REVIEW ARTICLE
HELTHY LIVING

Universal safe fall education – the missing pillar of prevention recommended by the WHO

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Manuscript Preparation
E Funds Collection

Bartłomiej Gąsienica-Walczak [1ABCDE], **Jarosław Klimczak** [2ABCDE]

[1] Health Institute, University of Applied Sciences in Nowy Targ, Nowy Targ, Poland
[2] Department of Physiotherapy, University of Warmia and Mazury in Olsztyn, Olsztyn, Poland

Received: 21 March 2023; **Accepted:** 13 April 2023; **Published online:** 28 April 2023

AoBID: 16390

Abstract

Background & Study Aim: The World Health Organization (WHO) publishes (2007) as part of the Global Fall Prevention Report for the Elderly, three pillars: first, to raise awareness of the importance of fall prevention; second, to improve the recognition and assessment of risk factors and determinants of falls; third, to develop and to implement realistic and effective interventions. The aim of this narrative review is to recommend universal safe fall education as the missing element of fall prevention system recommended by WHO.

Material & Methods: The narrative review is based on key WHO publications and the works of the 'Polish School of Safe Falling', which, in the authors' opinion, sufficiently demonstrate the global scale of this multi-threaded problem.

Results: Polish School of Safe Fall shifts the focus of preventing the inevitable consequences of falls to education that goes beyond the naive paradigm that falls can be eliminated (but they can be limited, admittedly) from human life – the annually 695 771 premature deaths and 19 252 699 people lived with a disability. This missing pillar was started in 1963 with a unique safe fall course for the blind. Currently, it is based on the theory of safe falls (1972) and on the methodology of teaching safe falls to healthy people and various high-risk groups (including amputees, blind, obese, with intellectual dysfunctions, etc.), also improved since 1972. A unique achievement are also methods of diagnosing and reducing susceptibility to the body injuries during a fall (including children 2 to 6 years of age).

Conclusions: The introduction of the 'Polish School of Safe Falling' recommendations (verified empirically many times) into global prevention of the effects of unintentional falls will protect the health of many millions of people around the world and will radically reduce the number of people who lose their lives in this seemingly trivial way. The high degree of generality of the argumentation of this narrative review (due to the extensiveness of the available empirical data) does not undermine the legitimacy of the above recommendations. Therefore, calling the fourth (missing) pillar 'universal safe fall education' would be neither a semantic abuse nor inconsistent with real evidence-based prevention.

Keywords: cognitive impairment • epidemiology of falls • Polish School of Safe Falling

Conflict of interest: Authors have declared that no competing interest exists

Ethical approval: Not required

Provenance & peer review: Not commissioned; externally peer reviewed

Source of support: Departmental sources

Author's address: Bartłomiej Gąsienica Walczak; Health Institute, Podhale State College of Applied Sciences in Nowy Targ, Kokoszków 71, 34-400 Nowy Targ, Poland; e-mail: bartlomiej.gasienica@ppuz.edu.pl

INTRODUCTION

Falls cannot be eliminated (limited, agreed!) from human life – falls cause 695 771 premature deaths and due to falls 19 252 699 people lived with a disability for many years. [1]. In 2007, the World Health Organization (WHO) published the 'Three Pillars of the WHO Falls Prevention Model' as part of its global report on the prevention of falls in older people: pillar one – building awareness of the importance of falls prevention; pillar two – improving the recognition and assessment of risk factors and determinants of falls; pillar three – developing and implementing realistic and effective interventions [2].

The above recommendations for fall prevention are based on the assumption that it is possible to eliminate falls. They are unavoidable in the life of any person moving independently. The effectiveness of fall prevention programmes recommended since the late 1980s ranges from 15% [3] to 48% [4], and there is no basis for predicting (much less guaranteeing) that in the further life of the participants of such courses, the risk of falling will only affect the remaining 85-52% and not all of them. Unlike proponents of a prevention paradigm limited solely to the elimination of falls from human physical activity, the 'Polish School of Safe Falling' (PSSF) is based on the theory and methodology of safe (soft) falls and shifts the focus (complements the WHO pillars) to prevention of the consequences of falls.

This missing pillar – figuratively speaking – was initiated in 1963 by Ewaryst Jaskólski with a unique course in safe falling (modelled on judo techniques) for blind people [5]. Today, it is based on the theory of safe falls [6] and on a methodology for teaching safe falls to healthy people and various risk groups (amputees, blind, obese, intellectually dysfunctional, etc.) not directly linked to any martial arts, which has also been improved since 1972. The theory of safe (soft) falling, published in Polish (in 1972), has probably not been known either to the authors of the aforementioned [3, 4] and to other prevention programmes or to the WHO experts recommending the pillars in question. The language barrier is not the only reason for this. Although there was no Internet in the 1970s and, moreover, the Iron Curtain restrained the free dissemination of scientific knowledge in many fields [7], yet nowadays formally these obstacles have ceased. Meanwhile, these unique theoretical and practical achievements of Polish scientists are still not disseminated not only in the global space of science but also in Poland.

Thus, entities with some statutory responsibility for monitoring scientific knowledge in general, let alone of high importance for the broader public health sphere, are failing. In the case of Poland, these are: universities, where original programmes have been or are being implemented (very highly rated and preferred by students as elective courses); the Ministry of Education and Science, as well as the Ministry of Health by failing to allow such a course (or specialty) to be ordered; and government advisory teams by ignoring the offer to implement safe falling exercises into the core curriculum of Polish schools; scientific associations; non-public health service providers; and the media.

In such a situation, it is difficult to count on meaningful implementation and, above all, rapid progress in the prevention of the effects of falls. During the International Scientific and Methodological Conference 'Health Promotion in the Face of Civilizational Risks' (Nowy Targ, November 16-17, 2007), one of the papers concerned 'Universal teaching of safe falling skills as the most effective method of injury prevention' [8]. A conference participant, a well-known general physical activity promoter in Poland, as a member of the government advisory board working on the draft core curriculum at the time, submitted a relevant proposal. The proposal was dismissed by one vote, with the opponent's crowning argument stating that: 'student's fall, it has a bad connotation, we should come up with another name.

The aim of this narrative review is to recommend universal safe fall education as the missing element of fall prevention system recommended by WHO.

First pillar: building awareness of the importance of falls prevention

For WHO experts, the need to optimize the prevention of death, injury and life-long disability as a result of a fall is beyond debate. Public awareness that this is one of the most important practical public health problems of global concern is increasing every year. The truthfulness of this statement is supported by a large number of

Cognitive impairment – is when a person has trouble remembering, learning new things, concentrating, or making decisions that affect their everyday life. Cognitive impairment ranges from mild to severe. With mild impairment, people may begin to notice changes in cognitive functions, but still be able to do their everyday activities. Severe levels of impairment can lead to losing the ability to understand the meaning or importance of something and the ability to talk or write, resulting in the inability to live independently [61].

Narrative reviews – are a discussion of important topics on a theoretical point of view, and they are considered an important educational tool in continuing medical education. Narrative reviews take a less formal approach than systematic reviews in that narrative reviews do not require the presentation of the more rigorous aspects characteristic of a systematic review such as reporting methodology, search terms, databases used, and inclusion and exclusion criteria [62].

articles on the epidemiology of the phenomenon. After 2007, evidence of meeting demands of the first pillar of the WHO falls prevention model is the publication of a number of review papers in journals available in the global scientific space evaluated by reputable literature databases such as: EBSCO, Elsevier, Nature, Science, SCOPUS, Springer, Web of Science, Wiley.

The lack of adequate scientific diligence is an obstacle to raising awareness of the importance of preventing falls. This accusation can be made, for example, of Hsu et al. [9], who reviewed 66 articles published since 1948 that were relevant to the specificity of older people's cognitive processes in the context of risk of falls. The review is not careful not because the oldest publication is from 1973 and is not directly dedicated to falls issues [10]. It is because the next oldest publications (1987 and 1988) cited by the authors are exclusively concerned with fall prevention [11, 12], and the analysis of the others is subordinated to this paradigm. These facts authorize the conclusion that a competing view by Polish scholars is being ignored. Now there is no obstacle to reaching the Polish-language publication by Jaskólski and Nowacki [6], in which the authors clearly expound the theory of safe falling and formulate the methodological basis for anyone to learn such a skill. The possibility of acquiring an important source text is served by the principle of including in publications the correspondence address of the author who refers to this source. This author can not only make this text available to anyone interested (he or she is even obliged to do so [13, 14]), but also help to break down the language barrier.

Since 2005, papers published in the electronic, English-language open-access journal Archives of Budo have been available in the global learning sphere. In the first publication on the effects of preventing the consequences of falls by learning to collide safely with even the hardest ground [15], there is a reference to the elementary generalizations of safe fall theory and a link to the publication by Jaskólski and Nowacki [6]. Similarly, there are subsequent articles published before 2012, including in their title the phrases: 'teaching safe falls'; 'susceptibility to injury during a fall' [16, 17], and one only needs to use a simple Google browser to access this unique knowledge.

However, it is hard to believe (let us emphasise that again) that Poland, for more than 40 years a world leader in modern fall prevention based on positively verified implementation of safe fall programmes at many levels of health education, fails to promote these unique achievements.

The primary reason for the insistence on this paradigm since the 1980s is probably due to the lack of both knowledge of safe fall theory and knowledge of empirically verified practical applications of this theory in the scientific community and among public health quality personnel. However, it is difficult to accuse the following recommendations, recommended by proponents of the criticised paradigm, of not making sense: strengthening human muscular strength, and postural stability; maintaining adequate flexibility, proportion and body composition; developing a proper perception of the environment in which a person functions and the ability to accurately self-assess one's own motor capabilities, etc. Any reduction in the number of unintentional falls is a concrete result of prevention, which is usually based on the loss of balance (the ability to maintain a stable posture). Also, mere knowledge of theory and even the most extensive knowledge of the epidemiology and effects of fall prevention are not enough.

Safe unintentional and intentional falls (as, for example, the possibility of avoiding a collision with a moving object by changing the vertical position to dynamic, multiple rolling on a sufficiently long distance in a given emergency situation) are already a derivative of previously acquired special skills. An important testimony to the credibility of the Polish school of preventing the effects of unintentional loss of balance and collision with the ground or a vertical obstacle based on the skills of safe falling and avoiding collisions is strengthened by documented implementations in the field of methodology and training, as well as extreme case studies. For nearly half a century, methodological recommendations [18-22] and practical experience are intertwined with empirically verified claims of the theory of safe falling and provide arguments that the proposed solutions in the field of prevention are reliable [15-17, 23-28].

Mroczkowski et al. [29], however, provided empirical evidence that the high susceptibility to injuries during the fall of children and the lack of significant differences between the groups of students who are additionally activated by extracurricular

sports activities testify to the low effectiveness of the traditional model of physical education and sport for all in stimulating motor safety.

It is legitimate to divide the verification of the safe-fall theory theorems into three categories. The first two qualify for laboratory conditions. Specific motor tests and simulations consisting in throwing a given person off balance and causing them to fall, however, in circumstances ensuring full body protection: soft ground, head and/or other body parts protectors, tasks adapted to already trained skills, etc. [15-17, 23-28]. In certain circumstances, when the conditions of the highest professionalism are met, verification of the ability to safely fall and collide can be made on a hard ground and equally hard vertical obstacles [27, 28].

The third category consists of well-documented incidents involving people who were able to use previously trained skills effectively: either during a sudden loss of balance, a fall and collision with a hard surface or a collision with a vertical obstacle without a prior loss of balance; or in a collision with an object in motion; or to minimise the consequences of a fall or collision with a vertical obstacle of a person who is in close proximity and suddenly loses balance (a consequence of adjusting one's own motor actions appropriately to the circumstances while belaying a falling person). Such cases (fall from a ladder, collision with a car, cushioning a man's fall in a suddenly braking bus) are described in a widely available publication [17]. Popularising knowledge about such incidents corresponds directly with the content of the first pillar of the WHO postulates (building awareness of the importance of fall prevention).

Second pillar: improving the recognition and assessment of risk factors and determinants of falls

Cyclical reviews of scientific papers of interest to a particular researcher, research team, or commissioning institution are at the core of improving the recognition of any phenomenon using scientific methods. The so-called meta-analyses are valuable, but so are critical analyses of papers dealing with a sometimes seemingly mundane (but, in fact, key) issue of a multifaceted question. Such issues (e.g. the relevance of a specific test, an important measure of a particular therapy) usually require an interdisciplinary approach involving multiple actors or the interdisciplinary expertise of a single researcher. In such cases, improvements in recognition and evaluation can be achieved after in-depth critical analysis of just a few papers (more may not be available) or even an isolated case. The year of publication of the work, the language, the country, the publisher, the tools, etc. should not constitute any formal barriers. The only criteria should be the quality of reasoning, cognitive value, and power of inspiration. Tadeusz Kotarbiński [30] emphasises that an adequate division and classification (i.e. multiple division) of the studied phenomena is often underestimated in knowledge-forming proceedings.

Kangas et al. [31, 32] provide evidence of an inadequate breakdown of fall causes. The authors distinguish: fainting, tripping, slipping, falling out of bed, and sitting on something that is not really there (sitting on empty air). This division is based on the work of Lukkinen et al. [33]. However, this division lacks other important groups of causes of imbalance and falling: collision with a moving object (a cyclist or other vehicle, a running person, etc.); deliberate action of the aggressor; intentional individual and group action of participants in certain sports (most team games, combat sport and martial arts, self-defence training).

In contrast, evidence of a valuable, in-depth analysis of an important, multi-faceted phenomenon related to basic locomotor activity (mainly walking at different speeds on a relatively uniform surface), precisely from the perspective of possible falls, is provided by Howland et al. [34]. The authors comprehensively analyse falls of older people in a variety of circumstances on the facilities of a large airport.

Another example of the need for an in-depth analysis (apparently a very complex issue) are works on the structure of the fall time from the moment of losing balance to hitting the ground in various circumstances. Klenka et al. [35] presenting the results of their research on graphs show acceleration (m/s2), time (seconds), and mark the fall phase. Such a way of presenting the measurement data enables the calculation that the real fall and simulated falls (in laboratory conditions) last from about 1.5 to 2 seconds from the moment of loss of body balance to the impact with the ground. Secondary analysis of the Kangas et al. results [36, 37, 31] allows one to estimate the duration of real and simulated falls (about 2 seconds). Sucerquia et al. [38] analyse accelerations during simulated falls and

the available monitoring of 15 cases shows that the time of each is within 2 seconds. Michnik et al. [27] perform a kinematic analysis of body segments of two men (aged 24 and 65) during a forced sideways fall. The men (safe fall specialists) shuffled in place on a hard surface with each leg wrapped at the ankle in a judo belt. At one point, the assistant tugged at the judo belt and threw the subject off balance. The subjects did not know in which direction the forced fall would occur (right or left). Based on the videos of this experiment made available by the electronic journal, it can be calculated that the side fall during laboratory conditions simulated in this way lasts from about 1 to 1.5 seconds [27].

In these analysed works, it has been repeatedly confirmed that a falling person has less than two seconds to adjust his/her own motor actions from the moment of loss of balance to collision with the ground in such a way as to protect his body from damage or minimise it as much as possible. An in-depth analysis of the work by Michnik et al. [27] opens up the issue of more effective body control in identical circumstances (artificially created) by a man 41 years older. Another study by Michnik et al. [28] (incidentally of the same men) deals with a collision under laboratory conditions with a hard vertical obstacle. There are no publications in the literature bases providing similar empirical evidence. Thus, from this point of view, the work of Michnik et al. [27] is most inspiring and may provide a substantive rationale for designing a study with a larger sample from a population of individuals similar in characteristics to both studied men. The basic criterion for selection is the experience acquired in the course of permanent improvement of safe falling skills. If this criterion of permanence is met, then the 40-year age difference guarantees the validity of the research, which is reduced to the question of whether the ability to fall safely, acquired in youth and refined throughout life, provides optimal protection against damage caused by an unexpected fall on a hard surface.

Observation of the available videos of simulations by Michnik et al. [27, 28] highlights the importance of the cushioning function of the lower limbs (a phenomenon discussed in detail in the work of Jaskólski and Nowacki [6]) and the ability of the motor adaptation of individual body parts to the circumstances of loss of balance, fall, and collision with the ground. This aspect, i.e., the shock-absorbing capacity of the lower limbs, boils down not only to the efficiency of flexion in the ankle and knee joints, but also to positioning them at the correct angle in relation to the torso and the ground [6]. There is also the elimination of unnecessary bracing (extreme muscle tension), so that before the collision of the remaining parts of the body (buttocks, back, hands if they are used as dynamic shock absorbers) one corrects their posture with short steps or jumps with both feet, and moves to a place where there are no things that could increase the negative effects of the collision (stones, glass, other sharp objects, etc.).

The controversy over the second pillar of the WHO concept will continue until there is a revision of the prevention paradigm based solely on eliminating falls. They can be reduced, even to a very high degree. However, they cannot be eliminated from human life altogether. Falling is an immanent part of our earthly existence. The fight against the law of gravity is utopia in the sense that it is impossible to eliminate falls from human physical activity, but this fight can be won if one learns safe fall techniques.

This last statement could be put a little more broadly and precisely, although with more wording. Thus, a rational person subject their activity to laws that they have been able to define. We move by using the law of friction, but we are powerless against the universal law of gravity when we lose our grip on the ground and a fall is inevitable. However, we are not completely helpless in such a situation. A fall in a great many circumstances, considered standard, can be effectively cushioned by a human being without injury. To claim otherwise would be an outright misappropriation of human adaptive capacities, of which scientific knowledge is extensive. On the other hand, through the feats of athletes, commandos, stuntmen, circus artists, dancers, etc., continually provides evidence of the crossing of successive limits of effective control of one's own body in extreme situations.

This is perhaps the strongest argument of the critique of the falls prevention paradigm reduced to a demand to eliminate falls. Proponents of this paradigm tacitly ignore the plausibility of the laws of adaptation. The implications in the realm of an ageing human population will sooner or later translate into an amplification of the fear of falling in people qualifying for higher risk groups.

The consequence is a reduction in daily physical activity and an increased dependence on others, which in turn means a reduction in the quality of life of both groups.

Third pillar: design and implementation of realistic and effective interventions

The third pillar of the WHO model incorporates the personal experiences and achievements of the main founders of the Polish school of fall prevention based on the methodology of safe fall and collision avoidance. As the authors of this publication have their own significant contribution to this unique scientific and application event, we limit ourselves to only the most general information. Instead, we refer to the publication by Iermakov et al. [39], where the authors dedicate the concluding section of the 'discussion' to the issue of the perspective of implementing the unique achievements of the 'Polish School of Safe Falling'. That description captures the most important milestones of this unique project, which has been in operation for more than 50 years.

In this paper, we emphasise three issues. First of all, the effectiveness of programs to prevent the effects of unintentional falls (but also intentional ones, when a fall is to protect against, for example, a collision with a moving object) has been repeatedly verified in the course of educating commandos, military cadets, physical education and physiotherapy students [16, 40-42]. Secondly, that the repeatedly verified fall prevention programs dedicated to various groups at increased risk of such events were consistently implemented, from experiments based on motor simulations with the participation of healthy people [15, 43-47] to clinical trials with the participation of people with visual impairment, after limb amputation, obese, or with cognitive impairment [48-54]. Thirdly, the original achievement of the 'Polish School of Safe Falling' is a wide range of teaching safe falls within the fun forms of martial arts methodology [55-57], as well as unique diagnostic tools: test for safe falls [20]; the susceptibility test to body injuries during the fall (STBIDF [58] and STBIDF-M [59]) and an innovative method of diagnosing the susceptibility to the body injuries during fall of children aged 2 to 6 years [60].

CONCLUSIONS

The introduction of the recommendations of the 'Polish School of Safe Falling' (repeatedly empirically verified) in global prevention of the consequences of unintentional falls will protect the health of many millions of people worldwide and radically reduce the number of people who lose their lives in this seemingly trivial manner. The high degree of generality of the argumentation of this narrative review (due to the extensiveness of the available empirical data) does not undermine the validity of the above recommendation. Thus, calling the fourth (missing) pillar 'universal safe fall education' would neither be a semantic misuse nor even less so incompatible with real evidence-based prevention.

REFERENCES

1. James SL, Lucchesi LR, Bisignano C et al. The global burden of falls: global, regional and national estimates of morbidity and mortality from the Global Burden of Disease Study 2017. Inj Prev 2020; 26(Suppl 1): i3-i11
2. Yoshida-Intern S. A Global Report on Falls Prevention: Epidemiology of Falls. Geneva: World Health Organization; 2007
3. Sattin RW, Rodriguez JG, DeVito CA et al. Home Environmental Hazards and the Risk of Fall Injury Events Among Community-Dwelling Older Persons. J Am Geriatr Soc 1998; 46(6): 669-676
4. Wolf SL, Sattin RW, Kutner M et al. Intense Tai Chi Exercise Training and Fall Occurrences in Older, Transitionally Frail Adults: A Randomized, Controlled Trial. J Am Geriatr Soc 2003; 51(12): 1693-1701
5. Kalina A. Universal character of exercises on safe falls – an empirical verification. In: Kalina RM, Kaczmarek A, editors. Ukierunkowane przygotowanie obronne. Warszawa: Polskie Towarzystwo Naukowe Kultury Fizycznej, Sekcja Kultury Fizycznej w Wojsku; 1997; 3: 100-106 [in Polish]
6. Jaskólski E, Nowacki Z. Teoria, metodyka i systematyka miękkiego padania. Part I. Teoria miękkiego padania. Wrocław: Wyższa Szkoła Wychowania Fizycznego; 1972: 83-88 [in Polish]
7. Barczyński BJ, Graczyński M, Kalina RM. Barriers Restricting the Free Dissemination of Scientific Achievements: Own Experiences in Crossing Walls and Bridges. J Hum Kinet 2009; 22: 7-13
8. Kalina RM, Obodyński K, Przeździecki B et al. Universal teaching the ability safe falling down as the most effective method of the prevention of body injuries. In: Mucha D, Zięba HR, editors. Promocja zdrowia wobec zagrożeń cywilizacyjnych: praca zbiorowa. Nowy Targ: Podhalańska Państwowa Uczelnia Zawodowa; 2007: 279-285 [in Polish]
9. Hsu CL, Nagamatsu LS, Davis JC et al. Examining the relationship between specific cognitive processes and falls risk in older adults: a systematic review. Osteoporos Int 2012; 23(10): 2409-2424
10. Kahneman D. Attention and Effort. Englewood Cliffs: Prentice-Hall Inc; 1973
11. The prevention of falls in later life. A report of the Kellogg International Work Group on the Prevention of Falls by the Elderly. Dan Med Bull 1987; 34(Suppl 4): 1-24
12. Tinetti ME, Speechley M, Ginter SF. Risk Factors for Falls among Elderly Persons Living in the Community. New Engl J Med 1988; 319(26): 1701-1707

13. Ministry of Higher Education and Science. Danish Code of Conduct for Research Integrity [Internet] 2014 Nov [accessed 2023 Feb 29]. Available from: URL:https://innovationsfonden.dk/sites/default/files/2019-02/gs19_the-danish-code-of-conduct-for-research-integrity.pdf
14. Polish National Science Centre. The Code of the National Science Centre on Research Integrity and Applying for Research Funding. Annex no 1 to Resolution no 39/2016 of the NCN Council of 2016 May 11 [accessed 2023 Feb 29]. Available from: URL:https://www.ncn.gov.pl/sites/default/files/pliki/Code-of-the-National-Science-Centre-on-Research-Integrity.pdf
15. Kalina RM, Barczyński B, Jagiełło W et al. Teaching of safe falling as most effective element of personal injury prevention in people regardless of gender, age and type of body build – the use of advanced information technologies to monitor the effects of education. Arch Budo 2008; 4: 82-90
16. Gąsienica-Walczak B, Barczyński BJ, Kalina RM et al. The effectiveness of two methods of teaching safe falls to physiotherapy students. Arch Budo 2010; 6(2): 63-71
17. Kalina RM, Barczyński BJ, Klukowski K et al. The method to evaluate the susceptibility to injuries during the fall – validation procedure of the specific motor test. Arch Budo 2011; 7(4): 203-216
18. Hapek F. Judo: nowa technika i metodyka nauczania oraz profilaktyka uszkodzeń w okresie wstępnym. Kraków: Akademia Wychowania Fizycznego; 1977 [in Polish]
19. Kalina RM. Nauczanie sposobów bezpiecznego padania. Prz Wojsk Ląd 1976; 5: 77-81 [in Polish]
20. Kalina RM, Kalina A. Theoretical and methodological aspects of teaching lower extremity amputees safe falling. Adv Rehab 2003; 17: 71-87
21. Kalina RM. Miękkie lądowanie. Med Tribune 2009; 13: 28-29 [in Polish]
22. Kalina RM. Non-apparatus safe falls preparations test (N-ASFPT) – validation procedure. Arch Budo 2013; 9(4): 255-265
23. Kalina RM. Sporty walki i trening samoobrony w edukacji obronnej młodzieży. Warszawa: Polskie Towarzystwo Naukowe Kultury Fizycznej, Sekcja Kultury Fizycznej w Wojsku; 1997 [in Polish]
24. Sterkowicz S, Chwała W, Ambroży T. Zdolności motoryczne warunkujące rezultat w teście podstawowej umiejętności samoobrony. In: Korzeniowski L, editor. Kształcenie pracowników ochrony: założenia programowe. Kraków: Liport LFK; 2001 [in Polish]
25. Chodała A. Porównanie efektywności dwóch metod treningu fizycznego żołnierzy przygotowywanych do misji „operacje inne niż wojna" [PhD dissertation]. Warszawa: Akademia Wychowania Fizycznego Józefa Piłsudskiego w Warszawie; 2003 [in Polish]
26. Syska JR. Psychomotoryczne efekty uprawiania przez kobiety nowoczesnych form gimnastyczno-tanecznych z elementami samoobrony [PhD dissertation]. Warszawa: Akademia Wychowania Fizycznego Józefa Piłsudskiego w Warszawie; 2005 [in Polish]
27. Michnik R, Jurkojć J, Wodarski P et al. Similarities and differences of body control during professional, externally forced fall to the side performed by men aged 24 and 65 years. Arch Budo 2014; 10: 233-243
28. Michnik R, Jurkojć J, Wodarski P et al. Similarities and differences of the body control during professional collision with a vertical obstacle of men aged 24 and 65. Arch Budo 2015; 11: 27-39
29. Mroczkowski A, Mosler D. Rotating training simulator as an assessment tool measuring susceptibility of the body injuries during the fall caused by an external force – validation procedure. In: Kalina RM, editor. Proceedings of the 1st World Congress on Health and Martial Arts in Interdisciplinary Approach. HMA 2015; 2015 Sep 17-19; Czestochowa, Poland. Warsaw: Archives of Budo; 2015: 202
30. Kotarbiński T, Ajdukiewicz K. Elementy teorii poznania, logiki formalnej i metodologii nauk. Warszawa: Państwowe Wydawnictwo Naukowe; 1986 [in Polish]
31. Kangas M, Vikman I, Wiklander J et al. Sensitivity and specificity of fall detection in people aged 40 years and over. Gait Posture 2009; 29(4): 571-574
32. Kangas M, Vikman I, Nyberg L et al. Comparison of real-life accidental falls in older people with experimental falls in middle-aged test subjects. Gait Posture 2012; 35(3): 500-505
33. Luukinen H, Herala M, Koski K et al. Fracture risk associated with a fall according to type of fall among the elderly. Osteoporos Int 2000; 11(7): 631-634
34. Howland J, Bibi S, English J et al. Older Adult Falls at a Metropolitan Airport: 2009-2010. J Safety Res 2012; 43(2): 133-136
35. Klenk J, Becker C, Lieken F et al. Comparison of acceleration signals of simulated and real-world backward falls. Med Eng Phys 2011; 33(3): 368-373
36. Kangas M, Konttila A, Winblad I et al. Determination of simple thresholds for accelerometry-based parameters for fall detection. Proceedings of the 29th Annual International Conference of the IEEE EMBS Cité Internationale; 2007 Aug 23-26; Lyon, France. Piscataway: Institute of Electrical and Electronics Engineers; 2007: 1367-1370
37. Kangas M, Konttila A, Lindgren P et al. Comparison of low-complexity fall detection algorithms for body attached accelerometers. Gait Posture 2008; 28(2): 285-291
38. Sucerquia A, López JD, Vargas-Bonilla JF. SisFall: A Fall and Movement Dataset. Sensors 2017; 17(1): 198
39. Iermakov S, Podrigalo L, Podrigalo O et al. Means and methods of physical activity in the context of prevention and treatment of Alzheimer's disease (analysis of Russian-language scientific resources) and the perspective of implementing the unique achievements of the "Polish School of Safe Falling". Arch Budo 2022; 18: 121-143
40. Mroczkowski A. Motor safety of a man during a fall. Arch Budo 2015; 11: 293-303
41. Mosler D, Kalina RM. Possibilities and limitations of judo (selected martial arts) and innovative agonology in the therapy of people with mental disorders and also in widely understood public health prophylaxis. Arch Budo 2017; 13: 211-226
42. Mroczkowski A. Susceptibility to fall injury in students of Physical Education practising handball. Arch Budo Sci Martial Art Extreme Sport 2018; 14: 109-115
43. Boguszewski D. Zdrowotne aspekty sportów i sztuk walki. Warszawa: Warszawski Uniwersytet Medyczny; 2017 [in Polish]
44. Gąsienica Walczak B. Motoryczne, metodyczne i mentalne kwalifikacje studentów fizjoterapii z zakresu bezpiecznego upadania – perspektywa prewencji upadków osób z wadami wzroku, z unieruchomioną lub amputowaną kończyną [PhD dissertation]. Rzeszów: Uniwesytet Rzeszowski, Wydział Medyczny; 2017 [in Polish]
45. Dobosz D, Barczyński BJ, Kalina A et al. The most effective and economic method of reducing death and disability associated with falls. Arch Budo 2018; 14: 239-246
46. Kubacki R, Bołociuch M, Rauk-Kubacka A. Teacher Ball Ukemi: metody i narzędzia modelowania sposobów nauczania bezpiecznego upadania. Jelenia Góra: Wydawnictwo AD-Rem; 2020 [in Polish]
47. Blach W, Dobosz D, Gasienica-Walczak B et al. Falls Are the Leading Cause of Injuries among Farmers–Limitations of Practicing Judo in Preventing These Incidents. Appl Sci 2021; 11(16): 7324
48. Gąsienica Walczak B, Kalina RM. Zmodyfikowany test bezpiecznego upadania – aplikacje w diagnozowaniu specyficznych kompetencji motorycznych osób niewidomych. In: Włoch T, editor. Międzynarodowa Jubileuszowa Konferencja Naukowa Wydziału Rehabilitacji Ruchowej AWF Kraków. Kraków: Akademia Wychowania Fizycznego; 2012: 100 [in Polish]
49. Mosler D, Kmiecik-Małecka E, Kalina RM. Zmiany podatności na uszkodzenia ciała podczas upadku pacjentów z zaburzeniami psychicznymi objętych specjalną półroczną terapią poznawczo-behawioralną. Międzynarodowa Konferencja Naukowa Physiotherapy and Health Activity; 2014 Nov 23-25; Katowice, Poland. Katowice: Akademia Wychowania Fizycznego; 2014 [in Polish]

50. Gąsienica Walczak B, Kalina A. Susceptibility of body injuries during a fall of people after amputation or with abnormalities of lower limb. In: Kalina RM, editor. Proceedings of the 1st World Congress on Health and Martial Arts in Interdisciplinary Approach. HMA 2015; 2015 Sep 17-19; Czestochowa, Poland. Warsaw: Archives of Budo; 2015: 193-195

51. Mosler D. Fall as an extreme situation for people with mental disorders: a review. Arch Budo Sci Martial Art Extreme Sport 2016; 12: 87-94

52. Mosler D, Barczyński B, Kalina RM. The use of cognitive-behavioral kinesiotherapy based on innovative agonology methods in reduction of unintentional fall-related injuries of children with developmental disabilities. 19th Global Congress on Pediatricians and Child Psychiatry; 2017 Jul 12-13; Chicago, USA. J Psychiatry 2017; 20(Suppl 4): 53

53. Gąsienica Walczak B. Acceptance of the sense of implementing safe fall programs for people with visual impairments or after amputation of limbs – the perspective of modern adapted physical activity. Phys Educ Students 2019; 23(6): 288-296

54. Gąsienica Walczak B, Barczyński BJ, Kalina RM. Fall as an extreme situation for obese people. Arch Budo Sci Martial Art Extreme Sport 2019; 15: 93-104

55. Kalina RM, Jagiełło W. Zabawowe formy walki w wychowaniu fizycznym i treningu sportowym. Warszawa: Akademia Wychowania Fizycznego Józefa Piłsudskiego; 2000 [in Polish]

56. Jagiełło W, Kalina RM, Klimczak J et al. Fun forms of martial arts in positive enhancement of all dimensions of health and survival abilities. In: Kalina RM, editor. Proceedings of the 1st World Congress on Health and Martial Arts in Interdisciplinary Approach. HMA 2015; 2015 Sep 17-19; Czestochowa, Poland. Warsaw: Archives of Budo; 2015: 32-39

57. Klimczak J, Kalina RM, Jagiełło W. Fun forms of martial arts in diagnosing and reducing aggressiveness – mental effects of a one-day course for Polish animators of sport. In: Kalina RM, editor. Proceedings of the 1st World Congress on Health and Martial Arts in Interdisciplinary Approach. HMA 2015; 2015 Sep 17-19; Czestochowa, Poland. Warsaw: Archives of Budo; 2015: 187-189

58. Kalina R, Barczyński BJ, Klukowski K et al. The method to evaluate the susceptibility to injuries during the fall – validation procedure of the specific motor test. Arch Budo 2011; 7(4): 203-216

59. Gąsienica Walczak B, Kalina RM. Validation of the new version of "the susceptibility test to the body injuries during the fall" (STBIDF-M). Arch Budo 2021; 17: 371-400

60. Kalina R, Dłubacz N, Zachwieja J et al. Innovative method of Diagnosing the susceptibility to the body injuries during the fall of children from 2 to 6 years. Arch Budo Sci Martial Art Extreme Sport. Forthcoming 2022

61. COGNITIVE IMPAIRMENT: A call for Action, Now! 2011 Feb [accessed 2023 Feb 27]. Available from: URL:https://www.cdc.gov/aging/pdf/cognitive_impairment/cogimp_poilicy_final.pdf

62. Bernardo WM, Nobre MRC, Jatene FB. A prática clínica baseada em evidências: parte II – buscando as evidências em fontes de informação. Rev Assoc Med Bras 2004; 50(1): 104-108 [in Portuguese]

Cite this article as: Gąsienica-Walczak B, Klimczak J. Universal safe fall education – the missing pillar of prevention recommended by the WHO. Arch Budo Sci Martial Art Extreme Sport 2023; 19: 67-74