

Assessment of the frequency of falls and attendant risk factors, in conjunction with self-perceived quality of life, in elderly residents of nursing facilities in Wrocław, Poland

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Abstract

Introduction. An increase in the average life expectancy constitutes one of the greatest achievements of humanity, and at the same time a serious challenge for modern health protection and social care systems. The main aim of the work is to investigate quality of life and risk of falls.

Methods. Forty-four people (30 females and 14 males) aged 63 to 99 (average: 83.2 ± 7.2), recruited from two local nursing homes, participated in the study. To assess the risk of falling, the short-form version of FallScreen (physiological profile assessment, Prince of Wales Medical Research Institute) was used. To assess QoL (quality of life), the Polish version of the SF-36 questionnaire in its standard version was used.

Results. It was indicated that in the year preceding the study, nearly 60% of participants fell; 32% ($n = 14$) fell once and 27% ($n = 12$) fell two or more times. Occurrence of chronic diseases and taking at least three medications were reported by more than 80% of the seniors. The Results section presents the components of the physical and mental dimensions of the self-assessment of the quality of life of the participants of the study. The average index of quality of life among the studied people was 94.3 points, which is 55.2% of the maximum score.

Conclusions. The dominating risk factor for falls, as established in the nursing home residents against the Physiological Profile Assessment (PPA) scale, consisted in slower reaction to a stimulus; its average value exceeding by threefold the reference value for healthy individuals of similar age.

Key words: falls, fall risk, quality of life, older people

Introduction

An increase in the average life expectancy constitutes one of the greatest achievements of humanity, and at the same time poses a serious challenge for modern health protection and social care systems. It is expected that by 2050, the population of people over 65 in developed countries such as the US will have doubled. In Poland, the ageing of society is one of the fastest in the European Union [1].

The extension of a person's life does not always go hand in hand with satisfaction with physical and mental fitness [2]. Despite its individual varied pace and dynamics, ageing leads to aggravation of health and quality of life (QoL). Along with depression and dementia, falls constitute one of the main geriatric problems. Each year, approximately 30% of respondents over 65 and 50% of respondents over 85 suffer at least one fall [3, 4]. The main consequences of falls are serious physical injuries resulting in limited mobility, increased dependency, and necessary admission to nursing homes. Moreover, they are related to a high indicator of morbidity and mortality [5]. It is estimated that the consequences of falls absorb approx. one third of costs related to all injuries, constituting the third biggest cause of disability among the elderly and cause of 40% of admissions to care facilities [6].

Causes of falls in the case of the elderly are multifactorial, and their risk increases with the accumulation of involuntal organ changes, multiple diseases, functional deficiencies or administered pharmacotherapy. Such factors involve aggra-

vation in posture control, slowing down of reflexes and defensive reactions, as well as weakening of functions of the so-called strategic systems responsible for coordination, balance and gait [7–9]. Loss of muscle mass and strength (primary sarcopenia) mainly within the lower limbs and the trunk, impairment of the ability to generate an adequate muscle response to a stimulus, disturbance in feeling one's position (aggravation of proprioception), weakening of sight, a decrease in the active range of movement in joints and characteristic gait with small steps with a shortened support phase and failing to lift the feet above the ground are considered the main – apart from environmental factors – causes of falls among the elderly [10].

Old age, regardless of its course, should be a period of good quality of life. Its perception is conditioned by health, social, economic, cultural, and personality factors. For the elderly, quality of life is identified mainly with health, the degree of independence in performing daily activities, and the ability to deal with limitations and disabilities [11].

One of the main tasks of care facilities where elderly persons are admitted is to improve the comfort of life of seniors, their activation, and ensuring safety and good quality of services [12, 13]. In such institutions, optimal solutions reducing the risk of falling are continuously sought, as residents of such institutions fall three times more frequently than respondents living in their own homes [7]. Reviews of the literature indicate that only multifactorial risk assessments can effectively prevent or limit falls [14].

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Numerous previously used functional tests assessing balance and gait offer a limited possibility to predict falls among elderly people and identify people with a high risk of falling [15]. However, diagnosing the risk based on the presence of a disease can be problematic, as the weakening of the efficiency of key functions for body stability also occurs in persons without documented serious diseases. Measuring instruments which not only indicate the existence of the risk of falling, despite a disease, but also determine functions within which deficits occur and the scope of such deficits seem to be the most useful.

Associations between falls and QoL of the elderly have already been studied, however, there are few reports in the literature referring to elderly respondents residing at care facilities in Poland. Identification of the association between falls and QoL may constitute an important database for the planned rehabilitation and intervention services at such institutions. Therefore, the objective of the study was to assess the risk of falling based on the Physiological Profile Assessment (PPA), to subjectively assess the quality of life of nursing home residents and to determine the association between the risk of falling and the comfort of life of the seniors residing there.

Subjects and methods

Study participants

44 persons (30 females and 14 males) aged 63 to 99 (average: 83.2 ± 7.2) recruited from two local nursing homes (Wrocław, Poland) participated in the study. The study was approved by the Ethics Committee of the University of Physical Education. Participation in the study was voluntary. The

condition to participate in the study was written consent of the participant and a physical and mental condition allowing independent performance of basic daily activities. The exclusion criteria included medium and deep cognitive impairment (MMSE < 20), inability to move independently or physical disability, making it impossible to perform functional tests – neurological and orthopaedic diseases.

To characterise the studied group, a short (sociodemographic) interview was carried out with the participants and basic somatic features were measured. Questions concerned past falls, diseases, medications taken, wearing prescription glasses, and participation in activating activities, e.g. kinesiotherapy or occupational therapies. Table 1 illustrates characteristics of the participants.

Fall risk, quality of life assessment

To assess the risk of falling, the short form of FallScreen (PPA – physiological profile assessment, Prince of Wales Medical Research Institute) was used. It consists of five tests (edge contrast sensitivity, proprioception, knee extension – quadriceps strength, reaction time, sway on foam with eyes open) that measure physiological conditions of the risk of falling. The results of the tests were entered into a computer program (FallScreen) and adjusted to age and gender. The program calculates the fall risk indicator (z-score) using an algorithm that is a product of the discriminant analysis function of the applied data and the resulting score indicates: for < 0 no risk of falling; 0–1 small risk; 1–2 moderate risk; 2–3 significant risk; > 3 very high risk [16]. This method is quick and simple to use and is well tolerated by elderly people. It does not require excessive effort or cause pain or discomfort; it is characterised by high external validity and test-retest reliability.

Table 1. Subjects' characteristics

	Total (n = 44)	Females (n = 30)	Males (n = 14)
Baseline characteristic (mean ± SD)			
Age (years)*	83.2 ± 7.2	83.1 ± 7.2	72.3 ± 11.9
Mass (kg)*	69.3 ± 11.4	65.7 ± 12.4	72.8 ± 10.4
Height (cm)*	162.5 ± 7.5	155.8 ± 6.5	169.3 ± 8.5
Total medications per day (n)	2.9 ± 3.3	2.6 ± 3.5	3.2 ± 3.1
Mini-Mental State Examination	24.9 ± 3.4	25.5 ± 3.6	24.3 ± 2.9
No. of falls in past year (n)	0.94 ± 0.2	0.73 ± 0.2	1.14 ± 0.3
Falls in past year [n (%)]	26 (59.1)	16 (53.3)	10 (71.4)
Medical conditions [n (%)]			
Osteoarthritis	24 (54.5)	18 (60.0)	6 (42.9)
Hypertension	22 (50.0)	15 (50.0)	7 (50.0)
Lower limb ischemia	14 (31.9)	11 (36.7)	3 (21.4)
Stroke	5 (11.4)	3 (10.0)	2 (14.3)
Diabetes	6 (13.6)	4 (13.3)	2 (14.3)
Other	30 (68.2)	22 (73.3)	8 (57.1)
Use of walking aids [n (%)]			
Glasses	20 (45.5)	12 (40.0)	8 (57.1)
Participation in classes	12 (27.3)	8 (26.7)	4 (28.6)

* significant differences ($p < 0.05$)

ability, and 75% accuracy of predicting the risk of falling in institutional communities. The risk of falling is presented in 'contract units' (AU) [17].

To assess QoL, the Polish version of the SF-36 questionnaire in its standard version was used [17, 18]. It consists of 36 questions and analyses eight categories: limitations in physical activities because of health problems (PF), bodily pain (BP), limitations in usual role activities because of physical health problems (RP), general health perceptions (GH), vitality (VT), limitations in social activities because of physical or emotional problems; (SF), general mental health; (MH), and limitations in usual role activities because of emotional problems (RE). The questions are transformed into a point scale ranging from 0 (best) to 171 (worst). The categories are summarised into two collective domains of physical health and mental health: Physical Health Summary (PHS) and Mental Health Summary (MHS).

Statistical analysis

Data were processed with the Statistica 12.0 software package (Statsoft, USA). The Shapiro–Wilk test was used to confirm the normality of the data set. To characterise constant variables, descriptive statistics, i.e. mean ± standard deviation (SD), number, and percentages, were used. Comparison between groups for constant variables was carried out using the t test for independent tests (normal distribution) or the Mann–Whitney U test (abnormal distribution). Associations between the number of falls, the fall risk indicator, and quality of life were studied using Spearman’s rank correlation. Statistical significance was set at $\alpha < 0.05$.

Ethical approval

The research related to human use has complied with all the relevant national regulations, institutional policies, was in accordance the tenets of the Declaration of Helsinki, and has been approved by the Ethics Committee of the Wrocław University of Health and Sport Sciences (approval No.: 1/2016).

Informed consent

Informed consent has been obtained from all individuals included in this study.

Results

It was indicated that in the year preceding the study, nearly 60% of the participants suffered a fall: 32% ($n = 14$) of people fell once and 27% ($n = 12$) of participants fell twice or more.

The occurrence of chronic diseases and taking at least three medications were reported by more than 80% of the seniors; pain in the musculoskeletal system was reported by 90% and prescription glasses were used by 45% of the respondents. Only 27% of the nursing home residents participated in the physical activity classes and occupational therapy offered by the institution (Table 1).

Fall risk assessment – Physiological profile assessment (PPA)

Table 2 presents the results of the PPA assessment, including the calculated general fall risk indicator (z-score) and results of indicators for particular tests. The mean value of the fall risk indicator was 4.3.

A high risk of falling was observed in 72% of people (24 females and 8 males), a significant and moderate risk was observed in 9% of respondents (4 males and 4 females), and mild and low risk was found in 4.5% of persons (2 males and 2 females).

Table 2 also presents results obtained by the participants in particular PPA tests in comparison to the normal ranges suggested for respondents of a similar age without significant diseases.

Significant deficits in systems important for balance control were observed in the majority of the participants in the study (Table 2). Most deficits were observed in muscle strength of the lower extremities, visual acuity, and reaction time to a stimulus. Results appropriate for age, i.e. falling within the normal range and not indicating the need to intervene, were observed in muscle strength in 2 persons (4.5%), quality of sight in 3 participants (6.8%), and reaction time in 4 persons (9%). The best results were obtained in the assessment of proprioception: in 80% of people (36), the test result was normal. The differences between females and males both for the general fall risk indicator as well as in the results of particular tests, except for muscle strength of knee extension, were not statistically significant.

Assessment of quality of life

Table 3 presents results of the components of the physical (PF, RP, BP, GH, VT) and mental (VT, SF, RE, MH) dimensions of the self-esteem of the quality of life of the participants of the study. The average index of quality of life among the studied people was 94.3 points, which is 55.2% of the maximum score (the higher the score, the lower the assessment of quality of life). From the analysis of the health self-assess-

Table 2. Test results in the PPA of the risk of falling and comparison of test results with the reference norms appropriate for the mean age (79) of the participants of the study

Variable	Total (mean ± SD)	Females (mean ± SD)	Males (mean ± SD)	Reference values pertinent for	p
Falls-risk indicator (z-score)	4.3 ± 2.5	4.4 ± 2.6	4.2 ± 2.4	–	0.9
Reaction time (ms)	807.7 ± 566.1	830.2 ± 608.1	759.4 ± 504.7	216–295	0.8
Body sway (mm)	AP	33.4 ± 16.9	33.4 ± 16.6	–	0.9
	ML	38.0 ± 18.5	34.7 ± 18.5	–	0.2
Knee extension strength(kg)	10.1 ± 3.8	8.1 ± 2.0	14.3 ± 3.2	15–29	0.001
Proprioception (°)	2.3 ± 1.9	1.9 ± 1.4	3.2 ± 2.6	0.8–3.2	0.2
Edge contrast sensitivity (dB)	12.3 ± 4.1	11.6 ± 4.3	13.7 ± 3.6	17–22	0.3

AP – Anterior-Posterior, ML – Medial-Lateral

Table 3. Results of particular components of quality of life

	Total (mean ± SD)	Female (mean ± SD)	Male (mean ± SD)	p
Quality of life	94.3 ± 28.6	96.3 ± 27.7	90.1 ± 29.5	0.64
PHS	60.0 ± 18.9	61.2 ± 18.7	57.5 ± 19.0	0.681
PF	29.6 ± 11.9	30.1 ± 10.7	28.5 ± 11.2	0.76
RP	14.8 ± 7.0	15.3 ± 5.8	13.5 ± 8.0	0.56
BP	4.6 ± 2.5	4.5 ± 2.9	4.8 ± 2.4	0.80
GH	11.9 ± 3.0	11.9 ± 3.1	12.0 ± 2.9	0.93
MHS	33.6 ± 12.6	34.6 ± 11.4	31.2 ± 14.3	0.56
VT	11.6 ± 3.5	11.9 ± 2.5	10.8 ± 4.5	0.48
SF	3.2 ± 1.7	3.0 ± 1.7	3.5 ± 1.8	0.49
RE	7.3 ± 6.0	8.3 ± 6.1	5.0 ± 5.7	0.24
MH	11.6 ± 5.8	11.4 ± 3.9	11.8 ± 6.7	0.84

PHS – Physical Health Summary, PF – physical functioning, RP – role problems, BP – bodily pain, GH – general health, MHS – Mental Health Summary, VT – vitality, SF – social functioning, RE – emotional problems, MH – mental health

Table 4. Association between the number of falls and QoL components of the nursing home residents under study

	QoL	PHS	MHS	PF	RP	BP	GH	VT	SF	RE	MH
No. of falls in past year	0.61*	0.61*	0.57*	0.53*	0.30	0.23	0.67*	0.59*	0.45*	0.16	0.69*

QoL – quality of life, PHS – Physical Health Summary, MHS – Mental Health Summary, PF – physical functioning, RP – role problems, BP – bodily pain, GH – general health, VT – vitality, SF – social functioning, RE – emotional problems, MH – mental health

* significant differences ($p < 0.05$)

Table 5. Association between the fall risk indicator and particular QoL categories of the studied persons

	QoL	PHS	MHS	PF	RP	BP	GH	VT	SF	RE	MH
z-score	-0.14	-0.20	0.09	-0.19	-0.27	-0.41	0.01	0.04	-0.06	0.08	0.12

QoL – quality of life, PHS – Physical Health Summary, MHS – Mental Health Summary, PF – physical functioning, RP – role problems, BP – bodily pain, GH – general health, VT – vitality, SF – social functioning, RE – emotional problems, MH – mental health

* significant differences ($p < 0.05$)

ment, it can be concluded that in reference to the year preceding the study, 40% of the participants stated that their health had deteriorated insignificantly, 32% felt similar, 14% declared that their health had got much worse, 9% a little better and 4% much better.

The participants of the study assessed their physical functioning (58.3% of the maximum score) slightly lower than their mental functioning (49.4%). The low self-esteem level was mostly affected by the reported significant physical limitations (RP) which constituted up to 73.8% of the maximum score, as well as physical functioning (59.3%). Vitality (VT), included in the mental dimension of quality of life, was also assessed at a low level (57.9% of the maximum score) which affected the general assessment of quality of life. The other components, such as social activity, social limitations, and general mental health, were assessed at an average level.

Significant differences between females and males were not observed in the assessment of particular elements of the QoL index components. Both groups of respondents indicated a low level of quality of life.

Association between frequency of falls and quality of life

A significant association between falls and the quality of life of the participants of the study was observed (Table 4).

Frequency of falls positively correlated with the results of the physical and mental dimensions of quality of life and the general QoL indicator. Falls negatively affected the following spheres of life: physical functioning, vitality, social activity, and the sense of physical and mental health.

Association between risk of falling and index of quality of life

There were no significant relationships between the general fall risk index (z-score) and the quality of life index and its individual categories (physical and mental dimensions) (Table 5).

Discussion

In this study, the risk of fall (PPA) and the quality of life (QoL) of elderly respondents – residents of nursing homes – were assessed. Also, associations between falls reported in the medical history, the fall risk indicator (z-score) and quality of life were analysed.

Our studies revealed a high probability of falls (z-score 4.3) and a low self-assessment of quality of life in the studied community of elderly persons. We did not observe any significant associations between the fall risk indicator determined based on the PPA and the subjective assessment of the quality of

life of seniors. Significant dependencies occurred between the frequency of falls and the self-esteem, impacting the quality of life of the participants. The obtained results constitute valuable information for the personnel of care facilities. They identify people at particularly high risk and direct therapeutic intervention to the area of the observed functional deficits and quality of life.

The participants indicated numerous falls during the year preceding the study ($n = 38$), resulting in the PPA indicating a high risk of falling in the future: high in 32 respondents (73%), significant in 4 people (9%), moderate and mild in 6 participants (14%), and low in 2 persons (4%). In the studied community, falls concerned every second female and nearly two-thirds of males; moreover, males fell ≥ 2 more than females. Sex and age did not differentiate the participants concerning the fall risk indicator. The risk of falling was very high in 80% of females and 57% of males. The obtained results vary from the reports of some researchers. The study conducted by Gunendi et al. [18] shows that elderly females fall more often than males and this is related to poorer body stability. In the large-scale POLSENIOR studies, it was indicated that falls were more often experienced by females in all age groups (37.3% vs. 34.4%), while in 1997, it was observed that falls occurred as often among females as among males. However, the study group was not large [19]. What is more, it turns out that sex is not a factor determining the risk of falling [20]. In other studies, a larger frequency of falls among males of advanced age was observed (3.3 vs. 1.8 falls/man-year, respectively) [21]. In a study by Büchele et al. [22], conducted in nursing homes in Bavaria, it was observed that falls were related to age and female sex, and less with a limited functional status.

The fall risk assessment based on the PPA revealed significant deficits in systems important for balance control. Values of the body sway strength of knee extensors, quality of sight and reaction time significantly differed from the reference ranges. Also, large values of the range of bending in the frontal plane, similar to, equal to, or exceeding the values obtained in the sagittal plane, indicate issues with posture stability. Studies conducted by other authors indicated that aggravation of functional efficiency constitutes an independent risk factor of falls and determines decreased quality of life [7]. According to Landi et al. [23], weakening of muscle strength increases the probability of falls by three times, and it strongly correlates with an increase in fear of falls.

A problem that is frequently discussed in studies conducted on elderly people is satisfaction from their life in the general and fragmentary dimension consisting of satisfaction from particular manifestations of functioning [24].

Our studies indicated that more than half of the respondents (63.6%) assessed their quality of life as low. The physical dimension affected the obtained results more than the mental dimension, including limitations and physical functioning. The results are compliant with the results of other authors. Persons who fall and are admitted to care facilities have a lower quality of life and physical fitness than people living in their own homes [25]. According to seniors from various countries, the most important elements in the assessment of quality of life are the ability to perform daily activities, health, sensory efficiency, mobility, independence and energy [26]. The type of care does not significantly affect the assessment of quality of life. However, the need to be supported in basic daily activities has a negative impact (ADL). People who need assistance – both formal and informal – have a worse opinion about their quality of life. Significant factors correlating with the assessment of quality of life are mental disor-

ders and depression [27, 28]. Females assessed their quality of life lower than males. Our observations are confirmed by the reports of other authors. Lower self-assessment characterises females with a low assessment of health, physical limitations, emotional disorders and a difficult financial situation [24, 29].

In the studied group of nursing home residents, we did not observe any association between self-esteem or quality of life and the fall risk index determined based on the PPA, which suggests that subjective perception of quality of life – in the physical and mental domains – was not related to the studied efficiency of sensorimotor functions related to postural control, and it is not a sensitive indicator to predict falls. Studies conducted by other authors indicated that reduced functional efficiency in terms of daily activities and mobility is related to a greater risk of falling [30].

Our studies showed that people who fall assessed their quality of life as low. The more often they fall, the lower they assess their quality of life. The number of falls affected the physical dimension as well as the mental dimension related to their satisfaction with life. The above results are also confirmed by other authors. The studies conducted by Smee et al. [31] and Cockayne et al. [32] indicate that respondents who fall assess their physical and mental health lower, and they are reluctant to be physically active.

Lower self-assessment can be caused by fear (anxiety) of falls (FoF), injury and loss of independence [33]. The literature on the subject indicates that the feeling related to the possibility of falling, and not necessarily preceded by its occurrence, accompanies 12% to 73% of elderly people [34, 35].

One of the obstacles to taking up physical activity and improving quality of life is kinesiophobia – an irrational, debilitating and exhausting fear of movement and physical activity resulting from the feeling of being vulnerable to injury or damage. The conducted research and the current scientific reports indicate the need to reduce the severity of kinesiophobia in the elderly. They also indicate that the individualisation of the rehabilitation approach is indispensable in this process. So far, this has been shown to reduce the severity of kinesiophobia in people with lower back pain after participation in multidisciplinary rehabilitation, including six months after its completion [36]. Exercises to deal with kinesiophobia in individuals had similar effects after total plastic surgery of the knee joint [37, 38]. Also, physical therapy reduces the severity of kinesiophobia in people with sciatica.

Persons who experience fear of falls have lower results in tests involving gait and balance, they have poorer sight, they use assistance more often in performing daily activities, they are less active, and they assess their health and satisfaction with life lower [39, 40]. Epidemiological data indicate that residents of nursing homes are hospitalised due to falls twice as often. However, the frequency of all hospitalisations when compared across nursing homes is different and ranges from 9% to 59% [6].

The main task of care facilities is to ensure professional care, activation of seniors and an attempt to improve their quality of life. Social and physical activation, which constitutes an important element of these goals, is often limited by various types of financial, cultural and mental barriers [12]. In the studied community, up to 73% of residents did not participate in any additional classes related to physical activity. According to Costello et al., exercise is the only way to significantly limit the number of falls [42].

In our studies, due to the small amount of demographic and socioeconomic data recorded, we did not assess the association between the number of falls, the fall risk indicator

and the co-existence of diseases, taking medications, using assistance when walking or participating in activities.

The association with falls and quality of life is quite well understood. In the community studied by us, these factors probably affected the frequency of falls. Recent studies indicate that the increased fall risk in residents of nursing homes is related to taking ≥ 3 medications affecting the CSN [42, 43]. The presented study has a pilot nature and elements of the health assessment, daily physical activity, level of fear of falls, and results of the intervention introduced will be taken into account in subsequent studies.

Despite such limitations, the study provides evidence for the importance of the problem of falls and the need to predict their risk in communities of elderly people. We indicated a strong association between the frequency of falls and the perception of quality of life. Falls destructively affect independence and lead to a spiral of inactivity, further reduction of functionality, and an increased risk of falling occurring in the future [44].

Conclusions

The dominating risk factor for falls, as established in the nursing home residents against the Physiological Profile Assessment (PPA) score, consisted in a slower reaction time to a stimulus; its average value exceeding the reference value for healthy individuals of similar age by threefold. Significant differences in the general falls risk indicator between females and males were not addressed.

The frequency of falls was established to affect the individual perception of overall quality of life, both mentally and physically. The individuals who had sustained a larger number of falls in the past also rated their overall quality of life as lower.

Self-assessment of overall quality of life among the nursing home residents was low.

The results yielded by the study were affected appreciably more by the physical rather than mental factors.

No correlation between the falls risk indicator and gender was established.

Disclosure statement

No author has any financial interest or received any financial benefit from this research.

Conflict of interest

The authors state no conflict of interest.

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