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## Evaluation of comprehensive ambulatory rehabilitation of people over 60 years of age

### Abstract

**Introduction.** The provision of adequate health care for a successively growing group of geriatric patients requires taking into account many factors in order to preserve and/or improve their overall health and the related functional capacity. Its crucial aspects include the ability to safely change position and locomotion, as well as the severity of discomfort from the osteoarticular system.

**Aim.** The objective of the present study was to assess the impact of comprehensive ambulatory rehabilitation including tailored endurance training, preceded by an ergospirometry test, on indicators showing the risk of falls and the severity of pain symptoms of patients aged 60 and over, receiving health services at the Outpatient Healthcare Home (DDOM).

**Material and methods.** The study involved 60 seniors during their rehabilitation cycle implemented as part of the services provided to patients at DDOM of the W. Chodźko Institute of Rural Health in Lublin. The tests were carried out in the test-retest model on the first and last day of the kinesiotherapy cycle. The Tinetti scale of the risk of falls, balance and walk and Visual Analogue Scale of the severity of pain sensations (VAS) were utilized in the research. The patient rehabilitation program at the DDOM included adapted systemic kinesiotherapy (endurance training with a load determined according to individual exercise capacity, as determined on the basis of the ergospirometry test) and local kinesiotherapy as well as physical therapy adapted to the needs resulting from the condition of the musculoskeletal system.

**Results.** After completing the rehabilitation cycle, the patients obtained higher scores, compared to the tests carried out before the beginning of the rehabilitation cycle, in the scales of Tinetti Questionnaire. There were also lower results of the respondents in VAS scale used to assess the severity of pain sensations.

**Conclusions.** As a result of the rehabilitation program applied, DDOM patients simultaneously obtained the desired changes in minimizing the risk of falls, improving the ability to maintain balance and fitness while walking, as well as reducing the severity of pain sensation.

**Keywords:** TINETTI, VAS, risk of falls, aggravation of pain, endurance training, physical activity of seniors.

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### INTRODUCTION

The prognostic analyses carried out by the Central Statistical Office of Poland indicate that by 2030 seniors will constitute almost a quarter of Polish society [1]. Provision of appropriate healthcare services to this successively enlarging group of patients requires taking into account many factors in order to preserve and/or improve their overall health and related functional capacity, therefore what is significant in the process of treatment and rehabilitation of elderly people is a holistic approach to the manifestations of their health problems [2].

This assumption was the basis for a comprehensive rehabilitation and activation program for people over 60 years of age as part of the Outpatient Healthcare Home (Dzienny Dom Opieki Medycznej) at the W. Chodźko Institute of Rural Health in Lublin. The program was conducted in accordance with the guidelines contained in the project “DDOM in Lublin” with the POWER no.05.02.00-00-0109/15. The actions taken were aimed at improving the health and related physical and mental

fitness of seniors, and the rehabilitation program developed by a team of specialists, including permanent medical, nursing, psychological and physiotherapy staff, took into account the individual needs and health of the participants [3].

One of the crucial aspects of functional efficiency, as well as the quality of life of older people associated with it, is the tendency to falls and the severity of pain in the osteoarticular system [4,5].

The factors that increase the risk of falling in seniors are: muscle weakness of the lower limbs; gait disorders, which may be caused by various chronic conditions; occurrence of this type of events in the past; use of gait assistive devices; sight problems; medication being used; cognitive impairment of various etiology; structure of the body and intensification of perceived pain signals from the motor system [4-7].

Pain is defined as a “subjective negative sensory and emotional impression that arises under the influence of nociceptive stimuli that damage tissue or threaten with its damage” [8]. Pain is associated with stimulation of the sympathetic nervous

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system, and therefore, with the acceleration of heart rhythm, increased arterial blood pressure and increased secretion of certain hormones, e.g. adrenocortical hormones [9,10].

The available research results clearly indicate that comprehensive geriatric rehabilitation is conducive not only to improving the health and functional capacity of seniors, but also a factor shaping the well-being and perception of the quality of life [4,5].

The assessment of the effectiveness of a 12-week cycle of rehabilitation, including manual therapy and physical exercise, carried out by the Maiers team, demonstrated a significant reduction in pain in the cervical spine of the seniors [11]. The desirable effects of 8-week rehabilitation treatments, including both psychological and aerobic training, were also confirmed in pilot studies by Beissner et al. Based on the analyzes carried out, it was found that as a result of measures implemented in a group of Spanish seniors, a reduction in the severity of pain, depressive symptoms, as well as increased physical fitness and social involvement were all achieved [12]. The results of the Donath syndrome research also show the benefits of the kinesiotherapy program. It was proven that the applied cycle of physical exercise contributed to minimizing the risk of falls and improved the balance and fitness of movement in people over 60 [13].

The empirical work cited above allows us to conclude that the evaluation of the comprehensive rehabilitation program implemented at DDOM should include an assessment of the effectiveness of the measures applied in relation to the risk of falling and the severity of pain complaints in patients undergoing rehabilitation.

## AIM

The objective of the present study was to assess the impact of comprehensive ambulatory rehabilitation including tailored endurance training, preceded by an ergospirometry test, on indicators showing the risk of falls and the severity of pain symptoms of patients receiving health services at the DDOM.

## MATERIAL AND METHODS

The number of 60 seniors aged from 60 to 93 years old formed the research group. The respondents participated in the rehabilitation cycle carried out as part of the services provided to patients at DDOM at the W. Chodźko Institute of Rural Health in Lublin. The mean age of participants was over 74 years ( $M=74.06$ ;  $SD=7.75$ ). The group was dominated by women, who accounted for three-quarters of the surveyed population (75.0%;  $N=45$ ).

The stay of patients at DDOM was individually determined by the therapeutic team and ranged from 30 to 120 working days. The applied improvement program included:

- adapted, intensive systemic kinesiotherapy (endurance training with appliances) with sub-maximum loads determined according to individual exercise capacity, as determined on the basis of a ergospirometry test, training plan: 8 minutes of exercises for the first 5 days with the achievement of sub-maximal heart rate, and 15 minutes of such exercises for the rest of the training cycle;
- other kinesitherapeutic effects recommended according to the needs arising from the condition of the musculoskeletal system, including: active free exercises, active none-weight

bearing exercises, active-passive exercises, PNF exercises, manual massage, exercises with the use of devices such as balls, exercise sticks, ladders, mattresses, rotor for exercises of upper limbs, rotor for exercises of lower limbs, rehabilitation table;

- the necessary physical therapy: local thermotherapy, electrotherapy, phototherapy, electromagnetic field treatment.

The Tinetti Scale [14] and Visual Analogue Scale (VAS) [15] were utilized in the research.

Tinetti scale is used to assess the risk of falls in the elderly. The maximum score of the examined person can amount to 28 points – 16 in the part evaluating the balance and 12 in the part assessing the gait. A score of 28 to 25 means low risk of falls, a score between 24 and 19 – that the subject is prone to falls, and a score of 18 and fewer indicates high risk of falling [14].

The VAS scale is used to test the severity of pain experienced on a scale from 0 to 10, where the value of 0 indicates the absence of this type of discomfort, and the number of 10 indicates its maximum severity [15].

The permission of the IMW Bioethics Committee in Lublin was obtained for conducting the research. It was carried out in accordance with the assumptions of the Helsinki Declaration of 2013. Participation of patients in the study was voluntary and anonymous. Participants were notified about the purpose and the course of the research and answered questions. The participants completed questionnaires twice – the first and last day of the rehabilitation cycle implemented as part of their stay at DDOM.

Statistical analyzes were performed using the IBM SPSS 24 software suite. The characteristics of the studied population were based on the mean value, standard deviation, the minimum and maximum of quantitative variables and the distribution of percentages of the qualitative data occurrence. The distribution shapes of the parameters considered were estimated using the Shapiro-Wilk test. A parametric test used to verify intra-group differences was t Student for dependent samples. The obtained results were supplemented with measures of the effect size calculated with use of d Cohen statistic. The work assumes the limit level for false positive error of 0.05.

## RESULTS

Results of the performed intra-group comparisons in the range of results obtained in Tinetti scale are included in Table 1.

The analyzes carried out demonstrated that prior to the rehabilitation the DDOM patients were characterized by a high risk of falling ( $M=18.44$ ;  $SD=5.48$ ), and after the rehabilitation program was completed, the respondents showed a moderate tendency to falls ( $M=23.11$ ;  $SD=4.90$ ). In addition, before the rehabilitation program, the average patient balance was

TABLE 1. Risk of fall in DDOM patients.

Scale	Test				Intra-group comparison		
	Prior to rehabilitation		After completed rehabilitation		<i>t</i>	<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Risk of fall	18.44	5.48	23.11	4.90	9.09	0.001	1.52
Balance	9.08	3.64	12.47	4.14	8.67	0.001	1.44
Gait	9.33	2.12	10.67	1.64	6.22	0.001	1.03

9.08/16.00 points (SD=3.64), and after its completion it was graded at 12.47/16.00 points (SD=4.14). In turn, the efficiency when walking before the beginning of the kinesiotherapy cycle was 9.33/12.00 points (SD=2.12), while after the rehabilitation program ended, it was 10.67/12.00 points (SD=1.64).

The performed intra-group comparisons show that after the completed rehabilitation cycle, the respondents were less likely to fall ( $t=9.09$ ;  $p=0.001$ ), and also showed a higher ability to maintain balance ( $t=8.67$ ;  $p=0.001$ ) and gait efficiency ( $t=6.22$ ;  $p=0.001$ ) than before its commencement.

The obtained effect sizes confirm strong dependencies between the risk of falls ( $d=1.52$ ), the ability to maintain balance ( $d=1.44$ ) and fitness while walking ( $d=1.03$ ) and the applied kinesiotherapy program.

Results of the performed intra-group comparisons in the range of results obtained in the VAS Scale are included in Table 2.

Based on the data received, it was found that before starting the rehabilitation program, DDOM patients experienced

**TABLE 2. Intensity of pain syndromes in DDOM patients.**

Test				Intra-group comparison		
Prior to rehabilitation		After completed rehabilitation		<i>t</i>	<i>p</i>	<i>d</i>
<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
7.71	1.63	4.92	1.50	5.39	0.001	1.10

severe pain ( $M=7.71$ ;  $SD=1.63$ ), but after its completion they described it as moderate ( $M=4.92$ ;  $SD=1.50$ ).

Based on the analyzes performed, it was found that the severity of pain in DDOM patients was statistically significantly lower after the end of the rehabilitation cycle than before its commencement ( $t=5.39$ ;  $p=0.001$ ).

The obtained effect size ( $d=1.10$ ) confirms the strong dependency between the rehabilitation program applied, and the level of severity experienced by the respondents.

## DISCUSSION

The evaluation of the effectiveness of a comprehensive rehabilitation and activation program for seniors, which was carried out at the DDOM of the W. Chodźko Institute of Rural Health in Lublin demonstrated that, in the result of the applied interventions, the patients underwent a reduction in the risk of falls, improved balance and gait efficiency, as well as obtained reduction in the severity of pain sensations from the motor system.

Positive effects of the rehabilitation program developed for the elderly have also been confirmed in studies conducted in the population of people with mild cognitive deficits. Patients in outpatient settings participated in twenty/thirty-minute sessions twice a week. The respondents from the experimental group carried out balance training, while the control group members performed physical exercises combined with balance training. The risk of falling and the static and dynamic aspects of balance were assessed using the Tinetti test and functional stretching, while the gait efficiency was tested using four forms of the Timed Up & Go test. It was revealed that with the combination of physical exercise and balance training patients were achieving better results than with balance training alone [4].

Similar conclusions were also reached during the pilot studies carried by the Pluchino team. Based on the conducted analyzes, it was found that in a group of seniors, properly designed physical exercises are conducive to lowering the risk of falls [16]. Significant improvement in functional gait ability, assessed using a 6-minute walk test (6MWT) was also confirmed in the studies of Chen et al. [17]. In contrast, in other empirical studies, it has been proved that the series of rehabilitation measures performed in the elderly group contribute not only to the improvement of general physical fitness, but also have a positive effect on the mental condition of respondents and the severity of pain they experience [17,18].

The results of the meta-analysis of Xu et al. indicate that manual therapy significantly contributed to alleviation of pain, minimized stiffness and improved functional capacity of patients diagnosed with osteoarthritis of knee joint [19]. On the other hand, in the population of seniors suffering from pain in the cervical spine, it was proven that a cycle of physiotherapy significantly reduced the frequency of their occurrence [20].

To sum up the discussion, it should be emphasized that the applied daily outpatient care and comprehensive rehabilitation program including tailored endurance training, psychological therapy and other forms of therapeutic interactions proved effective in reducing the risk of falls, improving the balance and gait efficiency, and minimizing the severity of pain experienced by respondents. The results confirm that, where possible, geriatric rehabilitation should include elements of systematic and intensive physical activation in the form of endurance training that improves the functioning of skeletal muscles, cardiovascular and respiratory systems, and also positively affects the activities of the central nervous system [21-23].

## CONCLUSIONS

1. The applied program of comprehensive outpatient rehabilitation addressed to people from 60 years of age decreased the risk of falls and contributed to the increase of balance and walk fitness of DDOM patients.
2. The applied program of comprehensive ambulatory rehabilitation caused a decrease in the severity of experienced pain symptoms of DDOM patients.

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