

Cognitive functioning of older women with diverse physical fitness and independence: limitations of dementia screening in primary healthcare

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Key words: dementia, depression, old age, primary health care, screening assessment.

Abstract

Introduction: Decreased cognitive functioning is a common issue among older adults, particularly women, and physical inactivity is one of the risk factors.

Aim of the research: This study aimed to compare the cognitive functioning of older women with varying levels of physical fitness and independence, as well as to evaluate the potential usefulness of selected tools for screening dementia symptoms in primary healthcare.

Material and methods: The study included 193 women (mean age: 77.59 ± 8.22 years), of whom 98 were patients in long-term care facilities (ZOL) (group A), and 55 were participants at the University of the Third Age (group B). Five tools were utilized: screening tests to evaluate cognitive functions (MMSE, VFT, CDT), mood (GDS), and a self-reported questionnaire.

Results: Significant differences were observed between groups A and B for all tested variables ($p < 0.001$). No significant correlations were found among MMSE, VFT, CDT, and GDS scores ($p > 0.05$). The overall model, which included age and VFT scores, explained 51.7% of the variance in MMSE scores ($\Delta F = 36.93$; $p < 0.001$) between both groups.

Conclusions: Screening for cognitive functioning and mood disorders seems justified for all women over 60. However, the presence of accompanying disabilities should expedite this process. For practical reasons, the MMSE seems to be the optimal tool for assessing cognitive functions in primary care, followed by the VFT.

Introduction

Dementia is a syndrome marked by a decline in cognitive abilities, leading to impairments in overall functioning, with Alzheimer's disease (AD) being the most common form, accounting for 60–80% of cases [1]. In 2015, approximately 47 million people worldwide were living with dementia, and population projections indicate that this number will rise to about 130 million by 2050, leading to significant health, social, and economic costs [2].

Non-modifiable risk factors for dementia include age, gender, ethnicity, and genetic factors. The most significant modifiable factors comprise lower educational attainment, hypertension, smoking, obesity, depression, physical inactivity, diabetes, excessive alcohol consumption, traumatic brain injuries, hearing loss, air pollution, and social isolation [3]. Conversely, cognitive reserve serves as a protective factor. It pertains to the brain's capacity to adjust and effectively manage damage and negative changes associated with aging, trauma, or neurodegenerative diseases [4].

The criteria for diagnosing dementia are: 1 – impairment of higher mental functions (thinking, mem-

ory, orientation, understanding, calculation, learning, speech, judgment), 2 – persistence of symptoms for at least 6 months, 3 – impact on daily functioning, and 4 – presence of symptoms outside periods of consciousness disturbances [5]. In Poland, screening and clinical diagnostics of dementia are performed in specialized departments and medical offices, primarily in neurology, geriatrics, and psychiatry. Referring all patients with suspected cognitive disorders for specialized diagnostics offers significant advantages, such as reliable, professional assessments. However, it also presents notable challenges, including lengthy waiting times for specialist visits and prioritization of patients with pronounced symptoms, which can potentially overlook those with mild impairments and reduce their chances for early therapeutic interventions.

Given that primary care (PC) offices are health-care facilities most frequently visited by older adults, they provide an excellent starting point for screening diagnosis. PC physicians often know their patients for many years, which allows them to notice changes in functioning or health status. Additionally, they are typically trusted by their patients, which facilitates discussions on sensitive topics and enhances adher-

ence to recommendations. These factors increase the likelihood of effective screening diagnosis and the accurate identification of individuals who require more extensive evaluation. However, the organization of the healthcare system places numerous burdens on PC physicians (e.g., high patient loads and extensive bureaucracy), which may hinder the inclusion of dementia diagnostics in routine evaluations for older adults.

Aim of the research

The aim of our study was to compare the cognitive functioning of older women with varying levels of physical fitness and independence, as well as to evaluate the potential usefulness of selected tools for screening dementia symptoms in primary care settings.

Material and methods

Study group

Participants were 193 women aged 61–96 years ($M = 77.59$; $SD = 8.22$). The study included only women, reflecting their demographic predominance among older adults in Poland (58.1%) and their longer life expectancy (82 years vs. 74.7 years for men) [6]. This significant difference in life expectancy underscores the need for gender-specific health policies. Older women report poorer health, higher rates of chronic diseases, functional limitations, and more frequent use of outpatient and long-term healthcare. They are also more vulnerable to conditions such as arthritis, osteoporosis, depression, and dementia, and face financial hardship, lower pensions, and higher poverty rates compared to men [7, 8]. Participants were randomly assigned to groups A or B based on physical fitness and independence (Table 1).

Group A (98 women from the Nursing and Treatment Facility) and Group B (95 from the University

of the Third Age) showed no significant age difference ($p > 0.05$). Sociodemographic, health, and living condition data are presented in Table 2.

Group A participants reported “other diseases”, including diabetes, depression, liver disease, and Parkinson’s disease. Disability causes included heart attack, stroke, ischemic heart disease, hypertension, degenerative joint disease, rheumatoid arthritis, chronic liver disease, and asthma.

Methods and tools

The study employed the diagnostic survey method using selected research tools from the Comprehensive Geriatric Assessment, along with the Verbal Fluency Test (VFT) and a self-report questionnaire:

1. MMSE (Mini-Mental State Examination) – A screening tool for assessing cognitive function with the aim of detecting dementia. Scores range from 0 to 30. A corrected score based on age and education was also calculated [9]. Based on these scores, participants were categorized into one of three groups: 1 – normal score, 2 – suspected mild cognitive impairment (MCI) or dementia (high sensitivity, cutoff score: 26), and 3 – suspected dementia (high specificity, cutoff score: 24). In a secondary version, scores were divided into two categories with a cutoff score of 24: 1 – normal score, and 2 – suspected dementia.

2. Clock Drawing Test (CDT) – A screening tool for dementia and specific cognitive functions, such as visuomotor and executive skills. The study employed the scoring method proposed by Sunderland. Scores range from 1 to 10, where 1 indicates a severely distorted drawing or not taking up the task. Results were further divided into two categories: 1 – normal (raw score: 6–10) and 2 – suspected dementia (raw score: 1–5).

3. Verbal Fluency Test (VFT) – A task that engages various cognitive functions, frequently used in de-

Table 1. Inclusion and exclusion criteria adopted in the study

Criterion	Group A	Group B
Inclusion		
Age	60 years and over	
Sex	Female	
Mental state	Enabling participation in the study	
Consent to participate in the study	Conscious, voluntary	
Functional condition	Inability to function independently due to health condition and resulting disability	Functional and social activity
Exclusion		
Health condition	Diagnosis of dementia syndrome, schizophrenia, exacerbation of a chronic disease that may affect cognitive functioning	
Consent to participate in the study	Withdrawal of consent	
Communication skills	Inability to communicate verbally or in writing	

Table 2. Characteristics of the study participants

Variable	Group A (N = 98)		Group B (N = 55)		Total (N = 153)	
	N	%	N	%	N	%
Education						
Primary	38	38.78	12	21.82	50	32.68
Professional/Vocational	21	21.43	18	32.73	39	25.49
Medium/Secondary	31	31.63	24	43.64	55	35.95
Higher	8	8.16	1	1.82	9	5.88
Domicile/Place of residence						
City	98	100.00	55	100.00	153	100.00
Village	0	0.00	0	0.00	0	0.00
Life partner						
Yes	9	9.18	27	49.09	36	23.53
No	89	90.82	28	50.91	117	76.47
Disability						
Yes	98	100.00	0	0.00	98	64.05
No	0	0.00	55	100.00	55	35.95
Chronic diseases						
Cardiology	41	41.84	38	69.09	79	51.63
Respiratory	8	8.16	6	10.91	14	9.15
Musculoskeletal	28	28.57	11	20.00	39	25.49
Other	21	21.43	0	0.00	21	13.73
Lack/None	0	0.00	0	0.00	0	0.00
Self-service efficiency						
Yes	0	0.00	55	100.00	55	35.95
No	98	100.00	0	0.00	98	64.05
Social relations						
No friends	6	6.12	4	7.27	10	6.54
1–2 friends	39	39.80	13	23.64	52	33.99
A few friends	32	32.65	17	30.91	49	32.03
Many friends	21	21.43	21	38.18	42	27.45

mentia screening or differential diagnosis (e.g., in MOCA, ACE III, FAB scales). The task involves listing as many words as possible within a given semantic category (semantic fluency) – in this study, “Animals” – or starting with a specific letter (phonemic fluency) – in this study, the letter “K”. Specific rules for assessing word correctness lead to final numerical results for three variables in this study: “Animals”, “K”, and “Animals + K”. Expected word counts depend on age and education, but in dementia screening, values typically below 10–11 are considered indicative (e.g., in MOCA, FAB). Similarly, Polish norms for VFT classify

scores below 15 for “K” and below 18 for “Animals” as low (1–3 sten) for individuals aged 65+ [10].

4. GDS (Geriatric Depression Scale) – A tool for assessing the severity of depressive symptoms. The study utilized the shortened 15-item version. Results were divided into two categories based on a cutoff score of 6: 1 – normal, and 2 – suspected depression. This tool was included to explore potential associations between cognitive function and mood in participants.

5. Authors’ Own Questionnaire – A tool consisting of 12 closed-ended questions regarding sociode-

mographic data and health status. In some instances, respondents were asked to elaborate on their answers to follow-up open-ended questions.

Study organization

The study was conducted from November 2018 to March 2019. The study group was recruited from the Medical Care Facility in Katowice, while the control group came from University of the Third Age in Chorzów and the Senior Club in Bytom. Participation was anonymous, voluntary, and uncompensated, with informed consent obtained via a questionnaire. Tests were administered individually in distraction-free conditions by a psychologist and nurse. Participants could withdraw at any time. Data was coded and entered into Microsoft Excel.

The study was conducted according to the standards of the 1964 Helsinki Declaration and its subsequent amendments, and it was in compliance with the requirements of the Personal Data Protection Act of May 10, 2018. During the planning stage, a positive opinion was obtained from the Medical University of Silesia Bioethics Committee in Katowice (KNW/0022/KB/227/18).

Statistical analysis

Data analysis was performed using the IBM SPSS Statistics 25 software package. Descriptive statistics were calculated alongside the Shapiro-Wilk test, Stu-

dent's *t*-test for independent samples with Cohen's *d* effect size measure, Pearson's correlation analysis, and the χ^2 test. Due to minor distribution asymmetry, while meeting other assumptions, analyses were carried out using parametric tests. Statistical significance was evaluated at $p = 0.05$.

Results

Table 3 presents basic descriptive statistics of the studied variables and the results of assessing the normality of their distribution.

The differences between the studied groups were analyzed, considering the raw scores obtained from the tests. The groups differed significantly ($p < 0.001$) in all the results: MMSE ($t = -5.36$, $d = 0.81$), corrected MMSE ($t = -4.59$, $d = 0.70$), VFT "animals" ($t = -4.22$, $d = 0.71$), VFT "K" ($t = -5.35$, $d = 0.90$), VFT general ($t = -5.35$, $d = 0.90$), CDT ($t = -2.11$, $d = 0.32$) and GDS ($t = 6.26$, $d = 1.05$). The results indicate significantly better cognitive functioning and mood in the control group, compared to the study group. All measured differences are moderate or strong. Details are presented in Figure 1.

Next, the relationships between cognitive functioning, mood, and membership in the study or control group were analyzed, considering the interpretation of the test results (Table 4).

A significant relationship was found between assignment to a specific group and all indicators except CDT. Cognitive impairment and depressive symp-

Table 3. Basic descriptive statistics of the studied variables and the distribution's normality

Variable	M	Me	SD	Sk.	Kurt.	Min.	Poppy.	IN	P-value
Group A									
MMSE – overall score	22.47	23.00	4.06	−0.66	0.32	9.00	30.00	0.96	0.005
MMSE – corrected score	24.61	25.00	3.29	−1.06	1.80	12.00	30.00	0.93	< 0.001
CDT – raw score	7.21	8	2.86	−0.94	−0.37	1	10	0.83	< 0.001
VFT "animals"	9.82	9.00	3.74	1.12	0.70	4.00	20.00	0.89	< 0.001
VFT "K"	7.90	7.00	3.20	1.18	1.60	3.00	19.00	0.91	< 0.001
VFT total	17.71	16.00	6.48	1.03	0.52	8.00	39.00	0.91	< 0.001
GDS raw score	7.95	8.00	1.97	0.07	−0.34	3.00	12.00	0.97	0.021
Group B									
MMSE – overall score	25.42	26.00	2.73	−0.25	−0.83	20.00	30.00	0.96	0.064
MMSE – corrected score	26.67	27.00	2.24	−0.36	−0.76	22.00	30.00	0.94	0.012
CDT – raw score	8.05	8	2.02	−1.32	2.07	1	10	0.84	< 0.001
VFT "animals"	12.60	13.00	4.22	0.55	0.18	5.00	24.00	0.97	0.115
VFT "K"	11.05	10.00	3.98	1.20	1.33	5.00	23.00	0.89	< 0.001
VFT total	23.65	23.00	6.79	0.41	0.13	11.00	41.00	0.97	0.197
GDS raw score	5.78	5.00	2.20	0.81	0.01	3.00	12.00	0.91	< 0.001

M – mean, *Me* – median, *SD* – standard deviation, *Sk.* – skewness, *Kurt.* – kurtosis, *Min.* – minimum value, *Max.* – maximum value, *W* – result of Shapiro-Wilk test, *P* – significance level.

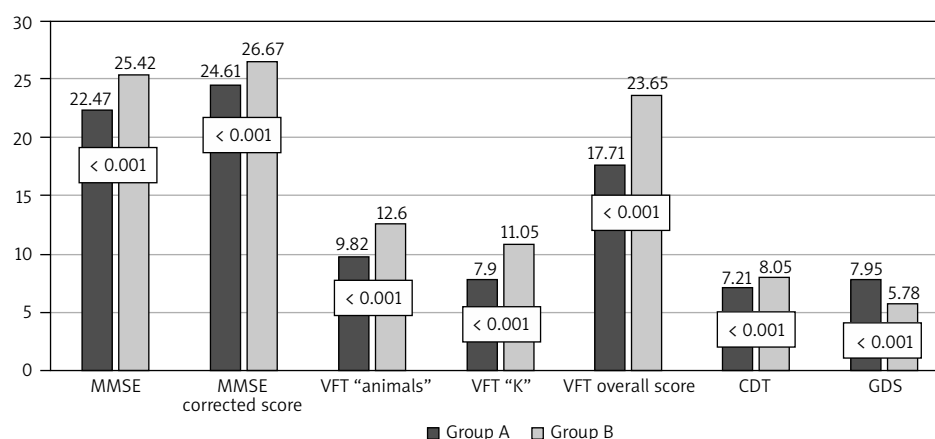


Figure 1. Mean values with 95% confidence intervals for cognitive functioning indicators and depression symptoms in the examined women from the clinical (A) and the control group (B)

Table 4. Comparison of women from the study and control groups in terms of cognitive functioning and mood norms (qualitative indicators)

Tool	Rate	Group A		Group B		Total		χ^2	df	P-value	V_c / ϕ
		N	%	N	%	N	%				
MMSE – interpretation I	In the norm	28	28.6	31	56.4	59	38.6	12.92	2	0.002	0.29
	Suspected mild cognitive impairment	42	42.9	18	32.7	60	39.2				
	Suspected dementia	28	28.6	6	10.9	34	22.2				
MMSE – interpretation II	In the norm	28	28.6	31	56.4	59	38.6	11.49	1	0.001	0.27
	Suspected dementia	70	71.4	24	43.6	94	61.4				
CDT	In the norm	75	76.5	49	89.1	124	81.0	3.62	1	0.057	0.15
	Suspected dementia	23	23.5	6	10.9	29	19.0				
MMSE + CDT	In the norm	27	27.6	30	54.5	57	37.3	10.98	1	0.001	0.27
	Suspected dementia	71	72.4	25	45.5	96	62.7				
GDS – interpretation II	In the norm	8	8.2	29	52.7	37	24.2	38.16	1	<0.001	0.50
	Suspected depression	90	91.8	26	47.3	116	75.8				

aThe effect size measure ϕ was calculated for 2x2 tables, and for larger ones – Cramer's V .

toms were more prevalent in group A, with depression showing the strongest effect. Notably, 43.6–45.5% of the control group showed dementia signs, and 47.3% had depression. VFT results indicated reduced cognitive function in both groups. Relationships between cognitive and mood indicators were further analyzed (Table 5).

The analysis revealed statistically significant positive relationships (mostly moderate to strong) between all indicators of cognitive functioning. The correlation coefficients did not indicate a statistically significant co-occurrence of depression symptoms and cognitive disorders. In the final stage of the analyses, linear regression models were developed to predict the cognitive functioning of the women studied. The results are shown in Table 6.

The initial model explained 27.6% of the variance in the dependent variable, with both predictors being significant. A negative Beta for age indicated declining cognitive function with age, while a positive Beta for group assignment suggested better cognitive function in group B. Adding VFT and GDS scores increased the explained variance by 24.1%, totaling 51.7%. VFT was a significant predictor, with higher scores linked to better cognitive function. Group assignment lost significance in the second block, suggesting verbal fluency better explains cognitive function than group membership.

Discussion

Cognitive impairment and co-occurring mood disorders are common issues in older age, especially

Table 5. Correlation between the indicators of cognitive functioning and mood of the respondents

	1.	2.	3.	4.	5.	6.
Group A						
1. MMSE – overall score						
2. MMSE – corrected score	0.87***					
3. CDT	0.52***	0.40***				
4. VFT "animals"	0.60***	0.51***	0.45***			
5. VFT "K"	0.64***	0.48***	0.44***	0.74***		
6. VFT total	0.66***	0.53***	0.48***	0.94***	0.92***	
7. GDS raw score	−0.12	−0.05	−0.12	−0.08	−0.04	−0.06
Group B						
1. MMSE – overall score						
2. MMSE – corrected score	0.90***					
3. CDT	0.51***	0.39**				
4. VFT "animals"	0.51***	0.50***	0.30*			
5. VFT "K"	0.47***	0.42**	0.29*	0.37**		
6. VFT total	0.59***	0.56***	0.36**	0.84***	0.82***	
7. GDS raw score	−0.18	−0.15	−0.15	−0.12	−0.18	−0.18

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 6. Hierarchical regression analysis models predicting the cognitive functioning of the participants

Model	Predictor	B	SE	Beta	t	P-value	ΔF	P-value	ΔR^2	R ²
1	(Constant)	35.34	3.01		11.74	< 0.001	28.66	< 0.001		0.276
	Age	−0.19	0.03	−0.40	−5.45	< 0.001				
	Group	1.91	0.59	0.24	3.21	0.002				
2	(Constant)	25.11	2.97		8.46	< 0.001	36.93	< 0.001	0.241	0.517
	Age	−0.10	0.03	−0.21	−3.22	0.002				
	Group	0.38	0.55	0.05	0.69	0.491				
	VFT total	0.31	0.04	0.56	8.45	< 0.001				
	GDS raw score	−0.10	0.11	−0.06	−0.89	0.373				

Dependent variable – MMSE total score.

among women [11]. Moreover, multimorbidity and the resulting disability are risk factors for dementia [12], which was confirmed in our study. Patients in the long-term care facility (ZOL) exhibited significantly more dementia symptoms, regardless of the research tool used, compared to the control group. At the same time, the percentage of women in the ZOL group with suspected cognitive impairments was alarmingly high. A similar observation was made regarding the suspicion of mood disorders – although meta-analyses show that depression affects 28.4–35.1% of older adults [13, 14], in our study, as many as 47.3% of independent and self-sufficient women reported symptoms of depression. In the ZOL group, this number was as high as

91.8%. Other authors confirm that depressive disorders are more common in women, people with disabilities, those suffering from chronic diseases, and those with cognitive impairments [7].

Meta-analyses provide evidence that depression may be a risk factor, a prodromal symptom, a consequence, or a co-occurring condition in dementia [15]. In our study, we did not confirm a relationship between dementia and depression symptoms, nor did we find an effect of depression symptoms on dementia progression, but rather a relatively independent co-occurrence of both problems. This result is atypical and surprising. Although its confirmation could potentially facilitate screening for both dementia and

depression, it currently suggests the need for further, more in-depth research in this area. At the same time, it indicates the necessity of deepening the diagnostic process for depression in a significant portion of our study participants.

In seeking answers to the question of which factors most accurately predict cognitive impairment in older women, we confirmed the importance of age and multimorbidity with resulting disability. We also analyzed the results of selected comprehensive geriatric assessment (COG) tests to determine which would most accurately predict cognitive impairment, regardless of the general health and functional status of the women studied. The established criterion was met only by the VFT. When considering this variable as a predictor of cognitive functioning, the importance of group membership (i.e., being part of a group with disability and dependence) ceased to be significant. The VFT is a simple, short tool that can be used even for individuals with limited visual or motor function, engages many cognitive functions, and demonstrates reduced results in various types of dementia, but in a variable configuration with other cognitive task results and types of verbal fluency. Other authors have confirmed a negative relationship between verbal fluency task performance and the risk of reduced cognitive performance, dementia, and the progression from one condition to another [16].

Based on the results of our study, the recommendation for screening women over 60 for dementia and mood disorders seems entirely justified. Since statistics show [6] that most outpatient medical consultations are conducted within primary healthcare (53.3%) and are more often attended by women (3 : 1), it seems that primary care physicians could play a fundamental role in identifying patients with both conditions and referring them, in line with COG recommendations, for further specialist evaluation. In seeking the optimal solution, it may be advisable to focus on screening in general practice primarily of individuals with risk factors [3] and those reporting cognitive complaints (e.g., memory problems, difficulties with planning, organizing, decision-making, time and space orientation) or resulting functional difficulties. At the same time, individuals with clear criteria for severe dementia should be excluded from screening diagnostics, including those with long-term, gradually worsening cognitive and behavioral symptoms, currently without the possibility of differential diagnosis and apparent potentially reversible factors at the stage of total dependence on caregivers.

The most difficult, costly, and least accessible would be deepening diagnostics for individuals with mild cognitive impairment (MCI), identified through MMSE with high sensitivity (low cutoff point). Such diagnostics would require a complete neuropsychological examination and often additional specialist tests, depending on the disease burden and potential

reversible factors. Considering that the average time for MCI progression to dementia is 3 years [17], in many cases, it may be challenging to complete full MCI diagnostics in an outpatient setting, as such suspicion does not warrant hospitalization. Even in the case of confirmed MCI, pharmacological treatment is not recommended, so it seems reasonable to recommend non-pharmacological interventions with a proven positive impact on cognitive function: regular physical exercise, endurance training, and cognitive interventions [18]. Conversely, it seems appropriate to refrain from referring individuals with positive screening test results for in-depth psychoneurological diagnostics if the primary care physician, based on long-term care (many years of health history knowledge), performed tests, and clinical knowledge, can independently diagnose dementia.

Regarding the optimal tool for cognitive function screening, the MMSE, which is best validated within COG and recommended for use, is the most appropriate. Our study suggests that the VFT is another tool worth considering. A rational approach would be to adopt the most commonly used cutoff points in this case: 10–11 words for phonological fluency and 12–14 for semantic fluency [10, 19]. Other authors have shown that combining both tools improves the diagnostic accuracy of the MMSE for mild cognitive impairment and dementia not related to Alzheimer's disease [20]. Future studies should examine whether the VFT can be considered the first-choice tool, shorter, less burdensome, and more patient-friendly than the MMSE, although less specific for Alzheimer's disease. Meanwhile, the CDT in our categorical model (normal vs. abnormal) did not provide much additional diagnostic information (aside from the MMSE result) for screening. This interpretation may be oversimplified, and qualitative analysis could provide valuable information. However, this remains beyond the expectations of the primary care physician as it requires specialized neuropsychological knowledge.

Undoubtedly, our study has limitations. First, we included only women in the study group, so extending the results to the general population of older adults is not justified and requires a separate study to identify more general patterns. Moreover, we used only selected tools from COG, which may limit the full clinical picture of the participants' functioning. Finally, medical data for the participants were obtained solely through their declarations, not through direct access to medical records, which, as always in such cases, carries the risk of misunderstandings and inaccuracies.

Conclusions

Older women who maintain functionality and independence are less likely to experience a decline in cognitive functions and mood than women with such impairments. However, this difference is still signifi-

cant enough to justify screening for symptoms of dementia and depression in a primary care physician's office. Older women, regardless of their level of functioning and independence, often exhibit both cognitive and depressive symptoms, although these variables may be relatively independent of each other. There is a justification for cognitive and affective screening in all women over 60. For practical reasons, the most optimal tool is the MMSE, with a cutoff score of 24, followed by the VFT, with a cutoff score of 10/11 points.

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Ethical approval

During the planning stage, a positive opinion was obtained from the Medical University of Silesia Bioethics Committee in Katowice (KNW/0022/KB/227/18).

Conflict of interest

The authors declare no conflict of interest.

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