Tomaszewska Katarzyna, Majchrowicz Bożena, Kłos Alicja. Assessment of the efficiency of cognitive function of people over 65. Journal of Education, Health and Sport. 2018;8(5):185-198. eISNN 2391-8306. DOI http://dx.doi.org/10.5281/zenodo.1246825
http://ojs.ukw.edu.pl/index.php/johs/article/view/5487

The journal has had 7 points in Ministry of Science and Higher Education parametric evaluation. Part b item 1223 (26/01/2017).
1223 Journal of Education, Health and Sport eISSN 2391-8306 7

The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 01.05.2018. Revised: 12.05.2018. Accepted: 14.05.2018.

Assessment of the efficiency of cognitive function of people over 65

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Abstract

Demographic estimates for Poland indicate that the average life expectancy of the population will increase further over the next decades. Weakness of memory is a physiological phenomenon affecting about 60% of people over 65, whereas the prevalence of dementia in the population is estimated at 10-11%. Identification of people at high risk of developing dementia is becoming a significant medical and social problem. Cognitive impairment is one of the first symptoms of dementia. The Mini-Mental State Examination (MMSE) is a screening method that allows initial assessment of cognitive performance.

Correct diagnosis of symptoms, determining the health needs of seniors in all dimensions sets its further paths and optimal medical treatment.

Aim of the paper: The aim of this paper is to assess the efficiency of cognitive function of people over 65.

Material and methods: The analysis included 135 questionnaires of the Mini-Mental State Examination (MMSE) and respondents' particulars. Additionally, the functional efficiency of the subjects was assessed using the Barthel scale. The research was conducted among people over 65 in the Podkarpackie Voivodeship in 2017. For the purpose of this work, especially for verification of hypotheses, the following tests were used for questions on nominal scales: V Kramer (2x3, 4x5 tables etc.), Phi (2x2 tables). Tb-Kendall or Tc tests were used for questions on ordinal scales. The statistical analysis was carried out using the SPSS program and all relationships were statistically significant when $p < 0.05$.

Results and conclusions: The number of co-occurring chronic diseases increases with age. In the study population of people over 65, the percentage of responders with mild cognitive impairment according to the MMSE score was 12.4%. The problem of dementia of a significant severity according to this scale concerned 26.1% of respondents. Sex of the subjects did not have a statistically significant effect on the degree of development of dementia. There is a weak statistically significant correlation, which informs that the older patients are, the more often they have a higher degree of dementia. Moreover, the higher the level of education respondents have, the more often they are characterized by a lower level of dementia.

Keywords: old age, MMSE scale, Barthel scale, cognitive impairment, functional fitness

Introduction

Old age is a phase of life characterized by growing adverse changes covering all spheres of human functioning: biological, psychological and social. In many European countries, including Poland, one can observe the process of successive demographic aging. Extending the average life expectancy of a human being with a simultaneous decrease in the birth rate is the main reason for changing the age structure in all industrialized societies. Aging is a natural process in human life. The World Health Report predicts that by the year 2025, more than 800 million people over 65 will have lived in the world. Demographic changes are confirmed by the prevalence of dementia disorders. The percentage of people with dementia increases exponentially with age.[1]

Progress in the field of medical science has contributed to the extension of human life, especially in relation to highly developed countries. The term "old age", understood as one of the stages of human life, is a static term and concerns biological age, while "aging" is defined as a continuous, dynamic process of variable nature, depending on the function of the body and health, conditioned not only genetically but modified by a number of environmental factors.[2] This process is irreversible and is characterized by an individual course. The nature of the aging process is also dependent on a number of health problems, which include, among others: impairment of nerve conduction and cognitive functions, such as short-term memory, concentration as well as mental and emotional activity.[3]

Recently in the field of aging, more and more attention is paid to issues related to the early diagnosis of cognitive functioning disorders. From a clinical point of view, it is important to identify such indicators that will allow to distinguish the state between physiological aging and changes that may constitute prodromal symptoms of dementia.[4]

[1]Freyberger H.J., Schneider W., Stieglitz R.D (red.): Kompendium psychiatrii, psychoterapii, medycyny psychosomatycznej. Wydawnictwo Lekarskie PZWL, Warszawa 2005.
[2] Tomaszewska K. Kłos A: Problemy rodzin w opiece nad osobą z demencją. (w) Rejman K., Rudzki S., Noworól J., Cebulak M., Stawarz B.: Interdyscyplinarność współczesnej medycyny, Wyd. PWSTE Jarosław 2017, s.147-156.
[3]Tomaszewska K.: Chronic diseases and the quality of life of seniors. (w) Hvizdová E., Mokrišová V., Ambrozy M.(red.) „SOCIÁLNE, EKONOMICKÉ A ETICKÉ ASPEKTY SÚČASNEJ SPOLOČNOSTI“ (národný aj medzinárodný kontext). Medzinárodna konferencia Kvalita života VI v sociálnych, etických a estetických dimenziách. ZBORNÍK VEDECKÝCH ŠTÚDIÍ Vysokej školy medzinárodného podnikania ISM Slovakia v Prešove Presov 2017r., pp. 111-122
[4]Rajtar-Zembaty J., Rajtar-Zembaty A., Starowicz-Filip A.: Poziom wykształcenia oraz depresji w łagodnych zaburzeniach funkcji poznawczych – badanie pilotażowe. Geriatria 2017; 11: pp. 15-21.

According to the definition of the World Health Organization (WHO), dementia is a syndrome caused by a brain disease, usually of a chronic or progressive nature, in which higher cortical functions (cognitive functions) are disturbed, such as: memory, thinking, orientation, understanding, counting, learning ability, language and assessment.[5] Weakening of memory is a physiological phenomenon affecting about 60% of people over 65. The diagnosis of patients belonging to the group of increased risk of dementia development becomes a significant clinical and social problem (about 97% of the light form of the dementia syndrome and nearly 75% of moderate and severe forms of it remain unrecognized at the moment). The prevalence of dementia in the population aged over 65 is estimated at about 10-11% (this proportion increases from nearly 10% at 65. to 30-40% after 90). It is estimated that currently in Poland about 500,000 people have symptoms of dementia.[6]

Dementia is a set of symptoms caused by chronic or progressive brain disease, characterized by numerous deficiencies in higher cortical function, such as understanding, counting, speaking and evaluation, orientation, memory, thinking and learning abilities. Very often the above dysfunctions are accompanied by impaired motivation, as well as behavior or emotional disturbances. The frequency of the disease increases significantly with age.[7] Epidemiological studies show that the number of cases increases with age. It has been shown that approximately 46.8 million people worldwide suffer from dementia. Currently, the number of people affected by Alzheimer's disease in Poland is estimated at approx. 250,000, of which about 150,000 there is no diagnosis. Each year, more than 9.9 million new cases of dementia appear.[8]

Dementia occurs in stages in which various disease processes are aggravated or new disorders appear. Therefore, three phases of dementia have been isolated:

1. The first phase - the phase of forgetting, characterized by short-term memory disturbances. The patient has difficulty remembering names, current events. Sometimes he tries to hide his problems or deal with them, writing everything on sheets hung on various objects at home.

[5]Wilmańska J., Gułaj E.: Ocena zaburzeń funkcji poznawczych osób starszych — próba porównania poszczególnych metod przesiewowych. Gerontol. Pol. 2008; 16, 2: pp. 111–118.
[6]Talarowska M., Florkowski A., Zboralski K., Gałecki P.: Skala MOCA oraz MMSE w diagnozie łagodnych zaburzeń poznawczych. Psychiatria i Psychoterapia 2011, Tom 7, Nr 1: pp. 13-20.
[7] Wieczorowska-Tobis K., Talarska D.: Geriatria i pielęgniarstwo geriatryczne. Wydawnictwo Lekarskie PZWL, Warszawa 2008.
[8]Kubis A.M., Janusz M.: Choroba Alzheimera - nowe możliwości terapeutyczne oraz stosowane modele eksperymentalne. Post Hig Med Dośw. 2008; 62: pp. 372–392.

2. The second phase - the phase of disturbances of orientation in time and space, as well as disturbances of language functions. Characteristic for this phase are: decrease in verbal readiness, disturbances in the organization of utterances, excessive concretization, shallow reasoning and thinking disorders. Started activities are interrupted after distraction, which can cause dangerous effects, for example, gas leak.
3. Phase three - dementia. It is characterized by a complete loss of cognitive activity and disorders of criticism - the patient cannot assess his own deficits. There are dysfunctional procedural memory, for example, the patient cannot remember what everyday activities are - dressing, etc. In the last phase, the brain ceases to fulfill its functions, there is a disturbance of consciousness.[9]

The assessment of cognitive disorders is carried out using scales and tests. The most frequently used one is a Mini Mental State Assessment (MMSE).[10] In order to recognize dementia disorders, one should find impairment of intellectual performance in at least two cognitive functions (there are always memory disorders), which cause deterioration of the patient's functioning in everyday life and have lasted for at least 6 months. The most widespread test used in the diagnosis of dementia is the Cognitive Impairment Test developed by Folstein (MMSE). The scale consists of elements evaluating allopsychic orientation, remembering words, attention and counting, reminding after deferring, naming simple objects, executing commands, writing and constructive praxis. Points are awarded for correct answers and tasks. The maximum possible result is 30 points. The result below 24 points suggests the presence of a dementia process, the result in the range of 24-27 points indicates cognitive impairment without dementia, and the result is 28 points and above. In everyday practice, the value of 24 points was considered to be the limit of the "regular" MMSE test, which indicates the need for further diagnostic tests.[11]

The aim of the study

The aim of the study was to assess the efficiency of cognitive functions of people over 65 years of age.

[9]Barcikowska M., Bilikiewicz A.: Choroba Alzheimera w teorii i praktyce klinicznej. Wydawnictwo Czelej, Lublin 2004.
[10]Sadowska A.: Jak radzić sobie z chorobą Alzheimera. Poradnik dla opiekunów. Polskie Stowarzyszenie Pomocy Osobom z Chorobą Alzheimera, Warszawa 2001.
[11] Wilmańska J., Gułaj E.: Ocena zaburzeń (…) wyd. cyt. pp. 111–118.

Material and methods

The MMSE (Mini-Mental State Examination) scale was used to assess the efficiency of cognitive functions and mental state of people over 65 years of age. The answer sheet of the psychological assessment scale includes six groups of tasks checking the degree of functioning of basic cognitive processes, such as: time and place orientation, remembering, attention and counting, reminding, language functions and constructional praxis. The questionnaire is used for dementia screening. In addition, it contains respondent's particulars.

The study covered persons living in the Podkarpackie province, the research sample was 135 people over 65 years. All people were informed about the purpose of the research that was carried out in 2017. During the verification, all surveys were filled in correctly, i.e. one that allowed entering the statistical program PASW / SPSS 17 into the statistical database. The maximum estimation error for the significance level of 0.05 and the sample size was about 9% - that is, the results obtained from the sample may deviate from the distribution in the population up to the threshold of this value. V Kramer (2x3, 4x5 tables etc.), Phi (2x2 tables) tests were used for questions on nominal scales for verification of hypotheses. For questions on ordinal scales, Tb - Kendall or Tc tests were used. The statistical analysis was carried out using the SPSS program and all relationships are statistically significant when $p < 0.05$.

Results

The period of old age is characterized by heterogeneity in all respects. For example, it is noted that the heterogeneity of health and fitness in any other period of life is not as significant as in old age. A group of older people is also heterogeneous, e.g. in terms of age. The maximum life expectancy, i.e. the number of years survived by people living the longest, is about 120 years. This means that old age covers about 50 years, which corresponds to two generations. Out of this huge age range, although not only, there are significant differences in the need for care and support during the old age.[12]

56 men and 79 women participated in the study. 25 people aged 91-100 (18% of respondents), 67 people aged 81-90 (46.6%), 36 people aged 71-80 (28.8%) and 7 people in

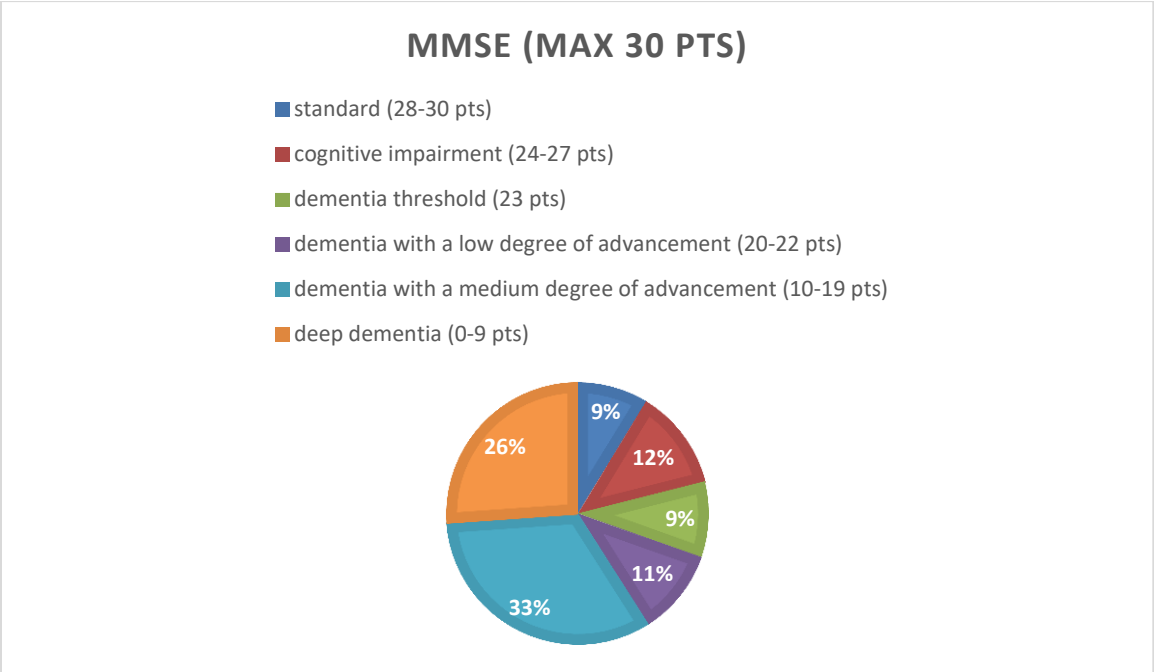
[12]Tobis S., Jakrzewska-Sawińska A., Talarska D., Wieczorkowska –Tobis K.: Wieloprofesjonalność opieki w geriatrii. Nowiny Lekarskie 2013, 82, 1, pp. 51–55.

the age group 65-70 (6.8%). 10.6% of respondents had higher education, 18.0% secondary, 22.4% vocational, 26.1% basic - other people declared primary, incomplete education. The surveyed group also was asked about their marital status - 52.8% of the respondents were widowers and 30.4% in a relationship, the remaining persons (8.1%) were lonely or divorced / separated (3.7%). Statistical analysis has shown that with increasing age, multi-morality increases, for example in the 81-90 group, 94.4% of respondents declared the coexistence of many diseases. The level of functional fitness was also determined using the Barthel scale. 60.2% received from 0 to 20 points - they were dependent persons, while help in everyday activities required 39.8% of respondents - they received from 21 to 40 points.

Considered a gold standard in the assessment of dementia, the Mini-Mental State Examination (MMSE) is the most commonly used cognitive screening tool used in the overall assessment of geriatrics.[13] It examines six areas: orientation, fact logging, attention and counting, reminding, language and construction skills. This test is characterized by a high level of reliability in detecting dementia and is particularly useful in tracking and quantifying changes over time.[14] MMSE interpretation: sum of points $\leq$ 23 out of 30 possible suggests dementia. However, it should be remembered that the result gained in MMSE is influenced by many factors unrelated to cognitive functions, such as age, level of education, language skills deficits and movement or visual impairment. Therefore, the cut-off point can be adjusted to the population or patient being tested, and the predictive value of the positive result, sensitivity and specificity for dementia is different.

[13]Kostka T. Całościowa ocena geriatryczna. W: Kostka T, Koziarska-Rościszewska M, red. Choroby wieku podeszłego. Warszawa: Wydawnictwo Lekarskie PZWL; 2009: pp. 17−37.
[14] Adelman AM. Initial evaluation of the patient with suspected dementia. Am Fam Physician 2005;71:1745-1750

Graph 1. Evaluation of the examined people after 65 years according to the MMSE scale



Source: own.

After analyzing the questionnaires of the test conducted among 135 subjects at the age of 65, 8.7% of the respondents received 28-30 points, which means that the body functions properly using the cognitive functions. A mild level of cognitive impairment was found at 12.4% of the respondents - they received a score in the range of 24-27 points. 9.3% of respondents received 23 points, which according to the MMSE scale are considered to be a dementia threshold. 10.6% received from 20-22 points, which suggests the presence of a dementia process with a low degree of advancement. 32.9% of respondents received from 10-19 points while 26.1% of subjects received from 0 to 9 points, which indicates deep dementia (38 people). [Graph 1].

Table 1. The influence of age of examined persons on the level of dementia

			Age				Total
			60-70	71-80	81-90	91-100	
MMSE - (max 30 pts)	standard (28-30 pts)	N	4	3	4	1	12
		%	**36,4%**	**6,5%**	**8,0%**	**3,4%**	**8,7%**
	cognitive impairment (24-27 pts.)	N	1	7	8	1	17
		%	**9,1%**	**17,4%**	**13,3%**	**3,4%**	**12,4%**
	dementia threshold (23 pts)	N	0	2	10	1	13
		%	**,0%**	**4,3%**	**16,0%**	**3,4%**	**9,3%**
	dementia with a low degree of advancement (20-22 pts)	N	1	6	4	2	13
		%	**18,2%**	**15,2%**	**6,7%**	**10,3%**	**10,6%**
	dementia with a medium degree of advancement (10-19 pts)	N	2	10	24	8	44
		%	**27,3%**	**26,1%**	**38,7%**	**31,0%**	**32,9%**
	deep dementia (0-9 pts)	N	1	12	11	12	36
		%	**9,1%**	**30,4%**	**17,3%**	**48,3%**	**26,1%**
Total		N	9	40	61	25	135
		%	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0%**
p=0,02, Tau-c Kendalla=0,16							

Source: own.

There is a small statistically significant correlation, which informs that the older the patients are, the more often they have a higher degree of dementia. The number and type of concomitant chronic diseases also have a significant impact. The sex of the subjects did not have a statistically significant effect on the degree of development of dementia.

Table 2. Impact of education of the examined persons on the level of dementia

			Education					Total
			Incomplete primary	primary	professional	secondary	high	
MMSE - (max 30 pts)	standard (28-30 pts)	N	0	1	2	6	4	13
		%	**,0%**	**2,4%**	**5,6%**	**24,1%**	**23,5%**	**9,2%**
	cognitive impairment (24-27 pts.)	N	1	2	4	5	3	15
		%	**6,9%**	**4,8%**	**13,9%**	**20,7%**	**17,6%**	**11,8%**
	dementia threshold (23 pts)	N	2	4	3	1	0	10
		%	**10,3%**	**9,5%**	**11,1%**	**6,9%**	**,0%**	**8,5%**
	dementia with a low degree of advancement (20-22 pts)	N	1	2	5	3	2	13
		%	**6,9%**	**4,8%**	**16,7%**	**13,8%**	**11,8%**	**10,5%**
	dementia with a medium degree of advancement (10-19 pts)	N	13	16	10	5	4	48
		%	**44,8%**	**42,9%**	**30,6%**	**17,2%**	**23,5%**	**33,3%**
	deep dementia (0-9 pts)	N	7	13	7	5	4	36
		%	**31,0%**	**35,7%**	**22,2%**	**17,2%**	**23,5%**	**26,8%**
Total			24	38	31	25	17	153
		%	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0%**	**100,0 %**
p<0,001, Tau-c Kendalla=-0,24								

Source: own.

As research has shown, people with higher education significantly more often achieved higher scores in the MMSE test and less often dementia. Statistical analysis showed a weak statistically significant relationship, which informs that the higher education level the respondents have, the more often they are characterized by a lower level of dementia. [Table 2].

Discussion

The new dementia criteria presented at the International Conference on Alzheimer Disease (ICAD) in Honolulu in 2010, as the overriding symptom, are the worsening of professional functioning or disruptions in the performance of daily activities. The Folstein Scale (MMSE - Mini-Mental State Examination) evaluates the most important aspects of mental performance, including: orientation, memorization, counting, concentration of attention, fresh memory and language functions. The achievable result is 30 points. Result in the range of 27-30 points is the correct result and the score is 0-10 points - which indicates deep dementia. In a study conducted by Bujanowska-Fedak et al.[15] 60 people aged 75 and over participated in the practice of general practice in Wroclaw. The elderly were subjected to mental and emotional state assessment using, among others, MMSE and Barthel scale. The study included 60 people, including 37 women and 23 men aged from 75 to 88. The study of cognitive functions in the MMSE scale showed a normal result, that is in the range of 27-30 points, in 71.8% of the surveyed patients. 53.4% of this group were women, 46.5% of patients had higher education, and in total nearly 60% of patients in this group performed mental work. About 65% of older people with a normal MMSE test result live with their families. Patients who obtained a score of 26-24 points, i.e. with mild cognitive impairment, but still without dementia, were 15%. 66% of this group were women, nearly 63% of them did mental work and 87.5% of patients in this group live with their families. The result in the range of 19-23 points, i.e. the result showing dementia in a light degree, was obtained by 10% of the subjects. The group was 70% women 100% with higher education, 67% living with family. Average degree of dementia, i.e. 11-18 score, concerned only 1.6% of respondents (female gender, mental work, housing with family). In contrast, severe dementia (0-10 points) also concerned only 1.6% of respondents (male gender, vocational education, housing with

[15]Bujanowska –Fedak M. M., Grata – Borkowska U., Sapilak B. J.: Otępienie i depresja u pacjentów w podeszłym wieku w Praktyce Lekarza Rodzinnego. Family Medicine & Primary Care Review 2012, 14, 3: pp. 349–353.

family). Overall, dementia was reported in 13.2% of elderly patients in the study. If we include cognitive impairment, this problem is already affecting nearly 30% of the patients.[16]

80 persons participated in a study conducted by Wilmańska and Gułaj.[17] The inclusion criterion was the lack of diagnosis of dementia. The vast majority of respondents (75%) were women, which is characteristic of geriatric population studies. The average MMSE test score was 27.0 ± 1.28 points. The average values of tests obtained by men and women were comparable and were respectively: MMSE - 26.85 points (M) vs. 27.05 points (W).

At Kowalska's et al. research, the study group consisted of 92 patients, including 71 women (77.2%), aged from 61 to 97 years (77.3 ± 7.4). After the patient was admitted to the ward, assessment of cognitive state (MMSE) was performed. The average state of cognitive functions (MMSE) was 18.2 (± 6.1) and was significantly dependent on the place of residence ($p = 0.037$). People living in the city were characterized by higher MMSE values compared to people living in villages. In the study group, 78.2% of patients obtained a score below 24 points in the MMSE test suggesting the presence of cognitive disorders, and 55.5% of the whole group obtained a score below 19 points. Of course, without carrying out a full clinical diagnosis, in accordance with the ICD-10 criteria, the obtained data are only a reflection of the general state of cognitive function at the time of admitting the patient to the ward and are not a medical diagnosis. In the case of 15.2% of ZOL residents, there was a record in the medical documentation confirming the presence of cognitive disorders (dementia syndrome, psychoorganic syndrome), in the case of other patients, the available documentation concerned only somatic diseases.[18]

Kot-Bryćko et al. analyzed the research carried out in people over 70. They have shown that the incidence of mild cognitive impairment is 14-18%. The degree of conversion to dementia, depending on the diagnostic criteria adopted, is 6-25% during the year, and after 6 years it increases up to 80%. The authors also presented studies by Schlosser et al. (2015), who noticed, however, that the majority of published papers (mainly meta-analyzes and prospective cohort studies) describing the risk reduction of dementia syndrome in relation to the exercise of physical activity are based on self-report tools, which is associated with the presence of many adulterations. The authors decided to investigate the relationship between

[16] Wilmańska J., Gułaj E.: Ocena zaburzeń(…) wyd. cyt. pp. 111–118.
[17] Therein, p. 116.
[18] Kowalska J., Szczepańska-Gieracha J.,, Piątek J.: Zaburzenia poznawcze i emocjonalne a długość pobytu osób starszych w Zakładzie Opiekuńczo-Leczniczym o Profilu Rehabilitacyjnym. PSYCHOGERIATRIA POLSKA 2010;7(2): pp. 61-70.

physical activity performed during the day and the presence of MCI and Alzheimer's disease by collecting objective and quantitative data on physical activity. The prospective cohort study included 716 cognitively functioning older participants who had been observed for 3.5 years. A higher level of physical activity measured with the wrist device ActiGraph (analyzes activity, movement) was associated with a lower risk of MCI or Alzheimer's disease (hazard ratio: 0.477, 95% confidence interval: 0.273-0.832). The authors, based on objective measurements, have therefore proved that a higher level of physical activity is associated with a reduction in the risk of MCI or Alzheimer's disease.[19]

Rajtar-Zembaty et al. in their research embraced 60 people (48 women and 17 men) aged 60-80. The respondents most often suffered from arterial hypertension (67%), osteoarthritis of the joints and spine (25%), diabetes (20%) and ischemic heart disease (12%). Variables that were significantly related to the occurrence of MCI were included in the logistic regression model. The model was statistically significant ($\chi 2 = 11.17$, $p < 0.003$). The level of depression turned out to be a factor increasing the chances of MCI (OR = 1.26, 95% CI, 1.02-1.8). In turn, the level of education (OR = 0.8, 95% CI, 0.68-0.98) turned out to be a factor decreasing the occurrence of MCI. In the light of the study and the conclusions drawn by other authors, they found that severe depression symptoms and lower educational level are factors associated with the impairment of cognitive performance of the elderly. Early identification of the MCI risk group may allow the use of appropriate therapeutic interventions.[20]

Conclusions

1. In the study population of people over 65, the percentage of responders with mild cognitive impairment according to the MMSE score was 12.4%.
2. The problem of dementia of a significant severity according to this scale concerned a further 26.1% of respondents.
3. The sex of the subjects did not have a statistically significant effect on the degree of development of dementia.
4. There is a small statistically significant correlation, which informs that the older the patients are, the more often they have a higher degree of dementia.

[19]Kot-Bryćko K., Pietraszkiewicz F., Piotrowska U.: Aktywność fizyczna a łagodne zaburzenia poznawcze. Medycyna Ogólna i Nauki o Zdrowiu, 2017, Tom 23, Nr 2, pp. 129–133.
[20] Rajtar-Zembaty J., Rajtar-Zembaty A., Starowicz-Filip A.: Poziom wykształcenia (…) wyd. cyt. pp. 15-21.

5. Statistical analysis showed a weak statistically significant relationship, which informs that the higher the level of education the respondents have, the more often they are characterized by a lower level of dementia.

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7. Kot-Bryćko K., Pietraszkiewicz F., Piotrowska U.: Aktywność fizyczna a łagodne zaburzenia poznawcze. Medycyna Ogólna i Nauki o Zdrowiu, 2017, Tom 23, Nr 2, pp. 129–133.
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