

REVIEW / PRACA POGLĄDOWA

Marta Podhorecka<sup>1</sup>, Kornelia Kędziora-Kornatowska<sup>1</sup>, Jadwiga Głowczewska<sup>1</sup>, Dominika Gębka<sup>1</sup>,  
Marta Sucharska-Szymkowiak<sup>1</sup>, Natalia Ciesielska<sup>1</sup>, Remigiusz Sokołowski<sup>2</sup>, Magdalena Weber-Rajek<sup>3</sup>

**FALLS IN THE ELDERLY – RISK ASSESSMENT AND PROCEEDING****UPADKI OSÓB STARSZYCH – OCENA ZAGROŻENIA I POSTĘPOWANIE**

<sup>1</sup>Department of Geriatrics, Nicolaus Copernicus University, Collegium Medicum in Bydgoszcz

<sup>2</sup>Department of Hygiene, Epidemiology and Ergonomics, Nicolaus Copernicus University,  
Collegium Medicum in Bydgoszcz

<sup>3</sup>Department of Physiotherapy, Nicolaus Copernicus University, Collegium Medicum in Bydgoszcz

**S u m m a r y**

The aging of society was an incentive to the development of many fields of medicine including geriatric physiotherapy. Rehabilitation in geriatrics involves a range of issues connected with the involuntional and/or disease related changes in the organism of an elderly person. To highlight the most important ones, so called ‘great geriatric problems’ were distinguished. One of them are falls. The risk of falls rises significantly after the age of 65. Among people older than 65 the chances of falls are 40% higher than among younger people.

The article aims at showing the issues connected with the role of physiotherapy in falls prophylaxis in the elderly. The problem of falls in the elderly is mainly connected with the consequences of falls. Falls may lead to injuries, disability and even death. Falls prophylaxis should start with complex geriatric assessment. To assess the risk of falls

a physiotherapist may use special scales: the stand up and go and the Tinetti test. After thorough analysis of the state of health of the elderly person appropriate prophylaxis measures may be chosen: removal of the environmental threats, appropriate selection of shoes as well as the assisting equipment, acute and chronic diseases treatment, pharmacotherapy modification, physiotherapy. Anti-fall rehabilitation usually focuses on balance training, expanding the range of motion, gait re-education and analgesic measures. In some medical centres special anti-fall programs are being developed, where physical activities and appropriate assisting equipment play the most important role. Modern physiotherapy methods enable individual anti-fall prophylaxis adjustment to the elderly person’s needs. The use of rehabilitation to diminish the risk of falls in the elderly is more and more common.

**S t r e s z c z e n i e**

Starzenie społeczeństwa spowodowało rozwój wielu dziedzin medycyny, w tym i fizjoterapii geriatrycznej. Rehabilitacja w geriatrici obejmuje szereg zagadnień związanych z występowaniem zmian inwolucyjnych i/lub chorobowych w organizmie osoby starszej. W celu podkreślenia najważniejszych wyodrębniono tzw. wielkie problemy geriatryczne. Jednym z nich są upadki. Ryzyko wystąpienia upadków znacząco wzrasta po 65. roku życia.

Wśród tych osób występuje o 40% więcej szans na wystąpienie upadku niż wśród osób młodszych.

Praca ma na celu przybliżenie zagadnień związanych z rolą fizjoterapii w profilaktyce przeciwapadkowej osób starszych. Problem upadków wśród osób starszych wiąże się głównie z ich konsekwencjami. Mogą prowadzić do urazów, niepełnosprawności, a nawet śmierci.

Profilaktyka przewypadkowa powinna rozpocząć się od kompleksowej oceny geriatrycznej. W celu oceny ryzyka

fizjoterapeuta może posłużyć się specjalnymi skalami: testem wstań i idź lub testem Tinetti. Po dokładnej analizie stanu zdrowia osoby starszej można dobrać odpowiednie środki profilaktyczne: likwidację zagrożeń środowiskowych, dobór obuwia i sprzętu pomocniczego, leczenie ostrych i przewlekłych chorób, modyfikację farmakoterapii, fizjoterapię. Rehabilitacja przeciwpadkowa zazwyczaj skupia się na treningu równowagi, zwiększeniu zakresów ruchu, reedukacji

**Key words:** falls, the elderly, geriatrics

**Słowa kluczowe:** upadki, osoby starsze, geriatra

## INTRODUCTION

In medical writing fall is described as a sudden and unconscious change of the body position during which the person is situated on the floor on the other lower level or without the loss of consciousness.[1].

Falls of the elderly are included among the so called 'great geriatric problems'. It is connected with their frequency, 30% of people after the age of 65 and 50% after the age of 80 experience falls at least once a year. The biggest group that experiences falls are the elderly living in residential homes or other care centres, the next group are the elderly living alone and the in-patients.[2].

## THE AIM

The work aims at presenting issues connected with the role of geriatric physiotherapy especially in fall prophylaxis of the elderly. The subject of causes, diagnostics and the consequences of falls of the elderly, as well as rehabilitation and anti-fall programs are discussed.

## CAUSES OF FALLS

World literature presents about 400 possible causes of falls in the elderly. However, not all of them have been studied thoroughly. It needs to be pointed out that the fall is not usually caused by one, but by many factors [3].

The causes of falls may be divided into external and internal. External factors leading to falls are connected with the environment where the elderly person stays and the internal factors are associated with the changes connected with aging or illnesses and diseases the organism is suffering from.

choду oraz działaniach przeciwbólowych. W niektórych ośrodkach opracowywane są specjalne programy przeciwpadkowe, gdzie ćwiczenia fizyczne i dobór odpowiedniego sprzętu pomocniczego odgrywają najistotniejszą rolę. Nowoczesne metody fizjoterapii pozwalają na indywidualny dobór profilaktyki przeciwpadkowej do osoby starszej. Zastosowanie rehabilitacji w celu zmniejszenia ryzyka upadków wśród osób starszych jest coraz bardziej powszechne.

Environmental causes include the housing of the elderly person such as slippery floors, folded carpets, and uneven steps in stairs, lack of handles in the bathroom or the incommensurate lighting (tab. I).

Table I. *External causes of falls in the elderly*

Tabela I. *Zewnętrzne przyczyny upadków u osób starszych*

External causes of falls	
<b>Floors</b>	waxed slippery and wet, high thresholds, folded edges of carpets
<b>Lighting</b>	incommensurate, too concentrated, dazzling, inaccessible switches
<b>Spatial devices and furniture</b>	blocked way, high-placed cupboards, shelves, too high beds and chairs, low armchairs, lack of bannisters, low backs, unstable furniture
<b>Bathroom</b>	bath, shower base – slippery bottom, slippery floor, toilet – too low, lack of grips and bannisters
<b>Stairs</b>	lack of bannisters, too high, damaged, slippery stairs, long stairs and limited number of landings
<b>External surroundings</b>	uneven pavements, slippery surfaces, high curbs, maladjusted means of transport

Based on Edbom-Kolarz A. Marcinkowski J., Upadki osób starszych - przyczyny, następstwa, profilaktyka, Hygeia Public Health, 2011 : T. 46, nr 3, p. 313-318

Internal factors include involuntional changes, i.e. changes connected with the aging of the nervous system (weakened exteroceptive sensation and proprioception, decrease in conduction), muscle system (sarcopenia) or the sense organs (eyesight deterioration, balance disorders). Internal causes of falls may also be connected with the present or previously experiences neurological, psychiatric, cardiovascular, rheumatic or orthopaedic disorders. (tab. II) [4, 5].

Table II. *Illnesses and disorders predisposing to falls in the elderly*Tabela II. *Stany chorobowe predysponujące do wystąpienia upadku u osób starszych*

Illnesses	
Psychiatric disorders	Neurological disorders
Depression, delirium, anxiety	Post stroke state, Parkinson's disease and parkinsonism, vertebro-basilar artery syndrome, cerebellum diseases, Carotid sinus hypersensitivity, cervical spondylosis, peripheral neuropathy, drop attacks,
Metabolic disorders	Cardio-vascular diseases
hypothyroidism, diabetes, hypoglycaemia, anaemia, water-electrolyte imbalance	heart rhythm disorder, arteriosclerosis of the cervico-cephalic arteries and lower extremities, orthostatic hypotension
Motor organ disorders	Others
Inflammatory and degenerative diseases of joints, feet malformations, osteoporosis, proximal muscle myopathy	Bleeding from the digestive tract, diarrhoea, nocturia, urinary incontinence, glaucoma, cataract

Based on Kostka T, Kozłowska-Rościszewska M. Choroby wieku podeszłego. PZWL 2009

### CONSEQUENCES OF FALLS

Falls are an important issue especially because of their consequences. Falls are the cause of injuries and hospitalisation of the elderly. Frequent results of falls are femoral neck fractures which lead to decrease in physical fitness in 50 % of the injured. As many as 20% of patients do not make it till the following year [6]. Apart from fractures the elderly person is subject to series of other consequences presented in Table III.

Table III. *Health risks connected with falls in the old age*Tabela III. *Zagrożenia zdrowotne związane z upadkami w wieku podeszłym*

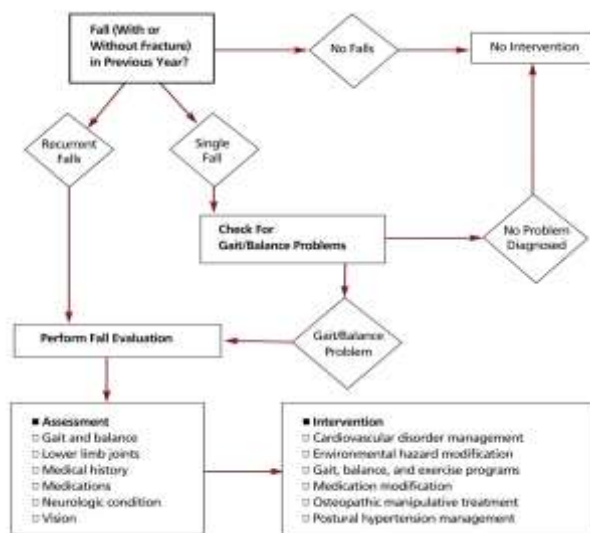
Consequences of falls	
Injuries	-fractures - subdural hematomas -widespread bruising -burns
Connected with immobilisation	-hypothermia -dehydration -deep vein thrombosis -infections -bedsores - joints contractures
Psychic	-post-fall syndrome

Based on Rosenthal T., Naughton B., Williams M.: Geriatria. Wydawnictwo Czelej, Lublin 2009

Apart from the physical consequences there may be observed post-fall syndrome. It is characterized by the fear of the next fall. It occurs in people who have experienced falls or witnessed somebody else falling. Post-fall syndrome leads to decrease in physical activity and as a consequence to deterioration of the physical state of a senior and increases the risk of falls. It is estimated that about 50 % of people after the age of 65 who have experienced at least one fall may suffer from the post-fall syndrome [7].

### FALLS DIAGNOSTICS

To prevent falls among the elderly in the most effective way, detailed diagnostics should be implemented to find their possible reasons. It is important to adjust the assessment measures in an appropriate and an individual way. According to the National Institute for Clinical Excellence in the UK every geriatric patient should be asked about falls during the interview and should the answer be positive, use the algorithm suggested by the American Geriatric Society (Pic. I) [8].

Pic. I. *The algorithm of falls assessment and proceedings based on Am Geriat Soc, Brit Geriat Soc, Am Acad of Orthop Sur Panel on Falls Prevention [9]*Ryc. I. *Algorytm oceny i postępowania w upadkach na podstawie Am Geriat Soc, Brit Geriat Soc, Am Acad of Orthop Sur Panel on Falls Prevention [9]*

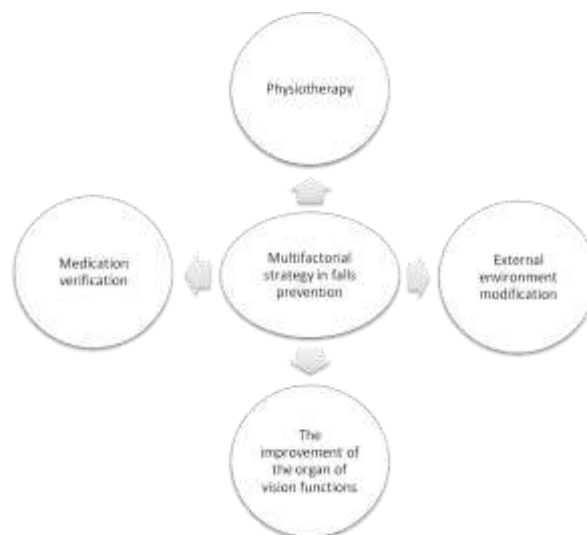
Functional tests are used in the diagnostics of the risks of falls. Even though new scales are created every year, medical personnel uses the ones that are thoroughly documented, e.g.:

- Stand Up and Go Test – consists in measuring the time during simple activities (e.g. standing up from a chair, walking a couple of meters)
- Dynamic Gait Index (DGI) – consists in estimating the gait during different activities e.g. while walking fast, walking up or down the stairs;
- The Step Test - based on measuring the number of steps up the stairs in 15 seconds;
- Stop Walking When Talking – based on estimating attention divisibility of the subject while walking;
- Tinetti Test (POMA) – consists of 2 parts. The first part estimates balance while sitting and standing, second part – while walking;
- Four Square Test – defines the time the subject needs to walk indicated fields while overcoming obstacles;
- Berg Test – based on estimating balance while doing 14 activities[10].

To carry out detailed balance evaluation, examination on balance platforms is used frequently enabling detailed diagnostics and objective documentation while using physiotherapy levelling balance disorders. During the examination measurements of the following can be taken: path length, average speed of the foot lever during examination, average lean out of the foot lever from the zero point, maximum lean out from the zero point in different directions [11].

## FALL PROPHYLAXIS

Efficient fall prophylaxis should be based upon 4 main areas of intervention: strength and balance training, modification of the external environment, the improvement of the organ of vision function, mental state and circulatory system and medication verification (Pic. II) [3].



Pic. II. *Model of multifactorial strategy in fall prevention, based on Czerwiński E i współ., Współczesne zasady zapobiegania upadkom z wykorzystaniem rehabilitacji, Ortopedia Traumatologia Rehabilitacja, 2006; 4(6); Vol. 8, 380-387*

Ryc. II. *Model wieloczynnikowej strategii prewencji przeciwapadkowej, opracowanie własne na podstawie Czerwiński E i współ., Współczesne zasady zapobiegania upadkom z wykorzystaniem rehabilitacji, Ortopedia Traumatologia Rehabilitacja, 2006; 4(6); Vol. 8, 380-387*

## PHYSIOTHERAPY

The role of physiotherapy in fall prevention actions focuses on two fields - the training of muscle strength and balance and training of picking oneself up after a fall. It is worth highlighting that the elderly need to have an individual program because of their susceptibility to multimorbidity. The training of strength and balance should be adjusted to the person in terms of intensity and the level of difficulty. Gait re-education that focuses on improving the elements that may create the risk of fall is also important [12].

Fall prevention program should include learning of picking oneself up after a fall. The senior should be taught the possible techniques of standing up after a fall e.g. standing up using a chair [12, 13].

During training exercises increasing muscle strength are introduced to prevent or slow down the processes of sarcopenia. More time should be devoted to such training because its results are visible after a longer period of time than among younger people. Some sources state that exercises should be done systematically through the whole period of the old age because discontinuing the training quickly leads to deterioration of the physical state of an elderly person.

Analgesic measures are also important because as many as 80 % of seniors complain of pain of different type. Levelling pain may improve locomotor functions of seniors [15].

Many medical sources indicate positive influence of Tai-Chi on balance improvement. Exercises usually last about 90 minutes during which senior balances their centre of gravity. It is worth mentioning that there are no contraindications to start Tai-Chi training which has got great importance taking into consideration multimorbidity of the elderly. Other form of group exercises beneficial for the seniors is yoga for the elderly, which lets participants perform majority of the asanas as they are adjusted to the physical possibilities of seniors. Some centres organise yoga exercises on chairs intended for people who cannot keep balance in standing position [16, 17, 18].

Geriatric recommendations state that when the elderly person does not have access to professional physiotherapy, they can improve their medical condition by means of walking, Nordic walking or dancing [18].

#### ANTI-FALL PROGRAMS

The problem of falls was analysed by New Zealand Falls Prevention Research Group, which controlled special anti-fall program called OTAGO. The program contains sets of exercises selected individually for each patient. It is worth mentioning that the program includes home visits of a trained instructor and the process of physiotherapy takes place in the place of residence of a senior [19].

Efficiency of the Otago program was proved in many significant studies. Randomized studies on the elderly women of Campbell showed decrease of 30% in the number of falls per year in comparison to the control group. Interesting research in this area was carried out by Robertson and the results showed better anti-fall efficiency of the Otago program in the group of people after the age of 80 [20, 21].

It is worth mentioning that apart from positive anti-fall impact the program contributes to the improvement of medical condition, quality of sleep and general quality of life of seniors who took part in it [21].

#### ENVIRONMENT MODIFICATION

The next stage of fall prophylaxis is the modification of home environment. It is important

because majority of falls occur at home. All possible external causes of falls should be analysed and all the necessary modifications should be implemented. Crucial is the issue of handles that should be installed especially in the toilet, where seniors can slip easily. When the fall has already taken place possible mechanisms that led to it should be analysed and changes that can make everyday life easier should be implemented [23, 24].

#### IMPROVEMENT OF MEDICAL CONDITION AND MEDICATION VERIFICATION

Improvement of the medical condition i.e. trying to stop or level the involuntional or disease related is a very important factor in the process of anti-fall physiotherapy. Significant issue is the possible improvement of cognitive functions of the elderly and the medication verification based on minimizing or resigning from psychotropic drugs. It was proved that people taking 3 or more different medications a day are more prone to falls than others. The above tasks are the responsibility of geriatricians or general practitioners [25, 26].

#### SPECIALIZED ASSISTING EQUIPMENT

Due to complex origins of falls, selecting the appropriate assisting equipment plays an important role. The usage of crutches or walking frame should be taken into consideration among people with considerable balance disorders. Daily life improvements may also be suggested, such as using special trolleys for shopping instead of carrying heavy shopping bags [27].

Another issue is the selection of appropriate shoes. Not rarely do we see elderly people in shoes that are too tight or women who wear high heels. It was proved that inappropriate selection of shoes may lead to increasing the risk of falls. Therefore, medical staff should educate seniors in the area of proper shoe selection and using anti-slip provisions especially in the winter period [28].

Prophylaxis also includes using specialised protectors for hips. However, despite many studies being carried out, evaluation of their efficacy has not been proved [29].

## CONCLUSIONS

Evaluation of the risk of falls among people after the age of 65 is a standard procedure among geriatricians but it should also be executed by general practitioners. Education of the medical staff in the field of fall prophylaxis could have a positive influence on levelling the consequences resulting from the falls of the elderly. As the available literature widely describes and illustrates the possible causes of falls there is a need to educate people staying in the company of the elderly.

Having in mind the easiness of modifying the environment of the elderly and integrating this with systematic physical activity we are able to minimize the number of falls significantly and especially their consequences.

## REFERENCES

- Masud T, Morris RO.: Epidemiology of Falls, *Age Ageing*. 2001 Nov;30Suppl 4:3-7.
- Anna Edbom-Kolarz, Jerzy T. Marcinkowski, Upadki osób starszych - przyczyny, następstwa, profilaktyka, *Hygeia Public Health*, 2011 : T. 46, nr 3, s. 313-318.
- Campbell AJ, Reinken J, Allan BC iwsp. Falls in old age: a study of frequency and related clinical factors. *Age Ageing* 1981, 10:264-270.
- Czerwiński E, Borowy P, Jasiak B, Współczesne zasady zapobiegania upadkom z wykorzystaniem rehabilitacji, *Ortopedia Traumatologia Rehabilitacja*, 2006; 4(6); Vol. 8, 380-387.
- Galus K, Kocemba J. (Red.): MSD Podręcznik Geriatrii. Wydawnictwo Urban & Partner, Wrocław 1999, 70-85.
- National Institute for Clinical Excellence (NICE). Clinical practice guideline for the assessment and prevention of falls in older people. Royal College of Nursing; November 2004.
- Anna Skalska, Marek Żak, Upadki – ocena ryzyka, postępowanie prewencyjne, 2007, 4 *Standardy Medyczne* 167-173.
- Pearse EO, Redfern DJ, Sinha M, Edge AJ. Outcome following a second hip fracture *Injury* 2003, 34: 518-521.
- American Geriatrics Society, British Geriatrics Society, American Academy of Orthopaedic Surgeons Panel on Falls Prevention. Guideline for the Prevention of Falls in Older Persons. *JAGS* 2001; 49: 664-672.
- Szot P., Golec J., Szczygieł E. Przegląd wybranych testów funkcjonalnych, stosowanych w ocenie ryzyka upadków u osób starszych. *Gerontologia Pol.* 2008; 16: 19-24.
- Thornby M.A.: Balance and fall in the frail older person. A review of the literature. *Geriatr. Rehabil.* 1995; 11: 35-43.
- Tomasz Ocetkiewicz, Anna Skalska i wsp., Badanie równowagi przy użyciu platformy balansowej, *Gerontologia Polska* 2006, tom 14, nr 3.
- Lewczuk E, Białoszewski D. Poziom aktywności fizycznej chorych na osteoporozę a upadki i ich profilaktyka. *Ortopedia - Traumatologia - Rehabilitacja* 2006; 4: 412-421.
- Żak M, Programy rehabilitacji przygotowujące osoby starsze do bezpiecznej zmiany pozycji samodzielnego podnoszenia się po upadku. *Pos. Reh.* 2006; 17-24.
- Czerwiński E., Białoszewski D., Borowy P., Kumorek A., Białoszewski A. Epidemiologia, znaczenie kliniczne oraz koszty i profilaktyka upadków u osób starszych. *Ortop. Traumatol. Rehabil.* 2008; 10: 419-428.
- Rubenstein L.Z. Falls in older people: epidemiology, risk factors and strategies for prevention. *Age Ageing* 2006; 35: i37-i41. Gf.
- Mętel S. Wpływ Tai Chi oraz ćwiczeń senso-motorycznych na poprawę równowagi u osób w wieku geriatrycznym. *Rehabilitacja Medyczna* 2003; 7(3): 55-63.
- Skalska A, Walczewska J, Ocetkiewicz T. Wiek, płęciaktywność fizyczna osób zgłaszających upadki orazoko licznosciich występowania. *Rehabilitacja Medyczna* 2003; 7(3): 49-53.
- Campbell AJ, Robertson MC, Gardner MM, Norton RN, Tilyard MW, Buchner DM. Randomised controlled trial of a general practice programme of home based exercise to prevent falls in elderly women. *BMJ* 1997;315:1065-1069. Gd.
- Robertson MC, Campbell AJ. Falls prevention and the role of home exercise programmes. *J Royal Soc Promot Health* 2001;121:143.
- Plautz B, Beck D. Modifying the environment: a community-based injury reduction program for elderly residents. *American Journal of Preventative Medicine* 1996; 12: 33-38.
- Robertson MC, Devlin N, Gardner MM, Campbell AJ. Effectiveness and economic evaluation of a nurse delivered home exercise programme to prevent falls. 1: Randomized controlled trial. *BMJ* 2001; 322:697-701.
- Campbell AJ, Robertson MC, Gardner MM, Norton RN, Buchner DM. Psychotropic medication withdrawal and a home-based exercise program to prevent falls: a randomized, controlled trial. *J Am Geriatr Soc.* 1999; 47(7): 850-853.
- Tinetti ME, Baker DI, Mc Vay G, et al. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. *N. Engl. J. Med.* 1994; 331: 821-827.
- Clinical practice guideline for the assessment and prevention of falls in older people. Guidelines commissioned by the National Institute for Clinical Excellence (NICE). Royal College of Nursing 2004 Nov.
- Fletcher PC, Hirdes JP. Restriction in activity associated with fear of falling among community-based seniors using home care services. *Age Ageing* 2004; 33:
- Clinical Practice Guideline for the Assessment and Prevention of Falls in Older People. National

Collaborating Centre for Nursing and Supportive Care (UK). London: Royal College of Nursing (UK); 2004 Nov. National Institute for Health and Clinical Excellence: Guidance.

28. Czerwiński E, Lorenc R, Marcinowska- Cameron ID, Cumming RG, Kurrle SE, Quine S, LockwoodK, Salkeld G, Finnegan T. A randomised trial of hip protector use by frail older women living in their own homes. *InjPrev* 2003 Jun; 9 (2): 138-141.
29. College of Nursing 2004 Nov. Sawka AM, Boulos P, Beattie K, et al. Do hip protectors decrease the risk of hip fracture in institutional and community- dwelling elderly? A systematic review and meta- analysis of randomized controlled trials. *Osteoporos Int* 2005 Dec; 16 (12): 1461-1473

Address for correspondence:

Marta Podhorecka  
Katedra i Klinika Geriatrii  
Szpital Uniwersytecki nr 1 im. dr. A. Jurasza  
ul. M. Curie Skłodowskiej 9  
85-094 Bydgoszcz  
tel. (52) 585-40-21  
fax (52) 585-49-21  
e-mail: martapodhorecka@wp.pl  
Kornelia Kędziora-Kornatowska –  
kikgeriat@cm.umk.pl  
Jadwiga Głowczewska – kikgeriat@cm.umk.pl  
Dominika Gębka – dominika\_gebka@wp.pl  
Marta Sucharska-Szymkowiak –  
marta.sucharska.szymkowiak@onet.pl  
Natalia Ciesielska – nataliaciesielska1986@gmail.com  
Remigiusz Sokołowski – sirremiq@gmail.com  
Magdalena Weber-Rajek – magdawr69@gmail.com

Received: 27.08.2015

Accepted for publication: 10.11.2015