural	4404	63.97		

Characteristics	N	%	Mean	Std. Dev
Demographic characteristics				
Non-agriclutural	2481	36.03		
Economy zone			0.82	1.21
Pearl River Delta	4564	66.29		
Yangtze River Delta	206	2.99		
Bohai Sea Ring Area	883	12.82		
others	1232	17.89		
Health insurance			0.84	0.37
No	1099	15.96		
Yes	5786	84.04		
Exercise status				
Daily exercise duration	6885	100	65.31	45.99
Health service utilization				
Health Examination			0.34	0.47
No	4544	66.00		
Yes	2341	34.00		
Doctor test			0.08	0.27
No	6352			
Yes	533			
Close relationship				
Number of friends	6885	100	8.00	10.41
Number of children	6885	100	2.57	0.75
0	57	0.83		
1	928	13.48		
2	926	13.45		
>=3	4974	72.24		
Health				
Health status			0.41	0.37
Unhealthy	6031	58.55		
Healthy	2854	41.45		
Hypertension/ diabetes			0.22	0.41
No	5402	78.46		
Yes	1483	21.54		

As to health status, there are only 2854 elderly migrants in healthy status, while almost 60 percent respondents are unhealthy. Although health examination is proved to be beneficial to the improvement of health level, most elderly migrants (66%) did not have health examination in the past year. Migrants who have three or more than three children take up for the largest part (72.24%) in the whole sample (Table 1).

As Table 2 shows, when we put variables about exercise, close relationship and health care utilization respectively into model 1 to model 3, we find that there is great significance between exercise and health status, the number of friends and health status as well as health care utilization and health conditions among all respondents. However, we can not find any significance when refer to the number of children and health status and the p values are all above 0.2 in model 2 and model 4 (Table 2).

Table 2
Basic logistic models on exercise, close relationship and health care service utilization (N = 6881)

Health status		**Model 1**		**Model 2**		**Model 3**		**Model 4**	
		OR (95%CI)	**P value**	**OR (95%CI)**	**P value**	**OR (95%CI)**	**P value**	**OR (95%CI)**	**P value**
Exercise		1.01 (1.00-1.01)	0.000***					1.01 (1.01–1.01)	0.000***
friend				1.04 (1.02–1.05)	0.000***			1.03 (1.01–1.04)	0.000***
children	**0**			Ref	Ref			Ref	Ref
	1			1.56 (0.77–3.12)	0.242			1.23 (0.59–2.59)	0.581
	2			1.09 (0.54–2.28)	0.812			0.92 (0.44–1.91)	0.815
	>=3			1.74 (0.93–3.72)	0.078			1.47 (0.71–3.02)	0.295
Health examination						1.87 (1.57–2.24)	0.000***	1.62 (1.35–1.94)	0.000***
Doctor test						0.25 (0.20–0.31)	0.000***	0.24 (0.19–0.30)	0.000***

*p < 0.05, **p < 0.01, ***p < 0.001

In order to further test the association between the dependent variables and independent variables, we add control variables in Table 3. When we add the hypertension or diabetes disease into model 4, we find this variable shows great negative association with health status and the association between doctor test and health conditions become less significant. We then add demographic characteristics into model 5 and this model shows there is no significance between the doctor test and health status. Among all demographic characteristics, the negative association exists between health status and age

(OR = 0.86, 95%CI: 0.70–0.98) and marriage (OR = 1.54, 95%CI: 1.15–1.76), east zone (OR = 1.88, 95%CI: 2.24–3.69) and middle zone (OR = 1.73, 95%CI: 1.25–2.39) both show positive association with health status of elderly migrants.

Table 3
Logistic analysis with control variables (N = 6881)

Health status		Model 4		Model 5		Model 6		Model 7	
		OR (95%CI)	P value	OR (95%CI)	P value	OR (95%CI)	P value	OR (95%CI)	P value
Exercise		1.01 (1.01–1.02)	0.000***	1.01 (1.01–1.02)	0.000***	1.01 (1.01–1.01)	0.000***	1.02 (1.01–1.02)***	0.000***
friend		1.02 (1.01–1.04)	0.000***	1.03 (1.01–1.04)	0.000***	1.01 (1.00-1.03)	0.008**	1.02 (1.00-1.04)	0.015*
children	0	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
	1	1.34 (0.63–2.85)	0.451	1.22 (0.57–2.61)	0.613	1.68 (0.75–3.74)	0.204	1.67 (0.75–3.73)	0.208
	2	0.94 (0.44–1.96)	0.867	0.80 (0.37–1.70)	0.560	1.28 (0.57–2.85)	0.546	1.29 (0.58–2.86)	0.538
	>=3	1.42 (0.68–2.96)	0.348	1.57 (0.73–3.35)	0.247	1.70 (0.77–3.78)	0.190	1.72 (0.78–3.83)	0.181
Health examination		1.46 (1.21–1.76)	0.000***	1.66 (1.38–2.01)	0.000***	1.66 (1.37–2.02)	0.000***	1.73 (1.15–2.59)	0.005**
Doctor test		0.73 (0.56–0.95)	0.018*	0.78 (0.59–1.02)	0.076	0.75 (0.56–0.99)	0.043*	0.74 (0.56–0.98)	0.035*
With hypertension or diabetes		0.25 (0.21–0.30)	0.000***	0.24 (0.20–0.29)	0.000***	0.25 (0.21–0.31)	0.000***	0.25 (0.21–0.31)	0.000***
gender				1.06 (0.94–1.29)	0.429	0.95 (0.81–1.13)	0.600	0.96 (0.81–1.13)	0.641
age				0.86 (0.70–0.98)	0.020*	0.84 (0.72–0.96)*	0.022*	0.99 (0.76–1.29)	0.017*
nationality				1.03 (0.85–1.42)	0.451	1.00 (0.75–1.28)	0.886	1.20 (0.96–1.50)	0.941
marital				1.54	0.000***	1.20	0.118	0.31	0.118

*p < 0.05, **p < 0.01, ***p < 0.001

Health status		Model 4		Model 5		Model 6		Model 7	
		OR (95%CI)	P value	OR (95%CI)	P value	OR (95%CI)	P value	OR (95%CI)	P value
				(1.15–1.76)		(0.96–1.50)		(0.30–3.07)	
district	North-east zone			Ref	Ref	Ref	Ref	Ref	Ref
	East zone			1.88 (2.24–3.69)***	0.000***	1.69 (1.23–2.33)	0.001**	1.69 (1.23–2.33)	0.001**
	Middle zone			1.73 (1.25–2.39)**	0.001**	1.86 (1.31–2.64)	0.000***	1.89 (1.33–2.68)	0.000***
	West zone			1.17 (0.94–1.45)	0.157	1.28 (1.00-1.63)	0.046*	1.30 (1.03–1.66)	0.033*
income	Subsistence allowances/ others					Ref	Ref	Ref	Ref
	Other family members					1.23 (0.96–1.57)	0.107	1.42 (1.09–1.85)	0.010**
	Labor income					10.20 (6.99–14.85)	0.000***	13.53 (8.86–20.65)	0.000***
	Pension/ savings					2.54 (1.89–3.43)	0.000***	4.25 (2.68–6.72)	0.000***
Education attainment	Middle school or below					Ref	Ref	Ref	Ref
	High school					1.22 (0.93–1.60)	0.151	1.21 (0.92–1.59)	0.174
	University or above					1.42 (0.94–2.15)	0.098	1.44 (1.21–2.18)	0.025*
Registration						1.26 (1.00-1.59)	0.054	1.26 (1.00-1.59)	0.050*
Economy zone	Pearl River Delta					Ref	Ref	Ref	Ref

*p < 0.05, **p < 0.01, ***p < 0.001

Health status	Model 4		Model 5		Model 6		Model 7	
	OR (95%CI)	P value	OR (95%CI)	P value	OR (95%CI)	P value	OR (95%CI)	P value
Yangtze River Delta					2.66 (1.39–5.09)**	0.003**	2.70 (1.41–5.18)	0.003**
Bohai Sea Ring Area					2.70 (1.73–4.20)***	0.000***	2.75 (1.76–4.31)	0.000***
others					1.25 (0.92–1.71)	0.154	1.28 (0.93–1.74)	0.127
Health insurance					1.12 (0.89–1.97)	0.324	1.11 (0.89–1.40)	0.352
Exercise * friends							1.00 (1.00–1.00)	0.538
Health examination * friends							0.99 (0.97–1.01)	0.191
Health examination * Exercise							1.00 (1.00-1.01)	0.444
Income * Exercise							1.01 (1.00–1.00)	0.003**
Income * examination							0.97 (0.82–1.16)	0.770
*p < 0.05, **p < 0.01, ***p < 0.001								

In model 6, we also put socioeconomic characteristics and it is illustrated that the significance between friend and health status has decreased (OR = 1.01, 95%CI: 1.00-1.03). Compared with model 5, the significance between doctor test and health in model 6 (OR = 0.75, 95%CI = 0.56–0.99) is slight, which is consistent in model 7 (OR = 0.74, 95%CI = 0.56–0.98). We also find that compared with north-east zone, the elderly migrants in west zone has greater health status (OR = 1.28, 95%CI = 1.00-1.63). It is also shown that elderly migrants living in labor income (OR = 10.20, 95%CI = 6.99–14.85) and pension or savings (OR = 2.54, 95%CI = 1.89–3.43) have better health. Migrants flowing into Yangtze River Delta (OR = 2.66, 95%CI = 1.39–5.09) and Bohai Sea Ring Delta (OR = 2.70, 95%CI = 1.73–4.20) are healthier than people in Pearl River Delta.

Interactions are added to model 7. When we add interactions into this model, we can clearly see the significance degree decreased in the number of friends (OR = 1.02, 95%CI = 1.00-1.04) and so do the health examination (OR = 1.73, 95%CI = 1.15–2.59). What is different from model 6 is that migrants who have entered university or have higher education degree are healthier than people who just have enjoyed middle school education or below (OR = 1.44, 95%CI = 1.21–2.18). People have

city registration enjoy better health compare with those with rural registration (OR = 1.26, 95%CI = 1.00-1.59). It is also found that there is significance between the interaction of income and exercise and health status (OR = 1.01, 95%CI = 1.00-1.01), which means high income shows positive impact the association of exercise and health status (Table 3).

What is more, in order to test the difference between different aging group, we conduct four logistic regressions for different age group. In 45–59 years old group, the significance in the association of friend and health status is higher than that of exercise (OR = 1.07, 95%CI: 1.02–1.11). There is no significance in the relationship of health examination and health status (OR = 0.79, 95%CI: 0.38–1.65), which is different from the whole sample. The interactions exercise * friends (OR = 1.00, 95%CI: 1.00–1.00) and health examination * exercise (OR = 1.01, 95%CI: 1.00-1.02) both showed slight significance in the association with health status.

In 60–74 years old group, there is no significance in the association of the number of friends and health status which is totally different from 45–59 years old group (OR = 1.00, 95%CI: 0.97–1.02). The association between exercise and health status is very significant (OR = 1.02, 95%CI: 1.01–1.03). Similar with the younger group, there is also no significance in the association with children, health examination and health status. Interestingly, in this model we find high significance in the association between income * exercise and health status (OR = 1.00, 95%CI: 1.00–1.00).

The group 75–89 years old shows similar significance when referring to exercise and the number of friends. However, it is shown that there is significance in the association between health examination and health status (OR = 2.79, 95%CI: 1.18–6.60). And in the group which migrants are all beyond or equal to 90 years old, we find that there is no significance in the association of our dependent variables and independent variables (Table 4).

Table 4
Logistic analysis on different age groups (N = 6885)

Health status		45–59 years old		60–74 years old		75–89 years old		>=90 years old	
		OR (95%CI)	P value	OR (95%CI)	P value	OR (95%CI)	P value	OR (95%CI)	P value
Exercise		1.01 (1.00-1.01)	0.040*	1.02 (1.01–1.03)***	0.000***	1.02 (1.01–1.02)	0.000***	1.05 (1.00-1.10)	0.092
friend		1.07 (1.02–1.11)	0.003**	1.00 (0.97–1.02)	0.891	1.02 (0.98–1.06)	0.410	1.11 (0.73–1.70)	0.615
children	0	Ref	Ref	Ref	Ref	-	-	-	-
	1	1.69 (0.70–4.09)	0.243	1.39 (0.70–2.77)	0.351	-	-	-	-
	2	1.27 (0.52–3.11)	0.605	0.89 (0.47–1.70)	0.724	-	-	-	-
	>=3	1.12 (0.43–2.92)	0.815	-		-	-	-	-
Health examination		0.79 (0.38–1.65)	0.533	1.59 (0.81–3.10)	0.177	2.79 (1.18–6.60)	0.020*	10.31 (0.08–1.28)	0.343
Doctor test		0.65 (0.39–1.09)	0.084*	0.76 (0.45–1.26)	0.282	0.83 (0.50–1.42)	0.502	0.49 (0.02–13.28)	0.674
With hypertension or diabetes		0.33 (0.24–0.46)	0.000***	0.20 (0.14–0.29)	0.000***	0.23 (0.15–0.35)	0.000***	0.21 (0.02–2.03)	0.176
gender		1.10 (0.83–1.48)	0.502	0.89 (0.67–1.19)	0.429	1.06 (0.76–1.49)	0.747	3.52 (0.40-31.07)	0.257
age		0.97 (0.93-1.00)	0.070	1.02 (0.96–1.08)	0.481	0.92 (0.89–0.96)	0.000***	0.79 (0.57–1.09)	0.148
nationality		1.72 (1.10–2.67)	0.017*	0.85 (0.54–1.42)	0.611	0.70 (0.42–1.18)	0.182	0.06 (0.00-3.73)	0.180
marital		0.79	0.407	1.71	0.004**	0.79	0.250	0.31	0.315

*p < 0.05, **p < 0.01, ***p < 0.001

Health status		45–59 years old		60–74 years old		75–89 years old		>=90 years old	
		OR (95%CI)	P value	OR (95%CI)	P value	OR (95%CI)	P value	OR (95%CI)	P value
		(0.46–1.37)		(1.18–2.48)		(0.53–1.18)		(0.03–3.07)	
district	North-east zone	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
	East zone	1.98 (1.06–3.69)	0.032*	1.72 (1.00-2.98)	0.052	1.69 (0.93–3.05)	0.084*	1.91 (0.04–90.69)	0.743
	Middle zone	3.28 (1.72–6.26)	0.000***	1.94 (1.10–3.40)	0.022*	0.94 (0.46–1.91)	0.860	0.73 (0.13–41.22)	0.877
	West zone	1.79 (1.08–2.96)	0.023*	1.68 (1.14–2.47)	0.008**	0.86 (0.53–1.38)	0.528	0.21 (0.01–5.53)	0.346
income	Subsistence allowances/ others	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
	Other family members	1.02 (0.66–1.59)	0.914	1.83 (1.16–2.88)	0.009**	1.34 (0.73–2.45)	0.343	15.95 (0.28-914.97)	0.180
	Labor income	2.65 (1.06–6.61)	0.037*	23.01 (12.49–42.40)	0.000***	18.95 (5.02–71.52)	0.000***	-	-
	Pension/ savings	0.59 (0.25–1.37)	0.224	14.69 (6.55–32.91)	0.000***	4.62 (1.88–11.36)	0.001**	42.45 (0.20-8807.21)	0.168
Education attainment	Middle school or below	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
	High school	1.31 (0.85–2.01)	0.224	0.97 (0.61–1.55)	0.911	1.49 (0.80–2.78)	0.206	-	-
	University or above	1.42 (0.75–2.68)	0.282	2.06 (0.72–5.93)	0.181	1.60 (0.70–3.67)	0.263	0.98 (0.02–42.41)	0.992
Registration		1.31 (0.84–2.04)	0.228	1.32 (0.89–1.96)	0.164	1.26 (0.79–2.02)	0.330	0.82 (0.07–9.80)	0.873
Economy zone	Pearl River Delta	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref

*p < 0.05, **p < 0.01, ***p < 0.001

Health status		45–59 years old		60–74 years old		75–89 years old		>=90 years old	
		OR (95%CI)	P value	OR (95%CI)	P value	OR (95%CI)	P value	OR (95%CI)	P value
	Yangtze River Delta	3.98 (1.44–11.09)	0.008**	1.93 (0.70–5.31)	0.204	6.23 (0.72–53.96)	0.097	-	
	Bohai Sea Ring Area	1.82 (0.87–3.79)	0.111	3.53 (1.64–7.57)	0.001**	3.84 (1.35–10.92)	0.012*	1.64 (0.01-256.01)	0.848
	others	1.01 (0.55–1.86)	0.967	1.66 (0.97–2.82)	0.063	0.98 (0.55–1.74)	0.952	3.45 (0.04-290.93)	0.584
Health insurance		1.06 (0.71–1.60)	0.763	0.95 (0.65–1.40)	0.812	1.32 (0.85–2.06)	0.208	1.68 (0.14–20.63)	0.685
Exercise * friends		1.00 (1.00–1.00)_	0.075*	1.00 (1.00–1.00)	0.876	1.00 (1.00–1.00)	0.533	1.00 (1.00-1.01)	0.696
Health examination * friends		0.99 (0.93–1.04)	0.593	0.98 (0.95–1.01)	0.188	0.99 (0.95–1.04)	0.929	0.94 (0.62–1.42)	0.779
Health examination * Exercise		1.01 (1.00-1.02)	0.015*	1.00 (0.99-1.00)	0.939	1.00 (1.00–1.00)	0.361	0.96 (0.92–1.01)	0.149
Income * Exercise		1.00 (1.00–1.00)	0.095	1.01 (1.00-1.01)	0.000***	1.00 (1.00–1.00)	0.145	0.98 (0.95-1.00)	0.083
Income * examination		1.40 0.95–2.06)	0.092	1.18 (0.86–1.61)	0.311	0.77 (0.56–1.07)	0.118	1.86 (0.23–15.24)	0.562

*p < 0.05, **p < 0.01, ***p < 0.001

4. Discussion

In this study, we find that people flow into east district and west district are much higher than other places, which may be related to the increased demand for labor after the rapid economic development in eastern China and the accelerated development of Western China.In addition, the number and proportion of migrants in China's mega cities (such as Beijing, Guangzhou and Shanghai) are much higher than those in other cities [28]. The source of the livelihood of migrants indicates that the overall elderly migrants' living conditions are not optimistic. Less than 40% of the elderly migrants have a fixed source of income, and others need to obtain economic income through family help, subsistence allowances, work, etc and the economic insecurity may also affect their health care services utilization and their health level [29, 30]. The education level of most elderly migrants have shown that most respondents did not have a good education level which may also influence their awareness of health and other related behaviour [31]. Migrants with agricultural registration took up for more than 60 percent, which is different from the proportion of the whole population. We suppose it is because of the flowing

reasons of the migrants. According to this survey, most migrants flow into other places for working or accompanying other migrants and they may have changed only in their living environment, but not on registered residence [32].

As to economy zone, we find it is interesting that the number of migrants flowing into Pearl River delta are almost two times higher than the sum of other places (Yangtze River delta, Bohai Sea Ring area and others), which may be owing to the manufacturing industry in this area is relatively developed, so many factories provide job opportunities for migrant workers [33]. At the same time, the Pearl River delta is close to Hunan, Sichuan and other populous provinces, which is also one of the important reasons for migrants to choose. The number of children can be attributed to the background of times, during which time the residents were advocated to have more children [34].

Consistent with previous study by Chekroud et al and other researchers, exercise is beneficial to people's physical and mental health [14–16, 35, 36]. The interactions show the high income has positive impact on the association between exercise and health status, which we suppose that high-income people would invest more to exercise and health product. Based on the existing research, we find to different age groups, the significance differs. To migrants who are younger, friendship is more important than exercise. We suppose at this age the contact with others are more essential than the self physical activities. Present studies also figure out the social contact plays a significant role in people's mental health [37] and it is proved to be also vital during the COVID-19 pandemic [38].

When refer to the whole population, health examination is great associated with health status. This proves that on the whole, there is an obvious positive correlation between physical examination and health. Based on this result, we believe that regular physical examination should be carried out to help the elderly migrants find potential health hazards and diseases. For the related diseases found in the physical examination, intervention and treatment should be carried out as soon as possible. This will also contribute to the implementation of the "healthy China" strategy and promote the improvement of global health [39]. When the respondents are grouped by ages, we found that physical examination plays a positive role in improving the health level of people aged 75–89, which tells us that we should focus on providing physical examination and other services for the elderly.

Some limitations of the present study should be acknowledged. On the one hand, as it was a cross-sectional study, it is difficult for us to figure out the casual inference of exercise, the utilization of health care services, close relationship and health status. On the other hand, this study only analyzes the health status and related factors of elderly migrant of different ages, but because the analysis is not the same group, it may be affected by factors such as income and education level among different groups. In the future, we plan to use cohort data to analyze the health status of the same group at different ages and its relationship with exercise, health service utilization and friendship.

5. Conclusions

Exercise, friendship and health care service utilization are all associated with the health status of the elderly migrants. Meanwhile, the association differs in different groups, which proves for younger elderly migrants, the friendship plays an important role in health but for older respondents exercise is more essential. Health examination is positively associated with health and for the elderly who is between 75 and 89 years old it is more important. We believe that we should pay more attention to exercise and health examination and keep a good relationship with friends. Further research are required to conform the casual relationship between exercise, friendship, health care utilization and health status.

Declarations

Author Contributions: Conceptualization, Yang Bai and Jue Liu; methodology, Yang Bai and Jue Liu; software, Yang Bai; validation, Jun Wang, Yang Bai, and Jue Liu.; formal analysis, Yang Bai and Jue Liu; data curation, Yang Bai and Jue Liu; writing—original draft preparation, Jun Wang, Yang Bai, and Jue Liu.; writing—review and editing, Jun Wang, Yang Bai, and Jue Liu.; visualization, Jun Wang, Yang Bai, and Jue Liu.; supervision, Jun Wang, Yang Bai, and Jue Liu.; funding acquisition,

Jun Wang, Yang Bai, and Jue Liu. Jun Wang and Yang Bai contributed equally to this work. All authors have read and agreed to the final version of the manuscript.

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Figures

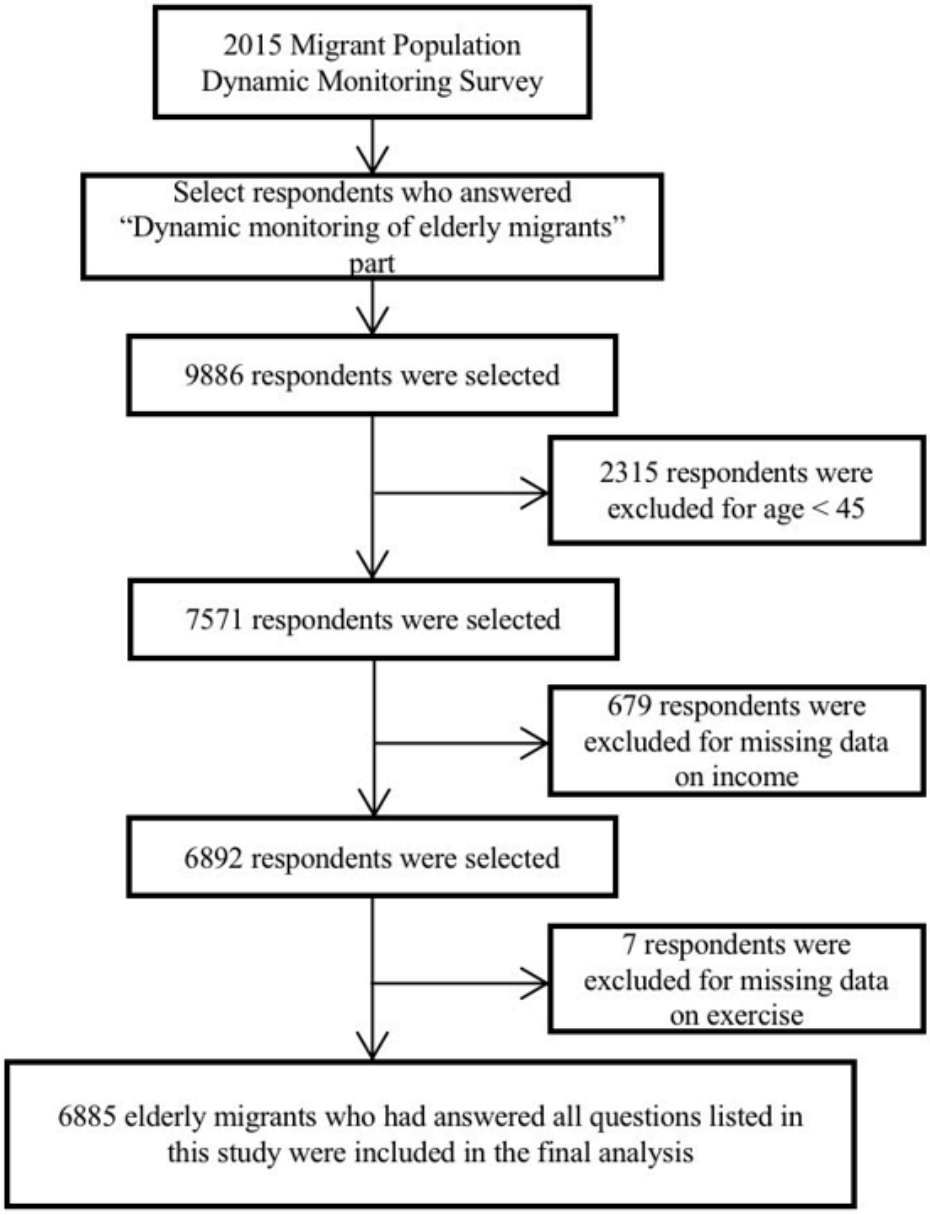


Figure 1

The flow chart of the respondents