

## Functional efficiency evaluation for the elderly staying in nursing homes

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### Summary

**Background:** Demographic prognosis show the elderly population increase. Their level of functional efficiency forecasts whether they should be placed in a nursing home or be hospitalized, what is the risk of their death or what are their chances for a long and happy antiquity.

The aim of the article was functional efficiency evaluation for the people over 65 years old staying in nursing homes.

**Material and Methods:** In the research we used an authorial questionnaire and the ADL, IADL and NHPPT scales. 411 people (310 women and 101 men) staying in nursing homes were surveyed, with their average age of 79,4+/-7,7.

**Results:** Average number of obtained points at ADL scale for 65-74 years was 4,7+/-1,9 point; 75-84 years 4,8+/-1,6 point; 85 years and more 4,0+/-2,0. Average number of obtained points at IADL scale for 65-74 years was 17,8+/-5,3 point; 75-84 years 18,3+/-4,9 point; 85 years and more 15,2+/-4,7. In the test NHPPT the surveyed people obtained the fol-

lowing points: for 65-74 years 18,7+/-6,5 point; 75-84 years 19,5+/-5,0 point; 85 years and more 17,8+/-6,2.

**Conclusions:** Better efficiency in basic and complex routine activities was typical for men. Efficiency decreases abruptly for both sexes in the oldest group. Worse results in efficiency tests were caused mainly by: age, (85 years and more), widowhood, a considerable grade of disability and depression symptoms.

**Key words:** functional efficiency, the elderly, ADL, IADL, NHPPT, nursing home

## Introduction

The demographical data unambiguously indicate that societies around the world are ageing. According to reports, infants born after 2000 in France, Germany, Italy, the United Kingdom and the United States will live up to their 100th birthday, despite the fact that these countries differ in fertility, migration and life expectancy [1].

GUS (Central Statistical Office) forecasts predict that the share of elderly people in the society in Poland may exceed 30% by 2050. The internal structure of the elderly population will also change, as it is assumed that, by 2050, persons of at least 80 years of age will account for 10.4% of the country's population, while in 2013 it was 3.9%. Out of 3.5 million inhabitants of Poland aged 80 and more in 2013, over 59 thousand will reach 100 years of age in the final year of the forecast [2].

The functional fitness of the elderly depends largely on the course of the ageing process, but also on the occurrence of ancillary illnesses, lifestyle (routines, habits), and socio-environmental and psychological factors which exert impact on the entire course of life, not only the old age [3,4,5].

Studies conducted on the centenarians in many countries around the world, including the United States, Australia, and Japan have shown that the key element of survival in extremely long life is maintaining functional fitness [6].

Functional fitness is defined as the ability to be independent of others in the basic activities of everyday life, such as mobility, nutrition, travel, keeping personal hygiene or sphincter control [7,8].

Unfortunately, sedentary lifestyle, increasing over the years, is common in the elderly population, and thus lack of physiologically essential motor activity. This causes deterioration of the functional ability of the ageing person and increases the probability of occurrence or exacerbation of diseases (diseases of the cardiovascular system, metabolic syndrome, diabetes). Lack of physical activity is an independent risk factor for chronic diseases [9,10]

All activities undertaken with regard to the elderly should aim at optimising functional efficiency understood as improving or maintaining fitness, or at least slowing down the pace of its deterioration. These activities should be holistic, based on comprehensive research and conducted by professionals [11]. This is important not only from the point of view of the design of medical services, but also with regard to the design of care services and strategies to improve the functioning of the elderly [12].

Not only the chronically ill will require assistance in daily functioning but also persons in whom the physiological ageing process proceeds normally, but results in the loss

of efficiency and need to be helped in, for example, shopping, cleaning or covering a greater distance[13]. Nursing possibilities may be measured with three indicators: the potential support ratio, the parent support ratio, and the nursing potential ratio. In 2016, the nursing capacity ratio was 344.5, while the forecasts for 2035 predict the index of only 219.2, which demonstrates reduced care potential of women, families and loved ones, and the necessity of support by various services and institutions[13].

## **Material and Methods**

The aim of the study was to assess the functional fitness of people aged 65 years and over, living in nursing homes in the area of Silesian Voivodship.

The research was based on an original anonymous survey questionnaire, as well as the ADL, IADL and NHPPT tests. Dr. Elen F. Binder's of the Washington University School of Medicine written consent was obtained to conduct the NHPPT test.

The ADL (Activity of Daily Living) scale according to Katz measures six activities: washing, dressing, toilet use, movement, fecal and urinary continence, and eating. One point was awarded to the surveyed for independent performance of each of the activities. In total, a person could get 0 to 6 points. Numbers 5 and 6 denoted fully maintained function, 3 and 4 – moderate functional impairment and 0-2 severe functional impairment. The scale for complex daily activities IADL (Instrumental Activity of Daily Living) according to Lawton measures the performance of nine activities. These activities include: conducting phone calls, arriving at places beyond walking distance, shopping, food preparation, performing minor chores, performing minor repairs at home, doing washing, taking medication and the use of money. For each of the tasks performed, the persons surveyed could obtain one point if they were entirely incapable of performing the action, two points if they performed it with some assistance and three points if they performed the action unassisted. Having performed the full index of tasks, a person could obtain from 9 to 27 points[14]. The person participating in the NHPPT (Nursing Home Physical Performance Test) was to perform six activities. These are basic and complex everyday activities including: sitting on and rising from a chair, pouring liquid from one vessel to another, elements of daily personal grooming, ability to use the telephone, elements of putting clothes on and taking them off and a gait test of six minutes or six meters. In accordance with the procedure of the test, for each of these activities, from 0 to 4 points may be awarded. A person participating in the test was awarded four points for independent performance of an activity following verbal instruction, three points if step by step verbal instruction was needed to perform the activity, two points if the person needed both verbal instruction and some assistance in performing the task, one point if the activity was performed largely with another person's assistance and zero points in the case of inability to perform the task. The person participating in the test could get from 0 to 24 points [15].

The results obtained were summarised in an MS Excel spreadsheet. Statistical calculations were made using STATISTICA PL. Mean values and standard deviations of the test indicators were calculated. Kolmogorow-Smirnow test was used to assess the normality of distribution. In the case of population with a normal distribution of comparisons between the groups (for example, sex, age groups), t-Student test was applied for unlinked variables. When the distributions did not demonstrate the features of normality, Mann-Whitney U test was used to estimate the statistical significance of differences between the groups. The relationship between parameters was examined by calculating the Pearson correlation

coefficient (normal distributions) or Spearman coefficient R (no features of normality). The frequency of incidence of certain features was calculated (such as the symptoms of depression) and compared between the studied groups (for example, age, gender) by means of Chi-square test. The level  $p < 0,05$  was adopted as statistically significant.

## Results

411 persons of both sexes aged 65 years and more participated in the study, among them 310 women (75.4%) and 101 men (24.6%). The average age of the subjects was  $79.4 \pm 7.7$  years. For women, it was  $80.5 \pm 7.3$  and for men  $76.0 \pm 7.8$  years. Among the persons surveyed, the most numerous group were widows and widowers – 60% of the surveyed. Single persons amounted to 22%, married persons – 8% and divorcees – 10%. Among the women, widows were the most numerous – 211 persons (68%), which is a number significantly higher than in the case of men, among whom there were 34 widowers. Together with the age of the surveyed, the structure connected with the marital status of the surveyed changed statistically significantly ( $p < 0,001$ ). Widowhood most frequently occurred among the surveyed above 85 years of age (74.7%).

Among the 411 persons surveyed, more than a half (238 persons, 57.2%), had a certified degree of disability, among whom the largest group consisted of persons with a significant degree of disability (142 persons, 34.5%). There were more disabled among the men than among the women. Surprisingly, a significant degree of disability was most frequently certified with respect to the youngest persons surveyed (42.6%). Among the respondents aged 85 years or more, as many as 55.2% did not have certified degree of disability ( $p < 0,01$ ) (Table I).

**Table I The degree of disability among the respondents**

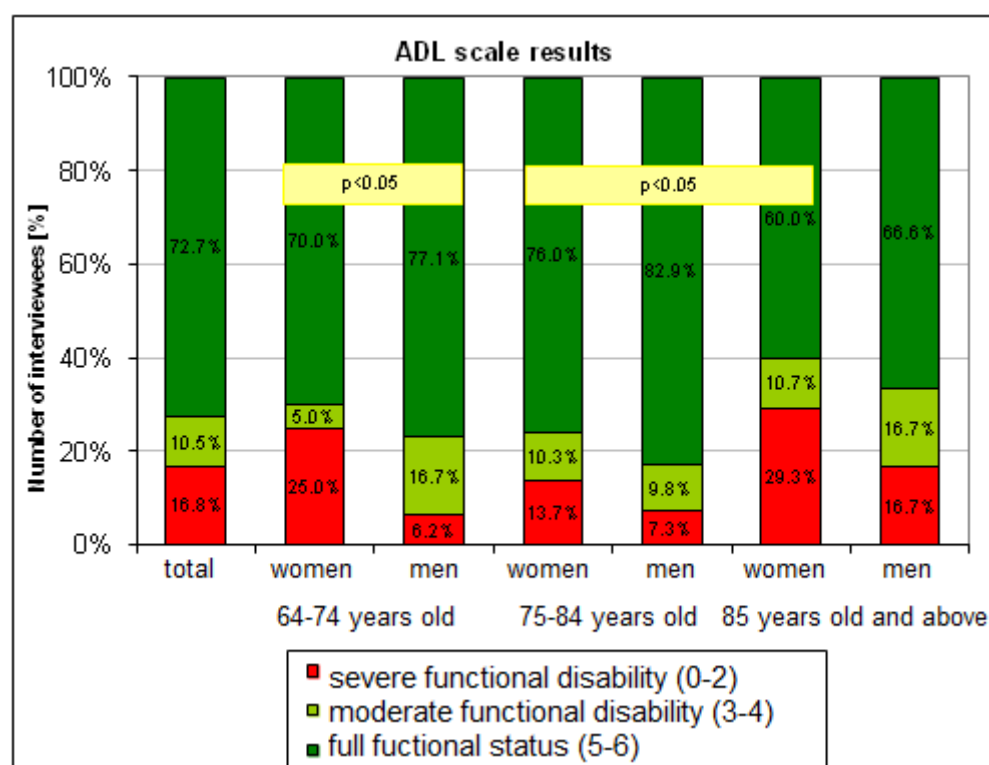
|                    | Degree of Disability |      |          |      |       |     |       |      |
|--------------------|----------------------|------|----------|------|-------|-----|-------|------|
|                    | Severe               |      | Moderate |      | Mild  |     | None  |      |
|                    | Count                | %    | Count    | %    | Count | %   | Count | %    |
| Women              | 104                  | 33.6 | 54       | 17.4 | 10    | 3.2 | 142   | 45.8 |
| Men                | 38                   | 37.6 | 19       | 18.8 | 10    | 9.9 | 34    | 33.7 |
| <b>Age [years]</b> |                      |      |          |      |       |     |       |      |
| 65-74              | 46                   | 43.6 | 23       | 21.3 | 7     | 6.5 | 32    | 29.6 |
| 75-84              | 66                   | 30.6 | 44       | 20.4 | 10    | 4.6 | 96    | 44.4 |
| $\geq 85$          | 30                   | 34.5 | 6        | 6.9  | 3     | 3.4 | 48    | 55.2 |

In order to assess the functional fitness of the respondents, the ADL and IADL scales were used, as well as the NHPPT test. The participants were asked to comment and perform tasks. Table II presents the results obtained.

**Table II Results obtained in ADL, IADL and NHPPT, taking into account age and gender**

|              | Age [years]           | In total   | Women      | Men        | Men to women comparison |
|--------------|-----------------------|------------|------------|------------|-------------------------|
| <b>ADL</b>   | 65-74 years (A)       | 4.7 ± 1.9  | 4.5 ± 2.2  | 5.1 ± 1.5  | p<0.05                  |
|              | 75-84 years (B)       | 4.8 ± 1.6  | 4.8 ± 1.6  | 5.1 ± 1.3  | NS                      |
|              | ≥ 85 years (C)        | 4.0 ± 2.0  | 3.9 ± 2.1  | 4.4 ± 2.1  | NS                      |
| Comparison   | A – B                 | NS         | NS         | NS         |                         |
|              | A – C                 | p<0.01     | p<0.05     | NS         |                         |
|              | B – C                 | p<0.01     | p<0.01     | NS         |                         |
| <b>IADL</b>  | 65-74 years (A)       | 17.8 ± 5.3 | 17.2 ± 5.2 | 18.6 ± 5.5 | NS                      |
|              | 75-84 years (B)       | 18.3 ± 4.9 | 18.1 ± 4.9 | 19.4 ± 4.9 | NS                      |
|              | ≥ 85 years (C)        | 15.2 ± 4.7 | 15.0 ± 4.5 | 16.4 ± 6.1 | NS                      |
| Comparison   | A – B                 | NS         | NS         | NS         |                         |
|              | A – C                 | p<0.001    | p<0.05     | NS         |                         |
|              | B – C                 | p<0.001    | p<0.05     | NS         |                         |
| <b>NHPPT</b> | 65 – 74 years (A)     | 18.7 ± 6.5 | 17.8 ± 7.3 | 19.8 ± 5.1 | NS                      |
|              | 75 – 84 years old (B) | 19.5 ± 5.0 | 19.3 ± 5.1 | 20.2 ± 4.8 | NS                      |
|              | ≥ 85 years (C)        | 17.8 ± 6.2 | 17.6 ± 6.3 | 18.9 ± 5.7 | NS                      |
| Comparison   | A – B                 | NS         | NS         | NS         |                         |
|              | A – C                 | NS         | NS         | NS         |                         |
|              | B – C                 | NS         | NS         | NS         |                         |

The analysis of the ADL scale results divided by sex and gender demonstrates that men are characterised by greater fitness (65-74 years old –  $5.1 \pm 1.5$  points; 75-84 years old –  $5.1 \pm 1.3$  points; above 85 years of age –  $4.4 \pm 2.1$  points) than women ( $4.5 \pm 2.2$  points;  $4.8 \pm 1.6$  points;  $3.9 \pm 2.1$  points, respectively) but it was statistically significant only in the age range of 65-74 ( $p < 0.05$ ). Both among the women and men, subjects over the age of 85 scored significantly statistically lower on this scale. Also, there were statistically significantly more women with severe functional impairment at the age of over 85 than between 75 and 84 years of age. In the group of men, the degree of functional impairment in specific age ranges were similar (figure. 1).



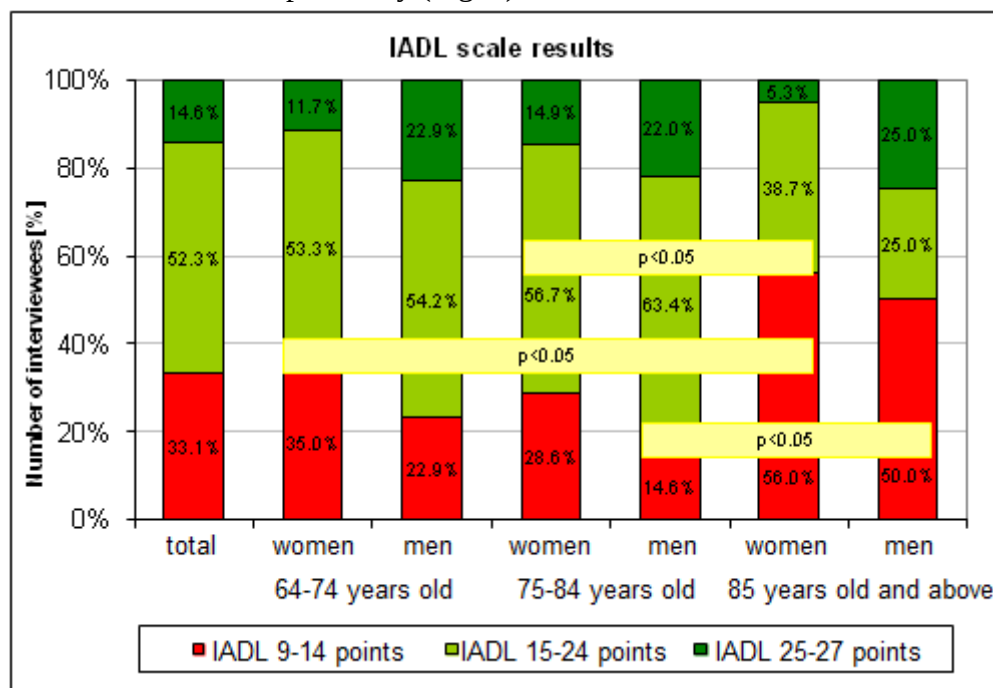
**Figure 1. ADL scale results taking into account the degree of functional impairment**

The activity which posed the greatest challenge for the surveyed was taking a bath. In the youngest group surveyed, 53.3% of the women and 65.6% of the men performed the task by themselves, as compared to only 25.3% of the women and 33.3% of the men aged 85 and more. Among the surveyed residents of nursing homes, 46.7% bathed, 79.8% dressed, 82% used the toilet, 78.1% moved around, 83.2% controlled their urinary and fecal continence and 99.6% ate meals, unassisted.

The scale of the complex activities of daily living (IADL) demonstrated that the majority of the respondents could not independently perform the tasks required and needed assistance. The average number of points scored in the 65-74 age range was  $17.8 \pm 5.3$  points; 75-84 years -  $18.3 \pm 4.9$  points; 85 years and over -  $15.2 \pm 4.7$  points (Table II). Both in the whole group studied and among women, respondents aged 85 had statistically significant lower scores. There were no significant differences in statistical results achieved according to the IADL scale between age groups among the men.

Among the women surveyed, 35% at the age 65-74 and more than half (56%) at the age of 85 scored between 9 and 14 points in IADL scale, which denotes inability to independently perform most of the tasks included in the scale.

As expected, the efficiency in performing complex daily activities decreases with age in both sexes. At the age of 85 or more, only 5.3% of women and 25% of men performed the IADL scale tasks independently (Fig. 2).



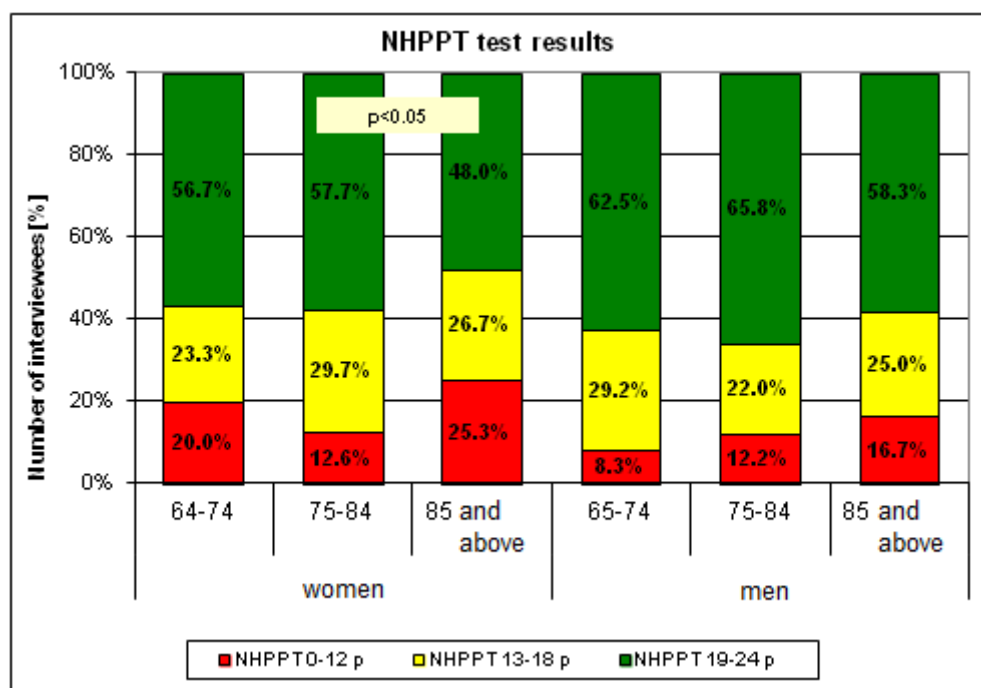
**Figure 2. IADL scale results**

Among the men, the activities most often performed independently were money management (74.3%) and telephone use (68.8%), while they were not able to make minor repairs (64.4%) and do the washing (51.5%). Similarly to the men, the women showed the highest level of independence in money management (62%) and the use of the phone (53%). Apart from DIY (85.8%), which can hardly be described as interesting for women in general, they were the least independent with respect to traveling over a distance greater than a walk (50.6%) and doing washing (50.3%).

To assess the respondents' fitness, the NHPPT (Nursing Home Physical Performance Test), unknown and never previously used in Poland was applied, containing elements of the basic scales and more complex daily tasks. In the group studied, the respondents obtained the following number of points: in the group between 65-74 years of age:  $18.7 \pm 6.5$  points; 74-85 years of age:  $19.5 \pm 5.0$  points; above 85 years of age –  $17.8 \pm 6.2$  points.

In the studied group consisting both of women and men, most scored four points for each of the tasks performed. 14.8% of the women and 16.8% of the men surveyed could not complete the task consisting in walking six metres. Washing their faces, undressing and dialling a number also posed a problem to the surveyed. The following activities were performed independently, without verbal or manual assistance, at the first attempt: face washing – 49% of the women and 58.4% of the men, dialling a number – 50.6% of the women and 68.3% of the men. The men and women in the age group between 75-84

displayed the greatest fitness, while those in the oldest age group showed the poorest efficiency – 25.3% of the women and 16.7% of the men were not able to independently perform the activities in the test (Figure 3).

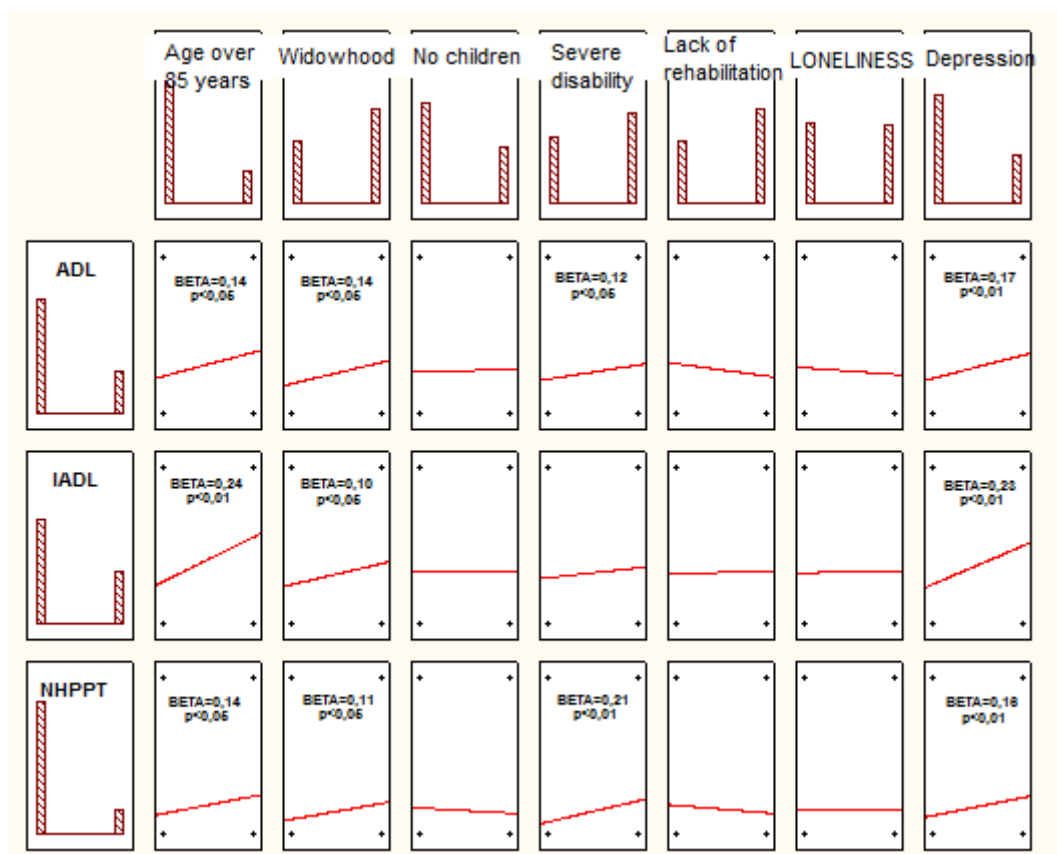


**Figure 3. NHPPT test results**

NHPPT test results correlate with the results on the ADL ( $R = 0.7505$ ,  $p < 0.01$ ) and IADL ( $R = 0.7994$ ,  $p < 0.001$ ) scales, which confirms the opinion about the applicability of this test to assess basic and complex activities of daily living.

Using multiple regression test, it was noted that the following have impact on the low values of the ADL, IADL and NHPPT: age of over 85, widowhood, a significant degree of disability and the occurrence of depression (figure 4).





**Figure 4. Factors contributing to low levels in ADL and IADL scales, as well as the NHPPT test**

## Discussion

The fact that the growth in the population of elderly persons involves new and specific objectives of social and healthcare policies is indisputable. The period of old age is very diverse, but frequently saddled with multiple morbidities, disability and dependence on others. Frequently, the impact of many factors contributes to the necessity of spending this period in places which provide care and assistance, that is, in the 24-hour care homes.

The study presented here was conducted in order to provide information on the functional efficiency of elderly persons residing in nursing homes.

Assessing the results on the ADL scale, we can conclude that efficiency in performing everyday activities decreases with age in both sexes, though men show a greater efficiency than women in each of the tested age groups. The average results of the evaluation on the ASDL scale are as follows (the average and standard deviation): for those aged 65-74 years –  $4.7 \pm 1.9$ , persons aged 75-84 –  $4.8 \pm 1.6$  points; those aged 85 years and over –  $4.0 \pm 2.0$  points.

Nursing home residents obtained better results in Płaszewska's study, as among the 102 residents of average age of 76.2 years as many as 89% scored 5 or 6 points in Katz's scale. The men obtained higher scores slightly more often than the women and the results lowered with age [7]. However, results comparable with the present study can be found in the

study by Kazicka I., conducted in a rehabilitation centre in Łódź in a group of 141 people. The average age of the surveyed was  $75.81 \pm 9.55$ . The average result on the ADL scale among the women was  $4.65 \pm 1.59$ , and among the men  $5.21 \pm 1.25$  [16].

Different results can be found in the study by Wysokiński et al, who conducted research on patients hospitalised in the internal medicine ward. The average age of subjects was  $78.02 \pm 7.89$ . In these studies, the men displayed lower results in the ADL functional fitness scale than the women (13.8% of the women and 46.4% of the men obtained 0-2 points, 12.8% of the women and 17.9% of the men obtained 3-4 points, 73.4% of the women and 35.7% of the men obtained 5 or 6 points. It was also found that respondents who were married significantly more frequently demonstrated severe functional impairment than those widowed and single [3].

A very good efficiency in the performance of daily activities was demonstrated by elderly patients living in their own home environment, attending a GP practice, in Lower Silesia, where the group in the early old age of 60 – 74 years obtained the result of 5.89 on ADL scale, and the group in the late old age of 75 years and more – 5.73 [9].

When dividing the ADL scale into the degrees of functional impairment in the present study, it was observed that among the residents, 16.8% had severe functional impairment, 10.5% moderate impairment, while 72.7% fully retained their functional fitness. In a Brazilian study of 760 elderly patients in care institutions, the incidence of dependence was 50.3% for ADL scale [17].

Research in Taiwan Taiwan [18] and Brazil [19] demonstrates that the results of ADL and MNA (Mini Nutritional Assessment) assessment are good predictors of death risk. Malnutrition or the risk of malnutrition contributes to reduced efficiency and, thus, the risk of death. These are valuable tools, especially in institutions providing 24/7 nursing and care.

Evaluation of the functional fitness of the residents on the basis of the present research, leads to the conclusion that they require assistance of another person in performing most tasks. Among these tasks, the residents surveyed were the least efficient in walking longer distances, washing their clothes and shopping. There was a visible difference in favour of men in performing the tasks independently. Also, as expected, the youngest respondents were more efficient. In the present study, 3% of all respondents scored 9 points. There were also individuals who could be described as fully independent, as they obtained 27 points, comprising 4% of the total number of respondents. By comparison, the score from 10 to 26 points was obtained by 92.7% of respondents.

In a study carried out on 286 Brazilians aged  $71.2 \pm 8.3$  in a home environment, nearly 62% were independent. For the ADL and IADL scales, dependence was associated with age of over 75 years, absence of a partner, as well as stroke, heart disease and diabetes incidence. According to the authors, it is important for the Family Health Strategy to strive for the promotion of health, disease prevention and therapeutic intervention to minimise factors affecting functionality [20].

The study conducted among the elderly persons at the average age of 70.06 years, living on their own Lower Silesian and Opolskie Voivodships, demonstrated by means of Lawton scale that 74% of respondents had no functional limitations (scoring 27 points out of 27 possible), 10% obtained 26 points, 2% - 25 points, 4% - 24 points, 4% - 23 points, 2% 22 points and 4% - 18 points. This means that only 26% of the respondents needed assistance in

one or more complex activities necessary for independent functioning in the public space. The group was also characterised by a valuable feature of family support[5]. On the other hand, the elderly hospitalised in the Internal Medicine Department achieved the following average results on the IADL scale: the men 19.1, and the women 17.2. The analysis conducted showed that the respondents who were married were significantly more likely to have a disability than those who were widowed or single [3].

Long-term studies conducted in Shanghai, China, based on more than 8,000 questionnaires, in which the average age was  $72.13 \pm 9.17$ , demonstrated that 16.51% of respondents reported one IADL disability. The analysis showed that the presence of at least one such IADL impairment was associated with almost a threefold increase in suicide rate, while the presence of five or more disabilities was associated with a fivefold probability of suicide [21]. In Poland, the suicide rate for persons over 65 is 19.0, and for 75-year-olds 18.8, with the average of 15.6 for the whole population (2004). The risk of suicide is more prevalent among the chronically ill, widowed or divorced, who are unable to find their place in the family and society [22].

The results of the present research conducted by means of the NHPPT test confirm that, similarly to the ADL and IADL scales, women at different age ranges show less efficiency in performing tasks than men. The respondents from the oldest groups are characterised by the poorest efficiency. These results are slightly different from the results obtained in the study among the US nursing homes residents[15].

Based on the results reported, the activities which posed the greatest difficulty for the residents were getting up and sitting down, walking six metres and putting on and taking off a sweater (this activity was performed by about 60% of respondents). Pouring a substance from one vessel to another, washing their faces or dialling a number was not a problem for the residents, as these activities were performed independently by more than three quarters of the respondents [15]. In the present study, walking 6 metres and taking off a sweater also posed the greatest difficulty for the respondents, but – unlike the US study, also washing their faces and dialling a number (independent face washing: women – 49%, men 58.4%, dialling a number: women – 50.6%, men – 68.3%). Summing up, it may be concluded that the difficulty in performing basic day-to-day activities and contacting by telephone (with the loved ones or emergency services) in a crisis situation were probably among the main reasons for availing oneself of the services of a nursing home. The NHPPT test conducted in the United States, twice at intervals, allowed to determine the deterioration or improvement in the efficiency of the respondents on a five-point scale [15].

The present study demonstrated that the NHPPT test results are comparable to those of the ADL and IADL scales, suggesting that the test may also be a useful and reliable tool for assessing functional fitness. Certainly, this test still requires adjusting the performance criteria of each task to the Polish conditions and re-testing on a large group. However, this gives the opportunity to use a new, simple tool for nurses, physiotherapists and carers to systematically assess the functional efficiency of elderly people. The test is short - it consists of six tasks, takes about 15 minutes, and, used systematically (for example, every few months), it can provide a lot of information about the efficiency of the patient or person under care. Lack of improvement in short periods of time or a rapid decrease in performance may be information to staff that there is a need to change strategies and interventions or to introduce new ones.

Research in Singapore shows that the functional efficiency of people living in social care homes decreases by an average of 0.84 points per year [23]. Numerous studies undoubtedly demonstrate that people living in social welfare homes achieve lower scores on the scale assessing the basic and complex activities of everyday life than persons living in their own homes. Efficiency decreases under the influence of many factors, but certainly age, sex, widowhood, nutrition and residence in institutions must be considered.

These results are valuable and meaningful information on the area in which action is needed to improve the functional fitness of the elderly, especially those placed in institutions.

The solution to this problem may be regular physical activity and involvement of residents in the daily life of the institution. Properly selected activity will result in a longer period of physical fitness and independence, as well as prevent falls, thus improving the quality of the seniors' life. Rehabilitation should play this important role in nursing homes, and, above all, a group of physiotherapists and occupational therapists. Additionally, a comprehensive geriatric evaluation performed by means of professional, repeatable and comparable tools should become the standard in planning senior care in every 24-hour nursing institution.

Based on the results and the analysis of the materials, the following conclusions can be drawn:

1. Men are characterised by greater functional fitness in basic and complex daily activities, while the efficiency declines dramatically in both sexes in the oldest age group.
2. The factors contributing to worse results in fitness tests were, above all: age (85 years and over), widowhood, significant disability, and the occurrence of symptoms of depression.
3. The NHPPT (Nursing Home Performance Physical Test) results are similar to the results obtained on the ADL and IADL scales, which confirms the adequacy of the NHPPT test for the assessment of functional fitness.
4. Introduction by physiotherapists and occupational therapists of a comprehensive geriatric assessment and implementing a plan to activate elderly people can help to improve the functional efficiency of people in 24-hour care institutions.

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