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The relationship between physical fitness and health self-assessment in elderly

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Abstract

Background: The process of population aging inclines to seek determinants of the quality of life in the older people. Health self–assessment is the one of the main elements of the quality of life. In the older people it is associated with functional efficiency. The aim of the study was to determine correlations of physical fitness and health self-assessment.

Methods: The study group included 123 people aged 60 to 86 years. Physical fitness was evaluated using the Senior Fitness Test (SFT). Self-esteem of health was assessed by the SF-36 questionnaire.

Results: The analysis included sex factor and the occurrence of chronic diseases. When comparing with healthy participants, people suffering from chronic diseases revealed a lower level of physical fitness ($P < .05$) and health self-assessment ($P < .05$). The results of a significant percentage of study participants were worse than norms proposed as standards. The percentage of people below norms varied depending on sex, age, and SFT assessment and ranged from 0 to 89.5%.

Conclusion: Physical fitness and health self-assessment among elderly may be strongly determined by cultural conditions, for example, habits, lifestyle in various regions. The application of conclusions suggests that the key element of rehabilitation programs among elderly should be focused on improving coordination and locomotor capabilities. Assessment of the elderly is more clearly associated with physical fitness in women than in men and also more in patients chronically ill than in healthy person. Comprehensive assessment of physical fitness according to standardized values does not indicate the diversity by sex.

Abbreviations: E/F = energy/fatigue, EWB = emotional wellbeing, GH = general health, OPFL = overall physical fitness level, PC = physical component, PF = physical functioning, PN = pain, RLEP = role limitations due to emotional problems, RLPH = role limitations due to physical health, SF = social, SFT = Senior Fitness Test, WHO = World Health Organization.

Keywords: health self-assessment, older age, physical fitness, senior fitness test

1. Introduction

In many countries, there is a process of society aging. Its main reason is the lengthening of the average life expectancy. Number of factors have an impact on longer life expectancy, but the most important are: beneficial – from the health point of view—environmental and lifestyle changes, better quality of life, higher quality of medical care and social services. According to demographic projections, population aging will continue to maintain.[1,2] This in effect leads to numerous social and economic problems.

One of the methods of solving these problems are activities toward preserving and improving the health of the elderly and the quality of their lives.[3,4] Therefore, it is important to determine which factors affect the quality of life of the elderly.[5] The social dimension of the quality of life in senility is composed of a number of issues concerning socioeconomic, medicobiological, and psychological spheres, which require interdisciplinary research in terms of biopsychosocial approach.[6] For individuals, the key seems to be the efficiency of the body.[7] It determines a subjective "sense of a body" or health self-assessment. It is generally associated with such level of fitness, which allows self-contained and independent functioning in different areas of life. This applies to self-service, functioning in the family, and functioning in the society as well. Efficiency and its associated self-assessment of health significantly influence the quality of life of elderly.[8] Physical fitness is related to activity and its basis in old age is a sufficient level of physical and motor independence.[9] Interactions between physical activity and physical fitness, and between physical activity and health have been the subject of numerous studies.[10–13] The main motives of these studies were the prevention of falls (which constitutes a major threat to the elderly) and also to maintain independent motor activity and mental acuity as long as it is possible.[14,15]

There are very few reports concerning the interdependence of physical fitness and health self-assessment in the elderly.[16] Both physical fitness and health self-esteem concepts are complex and consist of many elements. The method of health self-assessment

Editor: Dennis Enix.

DATA Availability: All data generated or analyzed during this study are available from the corresponding author on reasonable request.

The authors report no conflict of interest.

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Medicine (2019) 98:25(e15984)

Received: 25 January 2019 / Received in final form: 23 April 2019 / Accepted: 16 May 2019

http://dx.doi.org/10.1097/MD.0000000000015984

was developed and relatively agreed upon. The concept of "physical fitness " is understood differently and its level and importance are individual.[17]

It was assumed that a good way to "determine the level of physical fitness" was to interpret test results revealed in physical fitness test designed for the elderly. These results are not only important from the autotelic point of view, but also provide evidence about the individual possibility of functioning in everyday life. They can also significantly affect health self-esteem.

The aim of the study was to determine the level of physical fitness of the elderly (both in particular aspects and generally), to examine their health self-assessment and to explore the linkages between these parameters. It was decided to explain did gender, age and typical diseases for the elderly have influence on the examined variables.

2. Materials and methods

2.1. Ethical statement

The study has been approved by the Bioethical Committee of the Medical University of Silesia in Katowice under resolution No. KNW/0022/KB1/42/I/1. It is conformed to the Helsinki Declaration. All of the participants provided written informed consent before the study, including enrolment and data collection.

2.2. Participants

The study was conducted among participants of the University of the Third Age within the Medical University of Silesia in Katowice (southern Poland). Recruitment process for the University was carried out using advertisements in the local press, through information posted on the website, posters, and using the information in the neighboring parishes. Invitation to the study and applications of the volunteers took place during meetings and lectures at the University. All of the participants have been informed about the purpose, research procedures, and about possibilities to resign from the study at any stage.

The study design assumed the following initial inclusion criteria: the voluntary participation in the study with provided written informed consent before the study, age ≥60 years, consistent with definition of the World Health Organization (WHO), a sufficient level of mental acuity to fill in questionnaires and motor independence. It was assumed that active participation in lectures at the University of the Third Age meets the criterion of the mental level and there was no need for additional checking.

Lecture about the course of the research resulted in the fact that volunteers included in the study met the criterion of suitable motor independence. A total of 136 people met these criteria. The key criterion, because of the safety rules, was the state of health of the study participants, allowing to safely take part in physical fitness test.[18]

The medical examination, conducted immediately before test performance, excluded 13 people, for whom testing could pose a health risk and as a result 123 people were qualified for tests: 84 women (68.3%) and 39 men (31.7%) aged 60 to 86 years (x = 68.5; SD = 6.2).

2.3. Procedure

Testing procedure consisted of 3 stages: medical examination, filling out the SF-36 questionnaire, and physical fitness test performance.

Medical examination was intended to determine the current health condition, chronic diseases, associated with regular visits to a doctor (no/yes), type of diseases, and the number of taken medications. These data were included in further analyzes. This was also designed to eliminate possible risks during motor activity tests (relatively good feeling, controlled course of the disease, no exacerbations).

The questionnaire was used to collect demographic data. The next part of this questionnaire was the Polish version of the SF-36 v2.[19] By many researchers, this questionnaire is considered as a tool for examining a quality of life associated with health. However, according to the authors, it was considered—according to the WHO definition of health—that it is a tool which measures wellbeing. In addition, some of questions directly relate to health self-assessment. So it was assumed that the purpose of this tool is the self-assessment of health in 8 dimensions, which are associated with answers to particular questions. The average of 4 dimensions creates a physical component (PC). These dimensions include physical functioning (PF), role limitations owing to physical health (RLPH), pain (PN), and general health (GH). The remaining 4 dimensions form the mental component (MC). The composition of this component includes: role limitations owing to emotional problems (RLEP), energy/fatigue (E/F), emotional wellbeing (EWB), and social functioning (SF). The scale of scoring answers and the health indicators calculated on the basis of these answers are in the range of 0 to 100—the higher score, the better the health self-assessment is.[20] SF-36 is used in many studies, including monitoring health condition of the elderly.[21]

Senior Fitness Test (SFT) includes 6 motor tests, designed to determine the level of motor efficiency (functional) and is intended for the diagnosis of the elderly. This test includes 6 trials, which aim to determine physical parameters such as: muscular endurance, mobility, dexterity, speed, body balance, motor coordination, reaction time, flexibility. These parameters are diagnosed using 6 tests which include: the arm curl, back scratch, 30-second Chair Stand, IV, 8-feet, and the 6-minute walk trial. This test was validated by the authors, and the standards for the performance of these tests in the presented study have been retained according to the authors' recommendations.[22] Each trial was supervised and measured by the same researcher. Each test was made in 6 days, an average of 20 people a day were examined in a sports hall in the mornings. SFT test advantages are following: security, simplicity, and no specific equipment requirements for its implementation.[23,24] The reliability of the SFT test was confirmed.[25,26]

Overall assessment of physical fitness of the elderly was evaluated according to the following procedure: at first results of SFT attempts were translated into normalized values (NV) using the following formula: NV = (score – arithmetic average)/SD.

Subsequently, normalized values were summed up. The sum of the normalized values from 6 tests accounted for the level of fitness (overall physical fitness level [OPFL]) of a person in comparison with the study group.

Taking into account a large variety of age, study participants were divided into 4 age groups: 60to 64 years, 65 to 69 years, 70to 74 years, and ≥75 years.

2.4. Statistical analysis

Descriptive statistics were calculated—mean (x) and standard deviation (SD). For age groups of persons, medians and the min

Table 1

Number of chronic diseases and used medications.

No. of chronic diseases	No. of participants		No. of participants taking medications		No. of medications x (min – max)
	n	%	n	%	
0	10	8.13	0	0	0
1	33	28.83	18	54.55	2.72 (1-6)
2	58	47.15	54	91.10	2.46 (1–6)
3	18	14.63	18	100	3.33 (2–6)
4	3	2.44	3	100	2.33 (1–3)
5	1	0.81	1	100	6

to max values were calculated. Differences between groups were determined by Mann-Whitney *U* test (UM – W). Correlations between SF-36 variables and OPFL) and between the senior fitness test (SFT) and physical fitness level (PFL) were calculated using Spearman rank correlations. OPFL internal reliability index was calculated using Cronbach alpha index (Cronbach α) (AC). All statistical tests were performed at the 2-tailed 5% level of significance.

3. Results

Medical examination revealed that only 10 patients (8.1%) were not chronically ill (not sick [Ns]). The rest of the group—113 people (91.9)—are people suffering from chronic diseases (sick [S]). The most common chronic diseases were: hypertension, coronary heart disease, diabetes, hypothyroidism, chronic obstructive pulmonary disease, allergic diseases, and osteoarthritis. The courses of all diseases of persons qualified for research were controlled and with no exacerbations. People who suffered from chronic diseases declared 1 to 5 diseases, and the number of constantly taken medications by these patients ranged from 1 to 7. Statistics related to chronic diseases and used medications are presented in Table 1.

Descriptive statistics related to physical fitness, health self-assessment (mean values [x], standard deviations [SD]), their correlations with age and differentiation based on gender are presented in Table 1. Only correlation coefficients, which were characterized by statistical significance ($P \leq .05$) were taken into account. In the analysis of the correlation between SFT and SF-36 and the age in the examined women, correlation coefficients showed statistical significance twice as often as in men (Table 2).

The analysis of Cronbach α reliability index for OPFL revealed 0.61 for women and 0.62 for men. Correlations between each SFT tests, between SFT tests and the OPFL and Cronbach α reliability index for OPFL are presented in Table 3. Both during trial – OPFL and Cranach's α calculations, each test trial was excluded. Only significant correlations are presented below.

Test results according to the distribution of respondents in the adopted age ranges and a comparison with the standards proposed by Jones and Rilke are presented in Table 4.[24] Owing to the small number of people at the age of ≥75 years, they were classified into 1 group.

Table 2

Parameters SFT and SF-36 and their correlations with age and the differences by sex.

Variables		Total		Females		Males		
		x (SD)	[1]*r*	x (SD)	[1]*r*	x (SD)	[1]*r*	[2]*P*
SFT	I (n/30s)	17.4 (5.4)		16.5 (4.5)		19.2 (6.6)		
	II (cm)	−4.5 (13.1)	−.210*	−2.0 (10.3)	−.252*	−10.0 (16.6)		.0072*
	III (n/30s)	13.7 (4.0)		13.6 (3.8)		14.0 (4.6)		
	IV (cm)	3.4 (10.2)		4.4 (9.5)		1.4 (11.4)		
	V (s)	6.5 (2.8)		6.5 (2.2)	.240*	6.5 (3.7)		
	VI (m)	467.4 (109.9)	−.301**	463.0 (96.9)	−.278*	476.9 (134.3)	−.378*	
	OPFL	0 (2.7)	−.317**	−.1 (2.7)	−.386**	−.1 (3.1)	−.416**	
SF-36	PF	69.8 (24.1)		68.9 (23.7)		71.9 (24.9)		
	RLPH	51.3 (36.6)		53.2 (34.6)		47.1 (40.9)		
	PN	54.6 (25.2)		54.3 (24.1)		55.2 (27.7)	.379*	
	GH	48.7 (19.8)		50.4 (18.9)		45.1 (21.4)		
	PC	55.9 (22.2)		56.5 (21.8)		54.8 (23.2)		
	RLEP	58.3 (37.2)		65.2 (31.8)	−.241*	43.2 (43.5)		.0091*
	E/F	54.6 (17.1)		55.0 (15.8)	−.241*	53.9 (19.8)		
	EWB	64.5 (17.0)	−.217*	65.0 (16.8)	−.345**	63.5 (17.4)		
	SF	70.4 (20.6)		69.5 (21.1)		72.2 (19.6)	.331*	
	MC	61.8 (18.7)		63.5 (17.7)	−.305**	58.2 (20.4)		

* $P < .05$.

** $P < .01$.

[1] correlation with age, [2] differences: females-males, E/F = energy/fatigue, EWB = emotional well-being, GH = general health, I = The arm curl, II = Back scratch, III = 30-second Chair Stand, IV = Chair Sit-and-Reach, OPFL = overall physical fitness level, PC = physical component, PF = physical functioning, PN = pain, RLEP = role limitations due to emotional problems, RLPH = role limitations due to physical health, SF = social, SFT = Senior Fitness Test, V = 8 feet, VI = The 6-minute walk trial.

Table 3

Correlations between the SFT and the OPFL and the reliability of OPFL-normalized values.

		FST							
FST	**Sex**	**I**	**II**	**III**	**IV**	**V**	**VI**	**OPFL**	**Chronbach α:**
I (n/30s)	F							.667*	.52
	M							.514*	.58
II (cm)	F							.349*	.61
	M							.590*	.56
III (n/30s)	F	.725*						.730*	.50
	M	.784*						.767*	.51
IV (cm)	F			.239**				.578*	.55
	M		.571*					.541*	.58
V (s)	F	−.470*		−.494*	−.257*			−.347*	.75
	M	−.357*	−.469*	−.654*	*		−.720*	−.567*	.77
VI (m)	F	.545*		.542*	.239*	−.699*		.629*	.53
	M	.343*	.341*	.676*		−.720*		.717*	.53

* $P < .01$.
** $P < .05$.
F = females, I = The arm curl, II = Back scratch, III = 30-second Chair Stand, IV = Chair Sit-and-Reach, M = males, OPFL = overall physical fitness level, SFT = Senior Fitness Test, V = 8 feet, VI = The 6-minute walk trial.

The correlation analysis between the occurrence of chronic diseases and the use of medications and OPFL, PC, and MC values showed that the number of medications negatively correlated only with the OPFL ($r = -0.312$, $P = 0.02$). No significant correlation was found between the number of chronic diseases and OPFL, PC, and MC.

Analysis showed that the NS groups had higher levels of OPFL —as compared to S—and the differences were statistically significant, $P = .0144$. This also concerned health self-assessment (SF-36) in terms of the following factors: PF, $P = .002$; PN, $P = .019$; GH, $P = .027$; PC, $P = .025$; E/F, $P = .013$; EWB, $P = .016$; MC, $P = .036$.

The last step in the analysis was to calculate the correlation between OPFL and health factors and components. The division into groups according to sex and chronic diseases was adopted. The results are presented in Table 5. Only significant correlations are presented below.

4. Discussion

Maintaining the optimum level of physical fitness plays an important role at any age of life. Its significance in senility highlights the fact that it is closely associated with mobility and motor independence, which determine the daily self-service and domestic activities, enable social contacts and consequently the best possible level of welfare, as long as it is possible.[24,27] The decrease in physical fitness with age is inevitable, and its inter-individual variation in old age seems to be increasing.[28] It results from the individual course of the aging process and from various pathologies occurring at this stage of life. This was also reflected

Table 4

SFT results of the participants by age and comparison with standards proposed by Jones and Rikli[23].

		Age							
		60–64		65–69		70–74		75+	
SFT		**F (n = 29)**	**M (n = 11)**	**F (n = 26)**	**M (n = 9)**	**F (n = 19)**	**M (n = 9)**	**F (n = 10)**	**M (n = 10)**
I	A	19 (5–26)	18 (9–36)	16 (7–28)	21 (14–44)	16 (10–30)	19 (12–35)	14 (8–19)	17 (14–19)
	B	(13–19)	(16–22)	(12–18)	(15–21)	(12–17)	(14–21)	(11–17)	(13–19]
	C	3 (10.3%)	3 (27.3%)	4 (15.4%)	2 (22.2%)	1 (5.3%)	1 (11.1%)	2 (20.0%)	1 (10.0%)
II	A	2.0 (−20.0–+25.0)	0.0 (−50.0–+11.0)	−2.5 (−21.0–+15.5)	−16.0 (−31.0–+20.0)	−5.0 (−26.0–+6.0)	−6.0 [−56–+6.0)	2.3 (−15.0–+13.0)	−10.5 (−18.0–+11)
	B	(−3.0–+1.5)	(−6.5–+0.0)	(−3.5–+1.5)	(−7.5 ––1.0)	(−4.0–+1.0)	(−8.0 ––1.0)	(−5.0–+0.5)	(−9.0 ––2.0)
	C	6 (20.7%)	3 (27.3%)	13 (50.0%)	6 (66.7%)	12 (63.2%)	4 (44.4%)	3 (30.0%)	5 (50.0%)
III	A	14 (5 −21)	15 (3–23)	12 (6–20)	15 (10–29)	13 (10–19)	12 (10–20)	13 (7–19)	13 (8–15)
	B	(12–17)	(14–19)	(11–16)	(12–18)	(10–15)	(12–17)	(10–15)	(11–17)
	C	4 (13.8%)	4 (36.4%)	5 (19.2%)	3 (33.3%)	0	1 (11.1%)	1 (10.0%)	3 (30.0%)
IV	A	6.0 (−12.0–+20.0)	9.0 (−20.0–+20.0)	2.0 (−21.0–+30.0)	0.0 (−34.0–+19.0)	4.0 (−3–+19.0)	2.0 (−20.0–+10.0)	0.5 (−15.0–+17.5)	0.0 (−14.0–+7.0)
	B	(−0.5–+4.0)	(−2.5–+4.0)	(−0.5–+4.5)	(−3.0–+3.0)	(−1.0–+4.0)	(−3.5–+2.5)	(−0.5–+3.5)	(−4.0–+2.0)
	C	4 (13.8%)	0	7 (26.9%)	4 (44.4%)	2 (10.5%)	1 (11.1%)	3 (30.0%)	1 (10%)
V	A	5.2 (12.6–4.4)	4.7 (24.0–2.5)	6.3 (15.4–4.8)	5.8 (9.3–3.2)	6.2 (7.5–4.1)	5.4 (10.3–4.6)	7.2 (10.7–5.2)	6.8 (10.2–5.2)
	B	(6.0–4.4)	(5.6–3.8)	(6.4–4.8)	(5.7–4.3)	(7.1–4.9)	(6.0–4.2)	(7.4–5.2)	(7.2–4.6)
	C	22 (75.8%)	8 (72.7%)	12 (46.2%)	4 (44.4%)	17 (89.5%)	5 (55.6%)	5 (50.0%)	5 (50.0%)
VI	A	510 (253–616)	509 (220–692)	472 (200–633)	503 (404–692)	432 (334–586)	475 (324–601)	390 (308–550)	420.5 (105–534)
	B	(545–660)	(610–735)	(500–635)	(560–700)	(480–615)	(545–680)	(430–585)	(470–640]
	C	18 (62.1%)	8 (72.7%)	19 (73.1%)	5 (55.6%)	11 (57.9%)	6 (66.7%)	7 (70.0%)	7 (70.0%)

A = median (min–max), B = standards by Rikli and Jones (min max), C = persons below norm: n (%), I = The arm curl, II = Back scratch, III = 30-second Chair Stand, IV = Chair Sit-and-Reach, SFT = Senior Fitness Test, V = 8 feet, VI = The 6-minute walk trial.

Table 5

Correlations between physical fitness and health self – assessment.

		SF-36									
Group		**PF**	**RLPH**	**PN**	**GH**	**PC**	**RLEP**	**E/F**	**EWB**	**SF**	**MC**
OPFL: Spearman *R*	F	.235*	.254*	.241*	.341**	.289**		.324**	.379**	.379**	.332**
	M	.349*							.415**		
	Ns										
	S	.228*	.217*		.232*	.230*	.145*	.237*	.405**	.313**	.286**

* $P < .05$.
** $P < .01$.
E/F = energy/fatigue, EWB = emotional well-being, F = female, GH = general health, M = male, MC = mental component, Ns = not sick, OPFL = physical fitness level, PC = physical component, PF = physical functioning, PN = pain, RLEP = role limitations due to emotional problems, RLPH = role limitations due to physical health, S = sick, SF = social functioning.

in the results presented in this study, in the form of OPFL differences between healthy and chronically ill patients. However, this process can proceed in different directions and in the light of presented results it is clearly marked in locomotion, which affects the overall decline in physical activity levels. This could be a guideline on how to improve rehabilitation of the elderly.

The method of fitness level estimation, based on the sum of normalized values of SFT tests which was adopted by the authors, seems to be a weak part of the research. The reasons are reflected in low values of the AC. However, correlation analysis of individual tests from SFT indicates that the cause of this is an attempt "8 feet," which negatively correlates with other tests of SFT and with OPFL. Elimination of this test from SFT indicates a satisfactory reliability of this index. The same negative correlations between "8 feet" and other tests of SFT also received Zdrodowska et al.[29] Cautious approach to the interpretation of this efficiency test is recommended by Schone.[15] It seems that the cause of the negative correlation is the fact that this attempt is qualitatively different from the others. In "8 feet" test, speed-coordination factors are essential. In the other tests, such factors as muscle strength and flexibility are crucial. The problem of negative correlation between "8 feet" test and other tests can be explained by the compensation of involution changes of some motor skills aspects by the other ones, which seems to be an important discovery of the presented study. This hypothesis requires further investigation, which may be important in creating improved rehabilitation programs for the elderly. These programs should take greater account of age-appropriate physical coordination exercises, especially balance, spatial orientation, and speed. Both for people participating in rehabilitation programs, as well as for all elderly who do not have contraindications, physicians and physiotherapists should recommend walking. In older age, walking is the basic and often the only form of physical activity. Therefore, seniors should be encouraged to take this form of activity. Nordic walking should be especially recommended as a safe and effective form of activity with confirmed positive health effects.[30]

In the presented study, a significant percentage of persons achieved post weaker results in SFT than the limits proposed by Rilke and Jones. These percentages varied depending on sex, age, and SFT assessment and ranged from 0 to 89.5%. In the context of the accepted criteria for research, this may raise concerns.[26] In Poland, also Zielinski and Ignasiak et al reported a lower level of efficiency than the limits proposed by Rikli and Jones.[31,32] However, Fiodorenko-Dumas et al's study,[33] conducted on a group of 55 active seniors, practicing yoga and Nordic walking, showed better results. This may prove the effectiveness of regular seniors' exercise. Otherwise it seems that the use of "standards" regarding physical fitness is meaningful only when these standards are playing a role of a model which proves physical and mental health. This model should encourage older people to be more active and exercise, to increase the risk of premature loss of mobility and independence.[34]

Analysis of the averages in this study indicates fairly good level of health self-assessment among examined elderly. For PC and MC and for most of the factors, values were higher than the half adopted in the SF-36 scale, taking into account, of course, large natural individual variability.

Another factor adversely affecting both the PC and MC is the presence of chronic diseases, typical for old age. Correlation analysis indicates that the OPFL was positively stronger associated with health self-assessment in the group of chronically ill patients than in the healthy group. It is also interesting that it exhibits much clearer compounds of OPFL with health self-assessment in women than in men. It seems that this should be taken into account both in other studies, as well as in creating preventive and rehabilitation programs. It must also be taken into consideration that the examined persons were characterized by a potentially higher level of vitality than the average; this is the manifestation of voluntary participation in university and research activities. This can be treated as a specific limitation of this research. Other reservations may concern both the cross-sectional nature of the research and the number of participants. Presented method of estimating physical fitness—with one indicator—OPFL is a new proposal, which is the strength of this study. However, a review of the literature does not report a similar profile; it makes it difficult to compare presented results with other ones, which can be considered as its weaker side.

The application of conclusions from this study suggests that the key element of rehabilitation programs among elderly should be focused on concern for improving coordination and locomotor capabilities. Apart from improving functional condition and the slowdown of biological involution changes, it can bring significant benefits for improving both PC and MC.

5. Conclusions

On the basis of presented results, it can be concluded that health self-assessment of the elderly is more clearly associated with physical fitness in women than in men and also more in patients chronically ill than in healthy persons. Comprehensive assessment of physical fitness according to standardized values does not indicate the diversity by sex. This also applies to the PC and MC health self-assessment.

Author contributions

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