

ORIGINAL PAPER
ΕΡΕΥΝΗΤΙΚΗ ΕΡΓΑΣΙΑ

Physiotherapy and general health of older adults with musculoskeletal limb dysfunction

OBJECTIVE To investigate the effectiveness of physiotherapy in improving the general health of older individuals with musculoskeletal dysfunction. **METHOD** An observational study was conducted to compare the outcome of older adults with upper and lower limb dysfunction who underwent physiotherapy and those who did not. The study was conducted in the outpatient department of a general hospital in Athens. The participants were randomly recruited from outpatient services and asked to complete the SF-36 questionnaire. Of 300 questionnaires distributed to older adults (60–85 years), 201 were completed (90 males, 111 females). Group A included 99 participants who had undergone physiotherapy, and group B (the control group) 102 who had not received physiotherapy. **RESULTS** Physiotherapy for musculoskeletal dysfunction had a significant positive effect on individuals with upper limb dysfunction ($p < 0.0005$) and those who used medication ($p = 0.001$). Individuals of a higher educational level and those with lower limb problems appeared more likely to seek physiotherapy ($p = 0.015$) in order to maintain social engagement. The mental health in group A was better than in group B ($p = 0.055$), mostly in participants with upper limb problems ($p = 0.012$). General health and sex were marginally correlated with physiotherapy ($p = 0.07$). The individuals with the higher education levels in group A had a significantly lower health index than those in group B ($p = 0.029$). **CONCLUSIONS** Physiotherapy for musculoskeletal dysfunction has a positive effect on the general health of older adults, which is also correlated with upper limb function, sex, educational level, medication consumption and participation. Other factors, such as educational level and mental health, can affect the therapeutic results, and should be taken into account when evaluating patient outcome. It can be concluded that physiotherapy can improve the general health of older adults independently of medication use, and it is important as therapy for musculoskeletal dysfunction in this age group.

Technological advancements, scientific achievements in the healthcare field and improvements in living conditions have led to a reduction in the mortality rate and a significant increase in the average life expectancy.¹ At the same time, however, populations in urban centers have grown and changes in the way of life, such as a reduction in physical function, have been shown to exert a negative impact on the health of individuals. Considering these consequences and the physiological degenerative aging process, the quality of life of older adults may be negatively affected.² International studies document that physiotherapy,³ as a therapeutic intervention, can help prevent decline in physical function and improve the quality of life as people

age. Aging^{2,4,5} is a progressive process defined by changes in the composition of tissues and in the function of various vital organs, leading to biological and psychological deficits, and progressively increasing the risk of premature death. During aging, a variety of degenerative changes are observed in all the organic systems responsible for the general quality of health, including the nervous^{6,7} and musculoskeletal systems,^{8,9} with consequences that depend on many factors. According to Greek and international studies, musculoskeletal diseases, such as rheumatoid arthritis,¹⁰ lower limb osteoarthritis,^{11,12} upper limb osteoarthritis,^{13,14} osteoporosis,^{15,16} and fall injuries, such as fractures,¹⁵ are more common in older than in younger adults. A symptom often

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ΑΡΧΕΙΑ ΕΛΛΗΝΙΚΗΣ ΙΑΤΡΙΚΗΣ 2021, 38(5):635–641

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Φυσικοθεραπεία και γενική υγεία ηλικιωμένων με δυσλειτουργίες περιφερικών άκρων

Περίληψη στο τέλος του άρθρου

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recognized is joint pain, which leads to kinesiophobia¹⁷ with a resultant decrease in the sociability of individuals. Research has been conducted since the 1990s to identify the normal changes that occur in the human body with aging, and which lead to functional impairment.¹⁸ Recently, studies have been conducted, not only on the neuromusculoskeletal consequences that occur due to sedentary behavior in older adults, but also on their treatment²⁰ with modern physiotherapeutic interventions. According to the declaration of the World Confederation for Physical Therapy (WCPT)²⁰ and the World Health Organization (WHO),²¹ exercise is the main approach to the treatment of functional musculoskeletal problems in older adults. The scientific term for this treatment has been established as kinesiotherapy, or therapeutic exercise.²² The WHO makes it clear that the term "physical activity" should not be confused with the term "exercise".²² Exercise is the term used when there is a plan, structure, repetition and, most importantly, a goal of improving certain fitness parameters in an individual. Evaluation of individual needs must therefore take place before exercise is prescribed. Physical activity refers to any activity involving physical exertion in daily life, such as work, play, movements, chores, entertainment and other activities.²² The aging Greek population presents severe health conditions that affect physical function.²³ In many cases, medical treatment is associated with high healthcare costs for hospitalization and treatment, such as for joint replacement. Data on the results of various physiotherapeutic approaches, regarding primary or even tertiary prevention, for the preservation of a satisfactory quality of life in older adults in Greece are limited.

The purpose of this study was to investigate the effects of physiotherapeutic intervention on the general health of older Greek adults with limb musculoskeletal impairment.

MATERIAL AND METHOD

An observational study was conducted to compare older patients with limb musculoskeletal dysfunction who had undergone physiotherapy with those who had not received physiotherapy. The study was conducted in the outpatient department of a general hospital in Athens, Greece. On Tuesdays and Thursdays for a period of two months, every third patient who attended the outpatient department of the Internal Medicine Clinic of the General Hospital of Patisia was invited to participate in the study. The inclusion criteria were as follows: age between 60 and 85 years, the absence of musculoskeletal dysfunction according to the International Classification of Diseases²⁴ before the age of 50 years, and the ability to speak and read Greek. Those patients who had undergone at least ten musculoskeletal kinesiotherapy sessions, completed within one month prior to the study, regardless of any

other physiotherapy treatment, were enrolled in the study group (group A). Patients who had not received any physiotherapy in the previous two years were enrolled in the control group (group B). Questionnaires were distributed to 300 patients who met the criteria, of which 201 were completed. The respondents were 90 males, mean age 69.57 years, and 111 females, mean age 70.32 years. The characteristics of the study patients are shown in table 1. Group A (those who had undergone physiotherapy) consisted of 99 respondents, mean age 68.57 years, and group B (who had received no physiotherapy) consisted of 102 respondents, mean age 70.02 years. The duration of the data collection process was restricted to a period of two months to ensure homogeneity in the external conditions, such as weather, social events and possible changes in the health services provided. The participants completed the Greek standard version 1.0 of the IQOLA SF-36 questionnaire²⁵ under the supervision of a person not involved in the research study. In addition, basic demographic data, including the educational level, sex and age of the participants, were collected. The research proposal was approved by the Bioethics and Deontology Committee of the General Hospital of Patisia and designed according to the principles of the Helsinki Declaration (1975). The informed consent forms were provided in the Greek language.

Table 1. Demographic and clinical characteristics of the study population of elderly patients with musculoskeletal problems (n=201).

		n	%			
Sex	Male	90	44.8			
	Female	111	55.2			
Educational level	Elementary school	69	34.3			
	High school	63	31.3			
	Technological school	21	10.4			
	University	48	23.9			
Anatomical area of the clinical condition	Spinal cord	113	56.2			
	Upper limb	26	12.9			
	Lower limb	33	16.4			
	Combined areas	29	14.4			
Medication	No	84	41.8			
	Yes	117	58.2			
Physiotherapy	No	99	49.3			
	Yes	102	50.7			
Age (years)		Average	SD	Min	Max	
Physiotherapy	No	72.02	7.9	60	83	
	Yes	68.67	9.9	60	80	
Sex	Male	69.57	7.6	60	82	
	Female	70.32	9.0	60	83	

Statistical analysis

Data were expressed as mean±standard deviation (SD) for quantitative variables and as percentages for qualitative variables. Demographic and clinical variables were included in a multiple linear regression model, using the enter method to determine the most significant independent factors associated with the scores on the SF-36 subscales. All assumptions of linear regression analysis (homoscedasticity, linearity, normality and independence of error terms, and multicollinearity of independent variables) were examined. All tests were two-sided, and statistical significance was set at $p < 0.05$. All analyses were carried out using the Statistical Package for Social Sciences (SPSS), version 21.0 (IBM Corporation, Somers, NY, USA).

RESULTS

The numbers of males and females were relatively equal in the two groups, and the educational level of the participants showed no noteworthy differences. The participants in group A, who had undergone physiotherapy (50.7%), recorded general health scores similar on SF-36 to those in group B. The body areas influenced by the age-related diseases spanned the whole body; 88 individuals reported limb problems (43.8%) and 113 reported spinal problems (56.2%). Additionally, the proportions of individuals who were receiving medication (58.2%) were similar between groups. Table 2 shows the factors found to be associated with scores on the General Health scale of SF-36, following multiple linear regression analysis. Specifically, the factors that showed a statistically significant relationship with gen-

eral health were upper limb problems (a lower score by 18.9 units than those without problems, $p < 0.0005$); the females in group A had a marginally significantly lower score by 5 units on General Health than the males ($p = 0.070$), individuals with a higher level of education had a lower score by 7.3 units than those with a lower level of education ($p = 0.029$), individuals on medication had a lower score by 9.8 units than those who were not on medication ($p = 0.001$), and individuals in the physiotherapy intervention group had a higher score by 6.4 units on General Health than those in the control group ($p = 0.035$).

Regarding the Sociability scale, the factors that showed statistically significant association, as shown in table 3, were: Lower limb problems (a lower score by 12.4 units than those without lower limb dysfunction, $p = 0.015$), level of education (individuals with a higher level had a lower score by 12.8 units on social role growth than those with a lower level of education, $p = 0.005$), and physiotherapy (individuals who had not undergone physiotherapy had a lower score by 8.2 units than those who had, $p = 0.048$). Regarding the Mental Health scores, as shown in table 4, the factors that showed statistically significant association were as follows: Individuals with upper limb problems had a lower score by 12.3 units on Mental Health than those who had good upper limb function ($p = 0.012$), and an increase in age by one year lowered the mental health score by 0.40 units ($p = 0.055$).

DISCUSSION

Analysis of the responses to SF-36 showed that the fol-

Table 2. Factors associated with the score on the General Health scale* of elderly patients with musculoskeletal problems (n=201) (multiple linear regression analysis).

	Category reference	Beta	SE	p-value
Stable	-	90.01	13.03	0.0005
Age	-	-0.23	0.17	0.171
Sex	Male	-5.00	2.75	0.070
Educational level	Elementary/ secondary	-7.26	3.31	0.029
<i>Site of problem</i>				
Spinal cord	No	-4.20	3.19	0.189
Upper limb	No	-18.88	3.98	<0.0005
Lower limb	No	1.17	3.73	0.754
Medication	No	-9.82	2.81	0.001
Physiotherapy	No	6.40	3.02	0.035

*IQOLA SF-36 questionnaire²⁵

Beta: Coefficients of linear regression model, SE: Standard error of coefficients of linear regression model

Table 3. Factors associated with Sociability score* of elderly patients with musculoskeletal problems (n=201) (multiple linear regression analysis).

	Category reference	Beta	SE	p-value
Stable	-	61.07	17.69	0.001
Age	-	0.13	0.23	0.585
Sex	Male	5.15	3.73	0.169
Educational level	Elementary/ secondary	-12.77	4.49	0.005
<i>Site of problem</i>				
Spinal cord	No	-0.12	4.33	0.977
Upper limb	No	1.27	5.41	0.815
Lower limb	No	-12.37	5.06	0.015
Medication	No	-2.78	3.82	0.467
Physiotherapy	No	-8.18	4.10	0.048

*IQOLA SF-36 questionnaire²⁵

Beta: Coefficients of linear regression model, SE: Standard error of coefficients of linear regression model

Table 4. Factors associated with the Mental Health score* of elderly patients with musculoskeletal problems (n=201) (multiple linear regression analysis).

	Category reference	Beta	SE	p-value
Stable	–	88.82	15.81	0.0005
Age	–	-0.40	0.21	0.055
Sex	Male	1.75	3.34	0.600
Educational level	Elementary/ secondary	0.69	4.01	0.863
<i>Site of problem</i>				
Spinal cord	No	0.25	3.87	0.948
Upper limb	No	-12.28	4.83	0.012
Lower limb	No	1.67	4.53	0.713
Medication	No	0.58	3.42	0.866
Physiotherapy	No	3.84	3.67	0.297

*IQOLA SF-36 questionnaire²⁵

Beta: Coefficients of linear regression model, SE: Standard error of coefficients of linear regression model

lowing factors are statistically significantly associated with the general health of older adults: upper limb function, sex, educational level, medication consumption and physiotherapy. Those with upper limb problems and those who were taking medication had lower scores on the General Health scale. Lower limb function, educational level, and physiotherapy participation significantly affected sociability. Individuals with lower limb problems had a lower score on the Sociability scale than those without lower limb dysfunction, and those who needed a physiotherapeutic intervention had a lower score than those without physiotherapy. Age and dysfunction of the upper limbs had a significant negative effect on the Mental Health score. Aging decreases the mental health status, and the individuals with upper limb problems had a lower score for mental health than those with good upper limb function; in contrast, impaired lower limb function affects sociability negatively to a significant degree.

Females who had not undergone physiotherapy intervention had a lower general health score than those who had received physiotherapy. Individuals in the physiotherapy group with a higher level of education had a lower score than those in the non-physiotherapy group who had a higher level of education. Overall, those who had undergone physiotherapy had a higher mean score for general health than those without physiotherapy. Individuals with a lower level of education had a higher score for social role growth than those with a higher level of education.

These findings are mostly consistent with those in pre-

vious studies on the effects of musculoskeletal diseases in third-age people.^{17,20} These diseases are common, and their symptoms may become worse with aging.

This study shows that upper limb dysfunction is an important factor, with a negative impact on both the physical and mental health of the older population. Lower limb problems mainly affect the general health and sociability of the older individual, a correlation that has not been reported clearly in previous literature. The importance of lower limb function for the independence of older adults is not questioned, but here another issue emerges, requiring investigation of the consequences of upper limb dysfunction in the elderly population.²⁶

In this study, the educational level appears to be particularly influential in the response to disability, as the results revealed that the older adults with a lower level of education have better sociability and general health than those with a higher level of education. This may be because the majority of individuals with a lower level of education did not have a deskbound job when they were younger, or because they had different expectations.

The majority of the study findings suggest that a greater degree of physical dysfunction combined with a high educational level corresponds to a poorer effect on sociability of the aging population. This finding is interesting because the prevailing view is that educated and more wealthy individuals have a better health index.²⁷ The importance of upper limb dysfunction for mental health can be explained by the fact that older adults feel better when they can be somewhat independent in their daily life and accomplish activities that require good hand function, such as cooking food, feeding, and dressing themselves. When people have trouble moving, they are in their home and feel safe. In contrast, sociability requires moving outside of the house, and lower limb function is absolutely necessary for these activities.

According to the study findings, physiotherapy, regardless of whether the individual is taking medication, promotes the general health of older adults, which leads to the following question for future investigations: Is the regular and correct execution of limb physiotherapy an important factor in improving quality of life during aging? Even when there is no cure, the positive effects of physiotherapy on limb function clearly contribute to improvement in the daily functioning and independence and, through improvement in self-esteem, also strengthen the feeling of social engagement, leading to general social participation.

These effects may explain the possible differences

between males and females in general health score; upper limb dysfunction is more common in females, and it has a negative mental impact on their general health. The conclusion that physiotherapy has a statistically significant correlation with medication consumption is consistent with the international concept that kinesiotherapy is based on methods that affect all functional systems, including the nervous²⁸ and musculoskeletal²⁹ systems, increasing the effectiveness of medication or contributing to a reduction in the need for medication. This finding is consistent with the report³⁰ that individuals with functional pain syndromes who take medication and simultaneously have physiotherapeutic support show better compliance with medical therapy and have better outcomes, thus overcoming kinesiophobia. Because the average age of the participants in this study was not considerably different from the average age of samples in the previous international studies,^{31–33} the agreement with the findings of these studies is strong.

The results of this study, which examined the criterion of kinesiotherapy, are consistent with the international research results that show that controlled movement is therapeutic for aging people and improves their general health, which is multifactorial, through the improvement of functionality and the management of kinesiophobia.^{31,33} This phenomenon strengthens sociability and mental health, as it can reduce the feeling of insecurity during movement. In international studies,^{26,32,34} the occurrence of pain has been shown to be correlated with social factors, with implications for the development of policies in primary care services for older adults. This study concerned general musculoskeletal problems of the limbs in older individuals, in contrast with earlier studies that focused on one particular disease in specific joints. In addition, as in some studies there was no categorization by sex,^{12,32} only one sex was studied,^{17,30} or a strict age limit was not set,³² the results of the interventions cannot be generalized to the general population. In general, it appears that since the 1990s, researchers^{22,35} have supported the role of therapeutic exercise in the treatment of musculoskeletal dysfunctions during aging, but have not studied its relationship holistically with the quality of life of older people. Recent studies have differentiated the consequences of degeneration according to the affected area of the body, such as the limbs.¹⁴ This study also aimed to provide this information, with the inclusion of other factors, such as sedentary behavior.¹⁹ For the last five years, the WCPT²⁰ has suggested that movement is a therapeutic approach, and there is a need, therefore, for multifactorial studies in Greece to substantiate global approaches for the treatment of conditions associated with aging, including specialized therapeutic exercise rather than general instructions.

It can be concluded that physiotherapy can improve the general health of older adults with limb musculoskeletal dysfunction. Through this study and comparisons with the international literature, the effects of physiotherapy on the general health of older adults who had limb dysfunction when they were younger were revealed. It appears that physiotherapy, regardless of whether the individuals are taking medication, contributes to improvement of the general health status, with positive effects on social roles and mental health. The study findings were informative about the dominant effects of the various factors that affect older Greek people positively and negatively and the functional consequences that frequently develop.

The study has some limitations, however. First, it was conducted within a specific time period, and it does not have the advantage of re-evaluation. Data were not collected before and after physiotherapeutic intervention, and it was not possible to separate the various methods of physiotherapy that might have been applied, and personal kinesiotherapy was selected as the only criterion. For these reasons, it will be necessary to conduct further research with a larger sample population and to focus on specific types of dysfunction and intervention. It would be useful to include a variety of physiotherapeutic methods, such as group kinesiotherapy, consulting physiotherapy, and hydrotherapy, and their interactions with other interventions, including occupational therapy, nutrition and psychological support. From these data, a comparison of functional problems that older individuals face can be conducted according to their location and way of life and specific risk factors. It can also be concluded from this study that certain factors, including educational level and mental health, can affect the therapeutic results, which should be taken into account when evaluating and assessing patients. Well organized, specialized physiotherapy programs can be prescribed for Greek individuals of the third age, which can function as a tertiary preventive measure for musculoskeletal dysfunction, contribute to reduction in polypharmacy and improve the quality of life of older adults.

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ΠΕΡΙΛΗΨΗ

Φυσικοθεραπεία και γενική υγεία ηλικιωμένων με δυσλειτουργίες περιφερικών άκρων

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ΣΚΟΠΟΣ Μελέτη της επίδρασης της φυσικοθεραπείας στη βελτίωση της γενικής υγείας των ηλικιωμένων με μυοσκελετικές δυσλειτουργίες. **ΥΛΙΚΟ-ΜΕΘΟΔΟΣ** Η μελέτη διεξήχθη στο τμήμα εξωτερικών ασθενών ενός γενικού νοσοκομείου στην Αθήνα. Οι συμμετέχοντες επιλέχθηκαν με απλή τυχαιοποίηση στα εξωτερικά ιατρεία και συμπλήρωσαν το ερωτηματολόγιο SF-36. Διανεμήθηκαν 300 ερωτηματολόγια σε δύο ομάδες (ναι/όχι σε φυσικοθεραπεία) και απαντήθηκαν 201 (90 άνδρες, 111 γυναίκες, από τους οποίους οι 99 είχαν δεχθεί μυοσκελετική φυσικοθεραπεία ως ομάδα παρέμβασης και οι 102 αποτελούσαν την ομάδα ελέγχου). **ΑΠΟΤΕΛΕΣΜΑΤΑ** Η φυσικοθεραπεία επηρέασε περισσότερο τα άτομα με δυσλειτουργίες άνω άκρων ($p < 0,0005$) και τα άτομα που λάμβαναν φαρμακευτική αγωγή ($p = 0,001$). Τα άτομα με υψηλό μορφωτικό επίπεδο και προβλήματα κάτω άκρων βρέθηκε ότι χρειάζονταν τη φυσικοθεραπεία ($p = 0,015$) για να παραμείνουν κοινωνικά ενεργοί. Στην ομάδα Α φάνηκε ότι βελτιώθηκε η ψυχική υγεία ($p = 0,55$), κυρίως στους συμμετέχοντες με προβλήματα άνω άκρων ($p = 0,012$). Η γενική υγεία και το φύλο ήταν οριακά σημαντικά. Επίσης, τα άτομα της ομάδας Α με υψηλό μορφωτικό επίπεδο είχαν στατιστικώς σημαντικά χαμηλότερο δείκτη υγείας σε σχέση με την ομάδα Β ($p = 0,029$). **ΣΥΜΠΕΡΑΣΜΑΤΑ** Οι παράγοντες φυσικοθεραπεία, λειτουργία άνω άκρων, μορφωτικό επίπεδο, φαρμακευτική αγωγή και φύλο επηρεάζουν στατιστικά τη γενική υγεία των ηλικιωμένων. Ορισμένοι παράγοντες, όπως το μορφωτικό επίπεδο ή η ψυχική υγεία, μπορεί να επηρεάσουν τα θεραπευτικά αποτελέσματα και ως εκ τούτου οι θεραπευτές πρέπει να τους λαμβάνουν υπόψη όταν μελετούν τα αποτελέσματα των ασθενών. Διαπιστώνεται ότι η φυσικοθεραπεία μπορεί να βελτιώσει τη γενική υγεία των ηλικιωμένων, ανεξάρτητα από το αν λαμβάνουν φαρμακευτική αγωγή, και είναι σημαντική ως θεραπεία για τα άτομα με μυοσκελετικά προβλήματα.

Λέξεις ευρητηρίου: Γενική υγεία, Κινησιοθεραπεία, Μυοσκελετικές δυσλειτουργίες, Τρίτη ηλικία, Φυσικοθεραπεία

References

1. WORLD HEALTH ORGANIZATION. Life expectancy and healthy life expectancy: Data by country. WHO, Geneva, 2018. Available at: <http://apps.who.int/gho/data/node.main.688?lang=en>,4
2. WORLD HEALTH ORGANIZATION. Ten facts on ageing and health: Ageing and the life course. WHO, Geneva, 2017. Available at: <http://www.who.int/ageing/en>
3. WORLD CONFEDERATION FOR PHYSICAL THERAPY. What is physical therapy? WCPT, 2016. Available at: <https://www.wcpt.org/what-is-physical-therapy>
4. INTERNATIONAL ASSOCIATION OF PHYSICAL THERAPISTS WORKING WITH OLDER PEOPLE. Physical therapy for older people. IPTOP, London, 2018. Available at: <https://www.wcpt.org/iptop>
5. KIRKWOOD TB, KOWALD A. Network theory of aging. *Exp Gerontol* 1997, 32:395–399
6. BOURISLY AK, SHUAIB A. Neurophysiological effects of aging: A P200 ERP study. *Transl Neurosci* 2018, 9:61–66
7. ROOS MR, RICE CL, VANDERVOORT AA. Age-related changes in motor unit function. *Muscle Nerve* 1997, 20:679–690
8. BOOTH FW, WEEDEN SH, TSENG BS. Effect of aging on human skeletal muscle and motor function. *Med Sci Sports Exerc* 1994, 26:556–560
9. IANNUZZI-SUCICH M, PRESTWOOD KM, KENNY AM. Prevalence of sarcopenia and predictors of skeletal muscle mass in healthy, older men and women. *J Gerontol A Biol Sci Med Sci* 2002, 57:M772–777
10. RASCH EK, HIRSCH R, PAULOSE-RAM R, HOCHBERG MC. Prevalence of rheumatoid arthritis in persons 60 years of age and older in the United States: Effect of different methods of case classification. *Arthritis Rheum* 2003, 48:917–926
11. LESPASIO MJ, SULTAN AA, PIUZZINI, KHLOPAS A, HUSNI ME, MUSCHLER G ET AL. Hip osteoarthritis: A primer. *Perm J* 2018, 22:17–084
12. MANNONI A, BRIGANTI MP, DI BARI M, FERRUCCI L, COSTANZO S, SERNI U ET AL. Epidemiological profile of symptomatic osteoarthritis in older adults: A population-based study in Dicomano, Italy. *Ann Rheum Dis* 2003, 62:576–578
13. DAHAGHIN S, BIERMA-ZEINSTRASMA, REIJMAN M, POLS HAP, HAZES JMW, KOES BW. Prevalence and determinants of one month hand pain and hand related disability in the elderly (Rotterdam study). *Ann Rheum Dis* 2005, 64:99–104
14. ZHANG Y, NIU J, KELLY-HAYES M, CHAISSON CE, ALIABADI P, FELSON DT. Prevalence of symptomatic hand osteoarthritis and its impact on functional status among the elderly: The Framingham

- study. *Am J Epidemiol* 2002, 156:1021–1027
15. LEVEILLE SG, BEAN J, BANDEEN-ROCHE K, JONES R, HOCHBERG M, GURALNIK JM. Musculoskeletal pain and risk for falls in older disabled women living in the community. *J Am Geriatr Soc* 2002, 50:671–678
 16. LI N, OU P, ZHU H, YANG D, ZHENG P. Prevalence rate of osteoporosis in the mid-aged and elderly in selected parts of China. *Chin Med J (Engl)* 2002, 115:773–775
 17. JOELSSON M, BERNHARDSSON S, LARSSON MEH. Patients with chronic pain may need extra support when prescribed physical activity in primary care: A qualitative study. *Scand J Prim Health Care* 2017, 35:64–74
 18. SKELTON DA, GREIG CA, DAVIES JM, YOUNG A. Strength, power and related functional ability of healthy people aged 65–89 years. *Age Ageing* 1994, 23:371–377
 19. COPELAND JL, ASHE MC, BIDDLE SJ, BROWN WJ, BUMAN MP, CHASTIN S ET AL. Sedentary time in older adults: A critical review of measurement, associations with health, and interventions. *Br J Sports Med* 2017, 51:1539
 20. WORLD CONFEDERATION FOR PHYSICAL THERAPY. Policy statement. Physical therapists as exercise experts across the life span. WCPT, 2017. Available at: [https://www.wcpt.org/policy/ps-exercise %20experts](https://www.wcpt.org/policy/ps-exercise%20experts)
 21. WORLD HEALTH ORGANIZATION. Global strategy on diet, physical activity and health (DPAS). 57th World Health Assembly, 2004. Available at: [http://apps.who.int/iris/bitstream/handle /10665/43035/924?sequence=1](http://apps.who.int/iris/bitstream/handle/10665/43035/924?sequence=1)
 22. WORLD HEALTH ORGANIZATION. Global recommendations on physical activity for health – age group: 65 years old and above. WHO, Geneva, 2010. Available at: <http://www.who.int/dietphysical-activity/pa/en/>
 23. ANDRIANAKOS AA, KONTELIS LK, KARAMITSOS DG, ASLANIDIS SI, GEORGOUNTZOS AI, KAZIOLAS GO ET AL. Prevalence of symptomatic knee, hand, and hip osteoarthritis in Greece. The ESOR-DIG study. *J Rheumatol* 2006, 33:2507–2513
 24. WORLD HEALTH ORGANIZATION. International classification of functioning, disability and health (CF): Classification. 54th World Health Assembly, WHO, Geneva, 2001. Available at: <http://www.who.int/classifications/icf/en>
 25. PAPPA E, KONTODIMOPOULOS N, NIAKAS D. Validating and normalizing of the Greek SF-36 health survey. *Qual Life Res* 2005, 14:1433–1438
 26. BATISTA FS, DE OLIVEIRA GOMES GA, D'ELBOUX MJ, CINTRA FA, NERI AL, GUARIENTO ME ET AL. Relationship between lower-limb muscle strength and functional independence among elderly people according to frailty criteria: A cross-sectional study. *Sao Paulo Med J* 2014, 132:282–289
 27. JONES GR, STATHOKOSTAS L, YOUNG BW, WISTER AV, CHAU S, CLARK P ET AL. Development of a physical literacy model for older adults – a consensus process by the collaborative working group on physical literacy for older Canadians. *BMC Geriatr* 2018, 18:13
 28. HÄKKINEN K, HÄKKINEN A. Neuromuscular adaptations during intensive strength training in middle-aged and elderly males and females. *Electromyogr Clin Neurophysiol* 1995, 35:137–147
 29. ΠΕΤΤΑ Γ. Φυσικοθεραπεία στην οστεοπόρωση και σαρκωπενία. Ανοικτά Ακαδημαϊκά Μαθήματα, Τμήμα Φυσικοθεραπείας, Πανεπιστήμιο Δυτικής Αττικής, Αθήνα, 2014. Available at: [https://ocp.teiath.gr/courses/ F_THER_ UNDE-113/](https://ocp.teiath.gr/courses/F_THER_UNDE-113/)
 30. KARAKASIDOU P, SKORDILIS K, LYRITIS G. Motor control exercise can reduce pain and kyphosis in osteoporotic women with vertebral fractures: A randomized trial. *Rev Clin Pharmacol Pharmacokinet Int Ed* 2013, 27:95–106
 31. ISHAK NA, ZAHARI Z, JUSTINE M. Kinesiophobia, pain, muscle functions, and functional performances among older persons with low back pain. *Pain Res Treat* 2017, 2017:3489617
 32. JORDAN KP, THOMAS E, PEAT G, WILKIE R, CROFT P. Social risks for disabling pain in older people: A prospective study of individual and area characteristics. *Pain* 2008, 137:652–661
 33. LARSSON C, EKVALL HANSSON E, SUNDQUIST K, JAKOBSSON U. Kinesiophobia and its relation to pain characteristics and cognitive affective variables in older adults with chronic pain. *BMC Geriatr* 2016, 16:128
 34. BENYON K, MULLER S, HILL S, MALLEN C. Coping strategies as predictors of pain and disability in older people in primary care: A longitudinal study. *BMC Fam Pract* 2013, 14:67
 35. PHILLIPS WT, HASKELL WL. “Muscular fitness” – easing the burden of disability for elderly adults. *J Aging Phys Activ* 1995, 3:261–289
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