REVIEW PAPER
ARTYKUŁ PRZEGLĄDOWY

Health Prob Civil. 2024, Volume 18, Issue 4
ISSN 2353-6942, eISSN 2354-0265

MENTAL BARRIERS TO REDUCE VULNERABILITY TO INJURY DURING A FALL: AN ELEMENTARY ISSUE OF PERSONAL SAFETY IN A GLOBAL CIVILIZATION

MENTALNE BARIERY REDUKOWANIA PODATNOŚCI NA USZKODZENIA CIAŁA PODCZAS UPADKU: ELEMENTARNE ZAGADNIENIE BEZPIECZEŃSTWA PERSONALNEGO W CYWILIZACJI GLOBALNEJ

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Wkład autorów:
A. Study design/planning
zaplanowanie badań
B. Data collection/entry
zebranie danych
C. Data analysis/statistics
dane – analiza i statystyki
D. Data interpretation
interpretacja danych
E. Preparation of manuscript
przygotowanie artykułu
F. Literature analysis/search
wyszukiwanie i analiza literatury
G. Funds collection
zebranie funduszy

Tables: 0
Figures: 0
References: 74
Submitted: 2024 Aug 25
Accepted: 2024 Oct 14
Published Online: 2024 Oct 18

Summary

The effects of unintentional human falls are seen as a serious public health problem. The cognitive aim of the study was to argue, based on evidence, that radical progress in preventing the consequences of unintentional falls is possible as long as mental barriers are broken down among actors with the potential competence to make changes from the micro to macro scale. Aa a method, a narrative review was used of publications documenting the achievements of the experts of the "Polish School of Safe Falling" regarding the mental aspects of the widespread implementation of methods to reduce the phenomenon of vulnerability to injuries during falls throughout the entire ontogeny. Participants in the main pedagogical experiments declared that: teaching safe fall techniques made sense for both healthy and high-risk individuals (95% of physiotherapy students' responses); all amputees and 83% of patients with visual impairment were convinced that teaching safe fall techniques in high-risk fall groups made sense; one response from a patient with visual impairment (16%) was "I don't know", and none of the respondents denied the advisability of teaching safe fall techniques. The child's natural ability to protect their hands and head during an unintentional fall begins to be lost by the age of three. Therefore, learning how to fall safely is the surest of ways to reduce the number of people who would spend the rest of their lives in disability as a result of injuries sustained in a fall.

Keywords: safe fall techniques, unintentional fall, mental barriers, narrative review, prevention

Streszczenie

Skutki niezamierzonego upadku człowieka są postrzegane jako poważny problem zdrowia publicznego. Celem poznawczym pracy była argumentacja oparta na dowodach, że radykalny postęp profilaktyki skutków niezamierzonych upadków jest możliwy pod warunkiem przełamywania mentalnych barier wśród podmiotów o potencjalnych kompetencjach dokonania zmian od mikro do makro skali. Jako metodę zastosowano przegląd narracyjny publikacji dokumentujących osiągnięcia ekspertów „Polskiej Szkoły Bezpiecznego Upadania" mających związek z mentalnymi aspektami powszechnego wdrożenia metod redukujących zjawisko podatności na uszkodzenia ciała podczas upadku w całej ontogenezie. Uczestnicy najważniejszych eksperymentów pedagogicznych deklarowali, że: nauczanie technik bezpiecznego upadania miało sens zarówno w przypadku osób zdrowych, jak i osób z grup wysokiego ryzyka (95% odpowiedzi studentów fizjoterapii); wszystkie osoby po amputacji i 83% pacjentów z wadą wzroku było przekonanych, że nauczanie technik bezpiecznego upadania w grupach o podwyższonym ryzyku upadków ma sens; jedna odpowiedź pacjenta z wadą wzroku (16%) brzmiała „nie wiem" i nikt z badanych nie zaprzeczył celowości nauczania technik bezpiecznego upadania. Naturalną zdolność ochrony rąk i głowy podczas niezamierzonego upadku dziecko zaczyna zatracać w trzecim roku życia. Dlatego umiejętność bezpiecznego upadania jest najpewniejszym ze sposobów redukowania w przyszłości liczby osób, które na skutek obrażeń doznanych podczas upadku spędziłyby resztę życia w niepełnosprawności.

Słowa kluczowe: techniki bezpiecznego upadania, niezamierzony upadek, bariery mentalne, narracyjny przegląd badań, prewencja

Gąsienica-Walczak B, Kalina A, Litwiniuk A, Baj-Korpak J. Mental barriers to reduce vulnerability to injury during a fall: an elementary issue of personal safety in a global civilization. Health Prob Civil. 2024; 18(4): 453-462. https://doi.org/10.5114/hpc.2024.144111

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Introduction

For several decades, the effects of unintentional human falls have been seen as a serious public health problem. About 684,000 fatal falls occur each year. This makes them the second leading cause of death from unintentional injuries. There are falls that are not fatal (37.3 million) and at the same time are serious enough to require medical attention [1]. The epidemiology of this phenomenon is well documented [1,2]. However, prevention is still failing, and the main causes have to do with many mental barriers.

Iermakov et al. [3] pointed out the phenomenon that falling is probably the greatest threat and cause of stress in patients with Alzheimer's disease. Furthermore, they emphasize that with such dynamics of the phenomenon of unintentional falling, especially in the context of the aging of the human population, it is surprising that the exceptional achievements of the experts of the "Polish School of Safe Falling" are unrecognized in the global scientific sphere. The fact is that fundamental publications appeared behind the "Iron Curtain" and, in addition to that – in Polish. Fifty years have passed, and arguments linking the causes of the status quo to the political events of the time and the effects of social transformation should have little relevance. It is, of course, about the perspective of meaningful recommendations of elementary importance for public health globally, abstracting from other cognitive aspects of this state of affairs from the point of view of sociology, political science, psychology and so on. For this reason, this work does not show in historical order the breakthroughs and recommendations of the experts of the "Polish School of Safe Falling", but combines them with epidemiological data, which, in our opinion, can become crucial in making decisions that are closely related to personal safety.

Aim of the work

The cognitive goal of this article is to argue based on evidence that radical progress in the prevention of the consequences of unintentional falls is possible provided that mental barriers are broken down among actors with the potential competence to make a difference from the micro (individual, group) to the macro (global) scale.

Methods

For the purpose of this article, a narrative review was conducted of publications documenting the achievements of the experts of the "Polish School of Safe Falling" having to do with the mental aspects of the widespread implementation of methods to reduce the phenomenon of vulnerability to injuries during falls throughout the entire ontogeny.

Literature review results

Safe fall as the most effective form of reducing obvious vulnerability to injury from intentional or unintentional falls

The phenomenon of susceptibility to body injuries during the fall (SBIDF) abbreviated as susceptibility to fall injury (SFI) has been empirically studied since 2009. That year, the susceptibility test to the body injuries during the fall (STBIDF) was published, based on three motor activity tasks, with each successive task containing motor modifications having to do with the quality of control of the observed body parts: legs, hips, arms, head [4]. The study included about two thousand people between the ages of 10 and 56 [5-19]. In 2022, the first results on observations of children aged 2 to 6 years based on the innovative fun form of falling (FFF) method were published [20]. Knowledge of the SFI phenomenon has been successively expanded both by the specifics of susceptibility to head injuries during a backward fall with lateral body positioning [21] and by the results of preliminary validation of the susceptibility test to the body injuries during the fall – modified (STBIDF-M) [22].

This modification was based on six simulated backward falls under safe laboratory conditions, and its main advantage is that it multiplies observations of the way the "legs" make contact when jumping backward three times from a 20 cm platform. In contrast, the other body parts indicated by the STBIDF-M test ("hips", "hands", "head") were observed six times (each).

The basic element of the obviousness of the SFI phenomenon is the limited resistance of the soft and hard tissues of the human body to collisions caused by falls. The factor that most strongly modifies the consequences of a collision with the ground is the circumstances of the event, so it is reasonable to divide into intentional falls (characteristic of professional activities especially stuntmen, soldiers, a certain category of athletes training in combat sports, etc.) and unintentional falls. Intentional falls also involve people who take the risk of, for example, leaving a burning room by jumping from a window or balcony of a several-story building. Such choices are made both by people with professional safe fall skills, but adapted to everyday locomotion, and by people unprepared to counter such incidents. Many times the height from which a person falls is that crucial factor that nullifies anyone's chances of survival.

These extreme examples do not negate the validity of teaching safe fall, as the most effective form of reducing SFI and also the easiest to implement. Unfortunately, it is the implementations that are failing, although empirical arguments provide irrefutable evidence that such an educational model is the optimal solution.

Safe hand-to-hand combat – a source of inspiration and separation of a safe fall as a separate motor competence within the framework of personal safety in its broadest sense

A basic prerequisite for the widespread practice of judo (nowadays primarily associated with one of the Olympic combat sports) initiated by Jigoro Kano at the turn of the 20th century is an elementary course in safe falling (Japanese: *ukemi waza*) [23,24]. Injuries and even deaths that are related to judo teaching, training and participation in tournaments are a separate issue [25-28], while injuries sustained while teaching safe falling as part of initial judo learning, self-defense, etc. are yet another. This distinctiveness is not modified by recent trends of judo tournament fight settlement leaders [29]. Artur Kalina [30], at the end of the twentieth century, positively verified the following hypothesis: teaching safe fall techniques – both to children and adults, not excluding people with disabilities (especially amputees) – does not pose a health risk, on the contrary, it has great preventive and psychological significance. The author pointed out that this is basically the hypothesis of Ewaryst Jaskólski and Zbigniew Nowacki, which they formulated somewhat differently and not explicitly in "The Theory of Safe Falling" [31]. Among the 38 judo, ju-jitsu and self-defense educators interviewed, mostly from Poland, was prominent Austrian expert Josef Herzog [32]. The largest number (92.1%) of educators declared teaching safe fall techniques to people aged 16-30, but just as many taught children aged 6-10 (71%) and 11-15 (73.6%). Although only 36.4% of experts declared that they had taught safe falling to people over 40 (mainly professional soldiers and police officers), only in this group were no injuries reported during such courses. The five declarations that such events had occurred, but only once in their individual practice, were for the age groups 11-15, 21-30 and 31-40. In four cases, experts pointed to their own error as the cause, and the incidents occurred early in their teaching careers. The cause of one such incident was the spreading of the mattresses on which the exercises were taking place. More than half of the melee experts surveyed (52.2%) were confident that they had taught safe falls to people who had suffered injuries in the past (and 26.3% did not rule out the possibility), or whose mobility was restricted for other reasons [30].

Proprietary programs for teaching safe falling to adults in physical education and physiotherapy studies [33-36] turned out to be groundbreaking in terms of empirical argumentation. However, when a member of the government advisory commission on the core curriculum for physical education in Polish schools (at the end of the first decade of this century) proposed including the teaching of "safe falling", the opponent's absurd

argumentation – "student falling, it has a bad connotation" – gained recognition, and the proposal was dismissed.

Limitations of prevention based on the premise of eliminating falls, especially for the elderly

A more incomprehensible mental barrier is not so much the ignoring of knowledge about the health effectiveness and social benefits of widespread safe fall teaching (synthetic data is provided, for example, in the work of Dobosz et al. [37]), which ties excessive hope to programs to eliminate falls in people's daily activities [38]. After all, these events are inevitable in the life of any person who adopts a vertical stance.

One of the first multi-factorial intervention programs was the Yale FICSIT (Frailty and Injuries: Cooperative Studies of Intervention Techniques) [39], which involved eliminating or modifying identified risk factors (e.g., walking and balance disorders, risks in the home environment). Those diagnosed with walking and balance disorders were given an individualized exercise program (created by physiotherapists to be performed at home) that included balance and muscle strength training. Compared to the control group (which was visited only by social workers and received usual health care), fewer falls were suffered by those in the intervention group.

Another program is FICSIT (Frailty and Injuries: Cooperative Studies of Intervention Techniques) [40], based primarily on exercise and conducted at multiple centers. Although the structure of the interventions differed in terms of type of exercise, intensity and duration, the aggregate results from the centers showed similar reductions in the risk of falls. The SAFE program (Study to Assess Falls Among the Elderly) [41], involved assessing home conditions and eliminating factors that can lead to loss of balance and falls. Through the implementation of multi-directional measures, a reduction in the risk of falls has been achieved. Robertson et al. [42] analyzed studies conducted at centers in New Zealand. A study group and a control group were formed at each center. In some centers, fall prevention activities consisted of an individually created and controlled program by a physiotherapist. It was based primarily on exercises to strengthen muscle strength and improve balance. At other centers, specially trained nurses delivered the exercises and monitored their correctness. With improved muscle strength and balance, patients in the study group fell less often than those in the control group. Similar results were obtained by Barnett et al. [43]. They also tested elderly people who had a special program prepared by a physiotherapist to strengthen muscle strength and improve balance and coordination and compared the results with a control group.

The Atlanta FICSIT program (Frailty and Injuries: Cooperative Studies of Intervention Techniques) [44,45] was based on a study of three groups of patients at risk for falls. The first group was given balance training (center of mass feedback), the second group was given tai chi classes, and the third group – treated as a control – performed interval exercises. The group of patients practicing tai chi experienced the greatest reduction in fall risk. Also, the study by Li et al. [46] shows that after a six-month tai chi-based improvement program for the elderly, the risk of falling decreased. In order to prevent falls in elderly people living in their social environment, Clemson et al. [47] introduced a program that consisted of: a series of educational classes, a set of exercises (to be performed at home) to improve muscle strength and balance, and a list of activities and recommendations to reduce the risk of falls (these were developed after assessing the risk of falls in homes). The authors showed a reduction in the number of falls after the multifactorial program used. Skelton et al. [48] compared the results of two groups. The first was subjected to a specially prepared strategy (Falls Management Exercise – FaME), which consisted of group exercises under the guidance of a specialist and repetition of these exercises at home. The other, called the control group, received only an exercise program to be performed at home. There was a significant reduction in the number of falls in the first group compared to the second.

The adaptive effect of the aforementioned multifactorial intervention programs aimed at reducing the risk of falls was a reduction in fall risk of only 15% to 48%. Other studies have shown that similar programs are

effective in about 30% to 40% [49].

Other fall-reduction programs (i.e., increased use of wheelchairs, modification of the environment [50], home visits by nurses [51], and increased awareness of patients at risk of falling [52]) are effective to a similar extent. Stark et al. [53] found that a randomized clinical trial of a short program focusing on removing hazards in the home and teaching self-management strategies to prevent falls showed that the intervention did not reduce the risk of falls compared with the control group. However, the program reduced the rate of falls among elderly people living in the community by 38%. Thus, in 60-70% of circumstances when an acting person does not follow the rules of fall prevention, loss of body balance, fall and collision with the ground are inevitable. This objective reality will not change, despite still-published reports on the preventive qualities of tai chi exercises and some hand-to-hand combat systems [54-62].

Anonymous declarations from participants of professional safe fall courses

According to the authors of this paper, the greatest cognitive value, next to the results of specialized motor tests, comes from the results of anonymous surveys of people who have participated in professional safe fall courses. These, because they concern, in addition to the acquired skills, primarily the mental layer remaining in connection with the sense of change in the area of personal security. In a cognitive sense, the results of surveys of people who do not practice safe falling, but who were asked about the usefulness of such a skill, are also interesting.

Seventy-four third-year undergraduate students majoring in tourism and recreation (20 men and 14 women from part-time studies, and 20 men and 20 women from full-time studies) took part in an educational program called EKO-AGRO-FITNESS©. The curriculum-related proposal for this program was "Health-related training and injury prevention". One element of injury prevention was learning how to fall and avoid collisions. Among those surveyed, 76% of respondents said they found the program's qualifications attractive, 7% found them unattractive, and the rest (18%) had no opinion on the subject [63].

On the other hand, 134 physiotherapy students and participants with visual impairment (n=6) and limb amputation (n=8) took part in a program called "Safe fall theory and methodology". Stage I (pilot study) analyzed results from 68 women and 22 men who met the established attendance criterion (90-100%) during the pilot study. In Stage II (core assessment), the accepted attendance criterion (80-100%) was met by 30 women and 14 men. In Stage III (clinical evaluation), 6 adult students (1 female and 5 males) from the Special School and Educational Center for Blind and Visually Impaired Children in Krakow were evaluated. In addition, 8 players from the AMP-football Kraków sports club underwent clinical evaluation. At the end of the experiment in Stage I, almost 95% of all students were convinced that teaching safe fall techniques made sense, both for healthy people and those in high-risk groups. At the end of the Stage II of the experiment, more than 95% of the students surveyed were convinced that teaching safe falling to healthy participants and those at increased risk made sense, and none of the students denied this. At the end of the Stage III of the experiment, all amputee patients and more than 83% of visually impaired patients were convinced that teaching safe fall techniques to groups at increased risk of falls made sense. One response from a visually impaired patient (16%) was "I don't know", and none of the respondents denied the wisdom of teaching safe fall techniques [12,64].

Conclusions

In a sense, the main implications of the idea of "A physiotherapist in every school" [65] are a synthetic summary of the above argumentation. The authors of this innovative proposal point to the ability to fall safely in a myriad of circumstances as a distinct component of motor safety that fills the ontogeny from the moment of adopting a vertical posture [20,66] to late adulthood [67], when the risk of losing balance and falling during daily

activities at home and in its immediate surroundings increases [68-71]. Experts in the new applied science of innovative agonology (INNOAGON) [72] provide not only evidence-based justifications that falls are a real threat regardless of age, but also specific methods for diagnosing and reducing SFI [4,6,10,12,18,20,22,33-35,66,67].

Among these methods, the ability to fall safely is first and foremost the surest of ways to reduce the number of people who would spend the rest of their lives in disability as a result of injuries sustained during a fall (simply because they lack this elementary skill, identified rightly with preventive medicine of the future [73]). The child's natural ability to protect their hands and head during an unintentional fall begins to be lost by the age of three [20,66]. This seemingly trivial discovery by the experts of the "Polish School of Safe Falling" consisted of more than half a century of empirical research inspired also by the theory of safe falling, published in Polish in 1972 [31]. The justification of the phrase "seemingly trivial discovery" is the fact that from 1902 to March 2023, authors of 1,568 Web of Science-qualified publications in various disciplinary categories used the term "self-defense" in the titles of those papers [74], but never in the context of protection against the consequences of loss of balance and unintentional falls. Moreover, never, as an opportunity for effective "self-defense" (e.g., to avoid colliding with an object in motion) precisely by using professional falling techniques (Japanese: *ukemi waza*).

Disclosures and acknowledgements

The authors declare no conflicts of interest with respect to the research, authorship, and/or publication of this article.

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Artificial intelligence (AI) was not used in the creation of the manuscript.

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