The correlation between consumption of benzodiazepines and fall-tendency in elderly people — A literature study

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Abstract

**Background:** According to the Swedish Civil Contingencies Agency, medication is included in the top three most common risks for falling in the older population. Elderly people are here defined as individuals aged 65 or more. Benzodiazepines (BZDs) are associated with many adverse effects and complications out of which falls and fractures are mentioned in many studies. The aim is to study the correlation between the fall tendency in elderly people and their consumption of benzodiazepines.

**Methods:** PubMed has been used to search for articles. In order to find articles in the area of benzodiazepines, falling and hip fractures, keywords as benzodiazepines, falling and hip fractures were used. Only articles published between the year 1990 and 2015, written in English and with both genders were included. Studies with participants younger than 65 and studies about falls and hip fractures caused by other reasons than benzodiazepines were excluded.

**Results:** Two articles could not find any correlation between BZDs consumption and risk of falling. Both studies had included short-acting BZDs that did not show correlation to falling. The nine remaining articles show a clear relationship between the consumption of BZDs and falling in the elderly.

**Conclusion:** There is a statistically significant correlation between BZDs consumption and fall-tendency in elderly people. This conclusion is supported by several other studies but a review based on more prospective studies is needed for more reliable results.

**Keywords:** falls; benzodiazepines; polypharmacy; elderly people; multimorbidity.
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Background

Elderly people, fall and its consequences

The World Health Organization describes a fall as “an event which results in a person coming to rest inadvertently on the ground or floor or other lower level”\(^{(1)}\). Swedish statistics show that around 70,000 elderly people who fall need health care; almost 10% of the falls result in serious injuries and 1-2% in hip fracture or death\(^{(2)}\). Falling contributes with 90% of all hip fractures\(^{(3,4)}\) and it is therefore most important to prevent falling. Of all the medication prescribed, 40% are to the older population. Statistics show that the Swedish population which is 80 years and older use averagely five to six medications each but the variation is big; between one and 42 medications each. Approximately 15% of these people have 10 or more medications\(^{(5)}\).

The economic burden to the healthcare system that results from such falls and their complications is huge; 14 billion SEK in social costs due to elderly people falling. And the forecast is not looking bright with an estimated 22 billion SEK in 2050\(^{(6)}\). Also, deaths caused by falls is estimated to be doubled from the year 2010 to 2050 if no action is taken\(^{(5)}\).

It is claimed that around 17% of all white women aged 50 are at risk of having a hip fracture once in their life-time\(^{(7)}\) and that the risk of falling and getting a hip fracture increases with 35-40% if using benzodiazepines\(^{(8, 9)}\). The risk of hip fracture is at highest the two first weeks of use and decline thereafter\(^{(9, 10)}\).

Falls in the older population are a common and an important public health problem. Falls usually result from an interaction between different risk-factors of which medications have a big and important place, especially in the older population\(^{(11)}\). An estimation of 33% of individuals over 65 years of age and 50% of those aged over 80 fall every year. Falls are of higher frequency in hospitals than in the community and account for significant part of the hospital-acquired injuries. Falling, involving severely diseased patients including the elderly in the hospital, may have severe consequences for this group of population\(^{(12)}\). Studies have shown that inappropriate prescribing of benzodiazepines (BZDs) in elderly people may result in adverse effects that significantly decrease the quality of life\(^{(13)}\).
Falls prevention is a target of high clinical importance in the management of elderly people. Injuries resulted from falls are associated with morbidity, functional status decline, increased probability of nursing home placement and also increased use of medical services. In the cases where a fall does not lead to a serious injury, there will be a high risk of institution placement and that is supposed to be partly due to confidence loss leading to a general decrease in function.\(^{(14)}\) Generally, hospitalization-caused falls have big impact on health-related quality of life of the patient but also social and economical consequences on their families and societies.\(^{(15, 16)}\)

Medications and fall risk in elderly people

According to the Swedish Civil Contingencies Agency, medication is included in the top three most common risks for falling in the older population.\(^{(17)}\) Among others, reduced balance and muscle strength are also included in the top list. Elderly people are commonly defined as individuals aged 65 or more.\(^{(18)}\) Almost 9% of the Swedish population aged 75 or more consume 25% of all medications prescribed in total.\(^{(19)}\)

Anxiolytics are medications that are often prescribed to the older population with underlying anxiety, sleeping disorders and depression. BZDs are one of the alternatives that are often prescribed for these indications. The side effects are drowsiness, dizziness, confusion, ataxia, lethargy and muscle weakness.

Around 30% of the general population have sleeping disorders commonly referred to as insomnia – a medical condition that is often an indication for BZDs. Insomnia is defined as the inability of falling asleep or remaining asleep. Sleeping disorders are common and can be the results of secondary underlying medical conditions, but can also be the cause to many psychiatric disorders. It is estimated that 40% of the ones with insomnia also suffer from depression – which can both be a risk for and a result from insomnia.\(^{(20)}\)

Multimorbidity is an increasing health-issue in elderly people leading to an increase in prescribing medications in this group of population. This will in its turn lead to higher risk of drug-drug interactions and adverse effects.\(^{(21)}\) In the older population, the increasing age results in pharmacodynamic and pharmacokinetic changes that affect the distribution of different medications especially the lipophilic ones BZDs due to the redistribution of body mass fat in this group of population.\(^{(22, 23)}\) Changes in the body mass composition with the
increasing age as reduction in water contents but also liver size reduction of up to 25-35% followed by a decrease in the hepatic blood flow of nearly 40% are seen in the process of aging. These changes result in reduced drug clearance meaning a longer bioavailability of these drugs leading to diverse adverse reactions.\(^{(14)}\) It has been shown in one study that women treated with long-acting BZDs are at higher risk of hip fracture,\(^{(24)}\) while no difference has been found in the use of long-acting and short-acting BZDs in another study.\(^{(9)}\)

Chronic medical conditions and diseases are more common in the older population than the youth population. This results in that the elderly people consume more medications and are more prone to adverse reactions. Due to these facts, the term PIMs, Potentially inappropriate medications, was developed. It is defined as medications of which adverse risks are exceeding their health benefits compared to alternative therapies. Medications included in the PIMs are preventable cause of medical and socio-economic complications.\(^{(25-29)}\)

One of the most commonly used and highly popular medical guidelines for prescribing PIMs for the elderly people is Beers Criteria. Mark. H. Beers, an American geriatrician created Beers Criteria and it was released for the first time in 1991 and updated several times 1997, 2003, 2012 and the latest update in 2015.\(^{(30-33)}\)

Inappropriate medication prescription and use among the elderly people in combination with polypharmacy is known to result in multiple adverse reactions, cognitive dysfunction, falls, noncompliance among the patients but also increased hospitalization and mortality.\(^{(34, 35)}\)

Benzodiazepines

Benzodiazepines are a group of drugs that were introduced in the year of 1961. Their site of action is on the central nervous system. These psychoactive drugs are used in sleeping disorders due to their hypnotic effect. The chemical structure of BZDs is a seven membered heterocyclic ring that contains a carbox-amide group (see picture 1). A substitution in the seventh position with a halogen or a nitro group is required for the hypnotic activity. Disadvantages of benzodiazepines are the risk of dependence but also tolerance and depression of central nervous system functions.\(^{(36)}\)
Studies have shown that polypharmacy is an important risk factor of falls, in which BZDs have been consistently associated. Although many studies suggest that the association may not be significant when they are prescribed following correct indications.\(^{(37)}\)

Despite the fact that elderly people is more sensitive to BZDs side-effects due to the increasing age and the physiological changes related to it, BZDs are one of the most prescribed medications for the elderly people.\(^{(38-42)}\) The already known age-related decrease in kidney function, liver function and the plasma protein binding result in higher risk of adverse reactions due to the consumption of different medications including BZDs.\(^{(43)}\)

Many studies of BZDs and elderly people show that BZDs cause falls leading to hip fractures. Furthermore, several epidemiological studies found that 50% increased risk of falling is achieved by the use of BZDs. As a matter of fact, reducing the dose of BZDs reduces the risk of falling by 66\%.\(^{(44)}\) Costs caused by falls and the complications that follow are increasing. These costs are expected to increase even more over the next coming 50 years due to the increase in the older population.\(^{(45)}\)

Benzodiazepines are associated with many adverse effects and complications out of which falls and fractures are mentioned in many studies. Due to these risks BZDs are not recommended for the treatment of the elderly people and if indicated for a specific case, then it is recommended that the use should be in short term. Despite that, BZDs use is increasing
with the increasing age and the elderly people are more likely to use these medications long term.\(^{(46, 47)}\)

The most common adverse effects of BZDs are due to their action on the central nervous system (CNS). They have depressant effects that result in sedation, muscle weakness, respiratory depression and drowsiness. These effects are due to the nature of pharmacology of the BZDs which enhance the activity of gamma-aminobutyric acid (GABA), that is a major inhibitory neurotransmitter in the central nervous system.\(^{(48, 49)}\)

Benzodiazepines are still one of the most frequently used drugs by the elderly people. There are several indications for which these drugs are prescribed for, but these are mostly prescribed for sleeping disorders which are of high prevalence in this group of population\(^{(48)}\). It is well-known that BZDs are prescribed for symptomatic treatment of sleeping disorders, meaning that they give relief but also dependency. If the underlying disorder is not curatively treated which is noticed in the majority of the cases, then further prescribing of BZDs, even in higher dosages will prolong this persisting health issue.\(^{(32)}\)

Benzodiazepines are indicated and prescribed for short-term treatment of anxiety and sleeping disorders but with time, the prescription becomes long-term and this is due to several factors. One of these factors is the physicians attitude toward the BZDs and toward the patients treated by the physician that might be seen as a "deserving" patient, meaning that the physician might continue prescribing BZDs despite their impropriety toward the patient. The clinical health environment where the physician is working, and patients’ different health priorities in addition to the different level of adherence to the general guidelines of other physicians involved in the patient care are also very important factors that have a big impact on the chronicity of this process of prescription.\(^{(50, 51)}\)

Because of the multiple and well-know adverse effects of BZDs, several clinical practical guidelines have advised physicians against the use of BZDs for longer than four weeks. Therefore, many health-agencies around the world made several anti-BZDs campaigns. However, many recent studies show that such actions and recommendations have not had a big impact on the use of BZDs worldwide.\(^{(52, 53)}\)
It has been shown in several studies that physicians continue to find it difficult to stop prescribing BZDs when they once started. Causes are different and may be difficulties in making decisions from both physician and patient perspective. It may be uncertainty to stop prescribing medications started by other physicians, limited knowledge about stopping medications and of course the concern of possible withdrawal effects.\(^{(54, 55)}\)

Appropriate prescribing of medications especially BZDs for elderly people is of major importance due to the fact that this group of population is increasing and will increase even more in the coming years especially in the industrial countries.\(^{(56, 57)}\)

Since statistics show that medication is included in the top three most common risks for falling in the elderly,\(^{(17)}\) it is important to analyze the correlation between medications consumption and in this case BZDs and falling risk in the elderly. In addition to the previously described importance, BZDs are considered to be one of the most common causes of falling resulting in hip fractures in the elderly, but this association which has been widely studied, has shown variety of findings which makes it important to do more research on this topic.\(^{(24, 58-60)}\)

Aim

The aim is to analyze the correlation between the fall tendency in elderly people and their consumption of benzodiazepines.
Methods

The author of this study has chosen to perform it as a literature study. PubMed has been used since it has a great storage of articles about medicine. In order to find articles in the area of benzodiazepines, falling and hip fractures, keywords as *benzodiazepines*, *falling* and *hip fractures* were used in different combinations.

**Inclusion criteria:** Articles published between the year 1990 and 2015. Only articles written in English were included. Both genders included in the study.

**Exclusion criteria:** Studies with participants younger than 65. Falls and hip fractures caused by other reasons than benzodiazepines.

Searching process

When the author found articles, he read the abstract and decided then if the article fulfilled the inclusion criteria. If so, he would go to the method-part and read to see if the article met the criteria (table 1).

*Table 1. Searching process.*

<table>
<thead>
<tr>
<th>Keywords, combinations</th>
<th>Number of matching articles</th>
<th>Number of articles included in the results according to inclusion and exclusion criteria</th>
</tr>
</thead>
</table>
| Benzodiazepines + hip fracture + elderly| 77                          | 7
|                                         |                             | PMID:                                                                                   |
|                                         |                             | 22091502                                                                               |
|                                         |                             | 20931664                                                                               |
|                                         |                             | 24917232                                                                               |
|                                         |                             | 11264208                                                                               |
|                                         |                             | 11384896                                                                               |
|                                         |                             | 8598503                                                                                |
|                                         |                             | 8479356                                                                                |
| Benzodiazepines + hip fracture + falling| 7                           | 0                                                                                       |
| Benzodiazepines + falling + elderly     | 93                          | 4
|                                         |                             | PMID:                                                                                   |
|                                         |                             | 25398701                                                                               |
|                                         |                             | 19627577                                                                               |
|                                         |                             | 23375674                                                                               |
|                                         |                             | 18184030                                                                               |
Results

Articles included the results are presented in table 2. Eleven articles from 1993 to 2014 show different conclusions regarding the consumption of benzodiazepines and falling in the older population. Two articles (number 4 and partially number 6) could not find any correlation between BZDs consumption and risk of falling. Both studies had included short-acting BZDs that did not show correlation to falling. Though study number 6 had included a combination of two or more BZDs that showed to increase the fall risk. The nine remaining articles show a clear relationship between the consumption of BZDs and falling in the elderly people.

<table>
<thead>
<tr>
<th>Article number and title</th>
<th>Year, country, journal and authors</th>
<th>Aim</th>
<th>Participant(s) (n)</th>
<th>Methods, selection and statistical method</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Risk of fractures requiring hospitalization after an initial prescription for zolpidem, alprazolam, lorazepam, or diazepam in older adults.</td>
<td>2011, USA, Journal of the American Geriatrics Society, William D. Finkle, PhD; Jane S. Der; Sander Greenland et al.</td>
<td>Comparing zolpidem with different benzodiazepines in order to see if zolpidem is safer.</td>
<td>nZolpidem= 43343  nAlprazolam= 103790  nLorazepam= 150858  nDiazepam= 93618  nTotal = 391609</td>
<td>Retrospective cohort study. Poisson regression</td>
<td>Zolpidem were no safer than diazepam and induced a higher risk of injury than alprazolam and lorazepam. A high incidence of fractures are caused by these treatments. RRs for the 90-day posttreatment interval relative to the pretreatment interval: • Zolpidem: 2.55 (95% CI = 1.78-3.65; P &lt; .001) • Alprazolam: 1.14 (95% CI = 0.80-1.64; P = .42) • Lorazepam: 1.53 (95% CI = 1.23-1.91; P &lt; .001) • Diazepam: 1.97 (95% CI = 1.22-3.18; P = .01)</td>
</tr>
<tr>
<td>2. Trends of benzodiazepine prescribing and the risk of hip fracture in elderly patients in Taiwan: A population-based study.</td>
<td>2010, Taiwan, International Journal of Psychiatry in Clinical Practice, Agnes L.F. Chan; Shun-Jin Lin et al.</td>
<td>Explore the trends of potentially inappropriate BZD use (PIBU) and determine how this affect fractures in elderly.</td>
<td>nTotal= 200000</td>
<td>Retrospective administrative database analysis. Chi-squared test and multiple logistic regression analysis</td>
<td>The risk for fractures is increased with potentially inappropriate benzodiazepine use. The trend of PIBU seems fortunately to reduce. From 2000 to 2003 there was a decline from 28.1 to 25% and 19.5 to 14.5% in the proportion of patients taking BZDs (P&lt;0.001). Risk of hip-fractures (~50%) OR: 1.57, 1.38, 1.68, 1.45 for patients taking BZDs.</td>
</tr>
</tbody>
</table>
### 3. Hazardous benzodiazepine regimens in the elderly: effects of half-life, dosage, and duration on risk of hip fracture.

<table>
<thead>
<tr>
<th>Year</th>
<th>Country</th>
<th>Authors</th>
<th>Methodology</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>USA</td>
<td>Am J Psychiatry, Philip S. Wang; Rhonda L. Bohn; Sc.D. Robert J. Glynn et al.</td>
<td>Retrospective, cohort study, Chi-squared test</td>
<td>Treatment with benzodiazepines seem to increase the risk of hip fracture, even in low dosage. The risk is highest when initiating therapy and after one month of use. No significant difference was seen between shorter and longer half-life agents. 50% increase for all BZDs doses &gt;3 mg in diazepam equiva1ents and 60% increase after &gt;1 months continues use.</td>
</tr>
</tbody>
</table>

### 4. Sedative-hypnotic drugs and the risk of hip fracture.

<table>
<thead>
<tr>
<th>Year</th>
<th>Country</th>
<th>Authors</th>
<th>Methodology</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>USA</td>
<td>Journal of Clinical Epidemiology, Diane K. Wysowski; Carlene Baum; William J. Ferguson et al.</td>
<td>Retrospective, cohort study, Chi-squared test</td>
<td>The use of short- and ultra-short-acting benzodiazepines did not show to increase the risk of hip fracture in people aged 65 or older. RR=0.92 (95% CI 0.71-1.17) for Temazepam with Triazolam as referent group.</td>
</tr>
</tbody>
</table>

### 5. Psychotropic medications, including short acting benzodiazepines, strongly increase the frequency of falls in elderly.

<table>
<thead>
<tr>
<th>Year</th>
<th>Country</th>
<th>Authors</th>
<th>Methodology</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>Netherlands</td>
<td>Maturias, The Netherlands, Astrid M. van Striena; Huiberdina L. Koeka; Rob J. van Marumb et al.</td>
<td>Retrospective cohort study, Chi-squared test and T-test</td>
<td>Benzodiazepines increase the risk of falling considerably. Frequent falls significantly associated with exposure to: • Psychotropic medications: OR 1.96; 95% CI 1.17-3.28 • Antipsychotics: OR 3.62; 95% CI 1.27-10.33 • Hypnotics and anxiolytics: OR 1.81; 95% CI 1.05-3.11 • Short-acting benzodiazepines or Z-drugs: OR 1.94; 95% CI 1.10-3.42 • Antidepressants: OR 2.35; 95% CI 1.33-4.16</td>
</tr>
</tbody>
</table>

### 6. Benzodiazepines and hip fractures in elderly people: case-control study.

<table>
<thead>
<tr>
<th>Year</th>
<th>Country</th>
<th>Authors</th>
<th>Methodology</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>France</td>
<td>BMJ, Corinne Pierfitte; Gerard Macouillard; Michel Thicoipe et al.</td>
<td>Case-control study, Mann-Whitney test, Chi-squared test and Fisher’s exact test</td>
<td>Benzodiazepines did not show a tendency to increase the risk of hip fracture (OR 0.9, 95% CI 0.5 to 1.5). Except for lorazepam who gave a significant increase risk (1.8, 95% CI 1.1 to 3.1). Combining two or more benzodiazepines also increased the risk significantly.</td>
</tr>
</tbody>
</table>

### 7. Impact of drug interactions, dosage, and duration of therapy on the risk of hip fracture associated with benzodiazepine use in older adults.

<table>
<thead>
<tr>
<th>Year</th>
<th>Country</th>
<th>Authors</th>
<th>Methodology</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>Germany</td>
<td>Wiley Online Library, Kristina Zint; Walter E. Haefeli; Robert J Glynn et al.</td>
<td>Case-control study, Chi-squared test</td>
<td>The hip fracture risk by Benzodiazepines is increased when administrating other interacting drugs and at high doses. The risk is highest at initiation. RR for overall BZD use and hip fracture: 1.2, 95% CI 1.1 to 1.2 RRs for concomitant use of the following drugs and their interacting drug: *Alprazolam 1.5, 95% CI 1.3 to 1.7 *Lorazepam: 1.9, 95% CI 1.7 to 2.2 *Zolpidem: 1.7, 95% CI 1.4 to 2.0 for BZD use initiated within 14 days preceding the index date. RR increased with increasing BZD dose.</td>
</tr>
</tbody>
</table>
Discussion

Our data show that the majority of the included articles in this study report a correlation between BZDs consumption and fall-tendency in the elderly. In our study the aim was to study the relationship between the BZDs intake and falling in the elderly. We wanted to search for studies to end up with a likely conclusion.
A study from 1996 and one study from 2001 show no increased risk of falling in the elderly people consuming BZDs (partially study number 4 and 6). Later studies show a correlation between BZDs consuming and falls in elderly people (studies 1-3, 5 and 7-11). Interestingly there is one study, study number 4, that shows that BZDs consumption – both short acting and ultra short acting ones – do not increase the risk of falling in the older population. Short-acting BZDs seem to not increase the fall risk due to the fast elimination in the body, as well as their metabolites.\(^{(61)}\) It has been seen that the dose may affect the risk of falling more than the time of elimination\(^{(62)}\) but unfortunately, the dosage of the BZDs was not included in this study.

Retrospective cohort studies and case control studies are of lower scientific evidence than prospective studies because of recall bias – but they are cheaper, faster to conduct and require less resources than the prospective ones. When conducting a prospective study, the bias is lower than in a retrospective study since the scientists do not know if any results of interest will occur.\(^{(63)}\) According to our results the two studies showing no correlation were retrospective cohort/case control but both have low scientific evidence, due to the fact that in study number 6 one method was that participants were given a questioner with different BZDs names to recognize. This method may not be so accurate since many elderly people (younger people as well) may have difficulties in remembering exactly what medications they have taken. In study number 4 there were no control group which weakens this specific study. We do find that for example study number 6 is stronger since it is a randomized prospective placebo study.\(^{(63)}\)

The majority, nine of eleven of the studies included in our results, show that there is a significant correlation between BZDs and falling in the elderly. Study number 1, 2 and 7 have more than 100,000 participants and a high power. Study number 8 and 5 have less than 1000 participants though still having the same results as the previously named studies with higher number of participants.

Study number 6 shows no significant fall tendency when consuming BZDs except for Lorazepam and when combining two different BZDs. The weakness of this study is that the method was to study the correlation on one occasion and only in one hospital. Also the questionnaire that were used for those patient that had hip-fractures was not optimal due to
the fact that elderly people may have difficult to remember if they took their pills (BZDs) before their fall or not. In addition, although plasma extracts were collected to check for BZDs, elderly people taking BZDs occasionally will not have BZDs in their plasma and that will not indicate a correlation and not lead to a conclusion of reliable result. Study number 4 is a register study and has therefore a high number of participants. It shows no correlation between consuming BZDs and fall tendency in the elderly. It is hard to know if the results are reliable since we do not know if the register used is good. The weakness of this study is that all participants consumed BZDs (a group consumed Triazolam and the other group Temazepam) and no control-group that were not consuming BZDs were included. Due to that a conclusion about whether BZDs consumption increases the falling risk or not can not be drawn. A weakness in both these studies is that none of them did any research on whether the fall risk was dose dependent.

Study number 3 as for the above-named studies is retrospective including over 6,000 participants shows a significant correlation between BZDs intake and falling in the elderly. Study number 9 has the same results as well and has more than 3,000 participants.

Unlike the other studies, study number 10 and 11 are prospective – making them more reliable with less risk of bias in comparison with the other retrospective studies. In addition, the number of participants is good with 2,400 and 6,300 ones respectively. We do consider that having included studies with a large number of participants and a few prospective ones, gives a high power.

The general understanding and recommendation by many studies that are done and included in our study is that BZDs are medications that are widely used especially in the older population. These are prescribed for many indications as anxiety disorders and sleeping disorders as insomnia which approximately 30% of the general population suffer from. Untreated anxiety and sleeping disorders may lead to complications such as excessive tiredness and unexpected falling asleep and the related falls and unwanted events that may follow. Treatments with BZDs are symptomatic and attempts to treat the underlying disorders are the golden standard method of treatment.

Prevention strategies regarding falling risk and tendency in the older population are of high importance especially involving elderly people consuming BZDs. Such strategies are dosage
reduction that might contribute up to 66% of reduced falling risk.\(^{(44)}\) One weakness from study number 1, 4-6, 8, 9 and 11 is that they did not do any researches on whether the fall risk was dose dependent. The method of only looking into if the participants used BZDs or not may be criticized since it makes it harder to compare different studies. Also, introducing and developing medical guidelines to ensure the correct prescriptions of the different medications leading to various adverse effects is one of the other important strategies.\(^{(30)}\)

Since this study is a literature study, the method was searching, studying and compiling the results of the included studies – but also exclude studies that did not meet the inclusion criteria. Study-matches that were in other languages for example in Dutch, Italian, French and Japanese were automatically excluded (four studies). The cause was that the author was not able to translate these articles and performed studies. Several study-matches were excluded also due to the fact that they were not available for the author in full-text despite the fact that they met the inclusion criteria that were decided by the author of this study (six studies). It is hard to tell if the results of these excluded studies would influence the results of this literature study depending on the conclusion that was made on these studies. Due to the fact that the articles included in this study have different study types, a meta-analysis could not be implemented and no statistical analysis were performed.\(^{(65)}\)

The strength with this literature study is that the studies in the results are from different countries witch is good since every country has its own guidelines when prescribing BZDs. The guidelines can vary for example the first choice in terms of BZDs, the dose, time of treatment and combinations. Also, it is good that studies with different sizes and study designs are included for a variety.
Conclusion

This study is of great importance due to the high workload on healthcare facilities that falls and hip fractures cause. It is also highlighting and increasing the awareness of the possible consequences that may result of too high level of sleeping pill prescriptions by physicians. The burden on the economy of the healthcare system that results from such falls and their complications are huge and the forecast is not looking bright. Also, this study has clinical relevance since increase in knowledge can help developing preventive strategies to avoid falls and their outcome.

We conclude that from the founded articles in our results that there is a correlation between consumption of BZDs and fall-tendency in elderly people even though no significance could be demonstrated. This due to that the majority of the articles did show a significant correlation, even the prospective studies. This conclusion is supported by several other studies but a review based on more prospective studies is needed for more reliable results.


17. Myndigheten för samhällsskydd och beredskap, 2012


