

# Evaluation of Information about Medication use in Education Materials on Falls Prevention

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## ABSTRACT

**Background:** Fall-risk increasing drugs (FRIDs) are medications that can increase the risk of falls (ROF) among older people (OP). However, OP were shown to have little knowledge or awareness about FRIDs. Additionally, education materials (EMs) on falls prevention infrequently cover topics on FRIDs. This study aims to assess the freely available EMs on falls prevention to determine the content and extent of information about medications that are associated with falls. **Methods:** A systematic Internet search was conducted to identify EMs on falls prevention. Each EM was reviewed to identify information on (1) medications as a risk factor for falls; (2) type of medications associated with falls; (3) adverse effects of the medications; (4) medication review; (5) advice that OP should communicate with healthcare providers about medication use; and (6) advice for ensuring the safe use of medications. **Results:** Overall, 83 EMs on falls prevention were assessed. Only 33% of the EMs provided examples of drug classes associated with falls. Most EMs highlighted central nervous system (CNS) and cardiovascular (CV) drugs as FRIDs. About half of the EMs contained information on the adverse effects of medications associated with falls. Only 39% of them had information on

medication review. Advice to encourage OP to communicate with HCPs, and to ensure the safe use of their medications was only available in about half of the EMs. **Conclusion:** The analysis highlights the content gap in the existing EMs on falls prevention. Future developers of EMs on falls prevention may consider strengthening their content on FRIDs.

**Keywords:** Education material, Fall-risk increasing drugs, Falls, Medications, Older people.

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DOI: 10.5530/jyp.2022.14.41

## INTRODUCTION

Falls are common among older people (OP) and can result in injuries such as fractures, dislocations, open wound contusion, and sprains/strains of joints or muscles.<sup>1</sup> Such fall-related injuries can lead to hospitalisation<sup>2</sup> and may affect the quality of life of OP.<sup>3</sup> Falls may also lead to fear of falling (FOF), which often results in reduced daily living activities and further physical function limitations.<sup>4</sup> Moreover, falls are the leading cause of injury-related mortality among OP, the prevalence of which has increased annually over time.<sup>5</sup>

Fall-risk increasing drugs (FRIDs) are medications that can increase the risk of falls (ROF) among OP<sup>6</sup> mainly through their pharmacological actions which affect the central nervous system (CNS)<sup>7</sup> or blood pressure.<sup>8</sup> The pharmacological effects the drugs have on the CNS may lead to dizziness and drowsiness, whereas their effects on blood pressure may result in orthostatic hypotension (OSH). Such adverse effects can impair the stability of OP and increase their ROF.<sup>6</sup> It is important to note that OP are generally more prone to these adverse effects since the changes in their physiological functions alter the pharmacokinetics and pharmacodynamics of drugs.<sup>9</sup>

FRIDs commonly used by OP include CNS drugs (e.g., benzodiazepines, antidepressants, and antipsychotics) and cardiovascular (CV) drugs (e.g., diuretics,  $\alpha$ -blockers,  $\beta$ -blockers, and calcium channel blockers).<sup>10-11</sup> Other FRIDs include antidiabetic drugs and analgesics.<sup>12-13</sup> Previous studies have shown that OP who have fallen were frequently using FRIDs.<sup>6,14</sup> A systematic review reported that 65% to 93% of OP

with a fall-related injury were using FRIDs at admission.<sup>15</sup> In a study in Denmark, 87.5% out of 200 OP admitted to a hospital due to hip fractures were using at least one FRID.<sup>16</sup> In another study in Malaysia, 17.4% and 60.3% of OP who had fallen were using one and  $\geq 2$  FRIDs, respectively.<sup>10</sup> Even after hospital discharge following a fall-related injury, OP frequently continue to be prescribed FRIDs. For instance, in a study in Spain, out of 228 OP with hip fractures, 95% were discharged with FRIDs. Alarming, 35.5% of them were discharged with more than three FRIDs.<sup>17</sup>

Although being common FRID users, OP have been reported to have little knowledge or awareness about these medications and their adverse effects. This was demonstrated in studies conducted in the United States (US) and Canada, which reported that many OP could not recognise FRIDs or were largely unaware of their adverse effects.<sup>18-19</sup> Additionally, a qualitative study undertaken by Bell *et al.* (2017) reported that Norwegian OP did not recognise medications as a major risk factor of falls, and often blaming other factors such as worsening eyesight, other diseases, and their environment (e.g., a slippery floor or icy ground outdoors) for their falls.<sup>20</sup> The low awareness OP have about FRIDs has been recognised as an important issue in OP care by the European Geriatric Medicine Society (EuGMS) Task and Finish group on FRIDs.<sup>21</sup> The professional bodies recommend the dissemination of FRID knowledge to OP through the use of the media, as well as education materials (EMs) such as brochures and posters.<sup>21</sup>

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EMs are a common method of providing knowledge to OP on various health-related topics.<sup>22</sup> Examples of these include self-care for OP with heart failure,<sup>23</sup> nutrition education for diabetic OP,<sup>24</sup> and oral health.<sup>25</sup> Examples of the EMs available that cover a specific aspect of falls prevention include booklets on nutrition education,<sup>26</sup> home renovation,<sup>27</sup> and a mobile application for fall prevention exercises.<sup>28</sup> Many other EMs for falls prevention cover information on various components of falls prevention such as physical activity or exercise, a safe home environment, and FOF management.<sup>29</sup> Nevertheless, despite being an important modifiable risk factor for falls, medications are infrequently covered in these EMs.<sup>29</sup> Moreover, the content and extent of the information provided about medications that increase the ROF may vary between different EMs.

Therefore, this study aims to assess the freely available EMs on falls prevention to determine the content and extent of information provided about medications that can increase the ROF in OP. The specific aims were to identify: (1) the availability of information about medications as a risk factor for falls; (2) information on types of medications that are associated with falls; (3) information on the adverse effects of these medications; (4) the presence of information about medication reviews; (5) availability of advice that OP should communicate with healthcare providers (HCPs) about medication use; and (6) advice for ensuring the safe use of medications. The findings from this study can highlight the content gap in relation to FRIDs in the existing EMs on falls prevention. They also serve to inform improvement needs and strategies for future development of EMs on falls prevention. Consequently, the findings may guide EM developers to develop comprehensive EMs on FRIDs that prove useful for OP.

## METHODS

This study involved a systematic Internet search to identify EMs on falls prevention containing any discussion on medications. This Internet search followed the method described by Fajardo *et al.* (2019).<sup>30</sup> In this study, a fall was defined as “an unexpected event in which the person comes to rest on the ground, the floor or a lower level.” FRIDs are medications associated with an increased ROF among OP, as described in the meta-analysis by Bloch *et al.* (2013) and Woolcott *et al.* (2009), as well as the review by Huang *et al.* (2012).<sup>6,12-13</sup> Examples of FRIDs include CV drugs (e.g., antihypertensives,  $\beta$ -blockers, diuretics, and nitrates), CNS drugs (antidepressants, benzodiazepines, antipsychotics, sedative-hypnotics), non-steroidal anti-inflammatory drugs (NSAIDs), and hypoglycaemic agents (e.g., biguanides, sulfonylureas, and insulin).<sup>6,12-13,31</sup>

### Education material inclusion and exclusion criteria

EMs on falls prevention were included for evaluation if they: (1) were EMs in the form of a fact sheet, brochure, leaflet, booklet, or poster; (2) mentioned or discussed medications; (3) were written in English; and (4) targeted OP. EMs were excluded if they were: (1) developed by an entity unaffiliated with a professional body/institution; (2) not freely available to the public; or (3) targeted the HCPs or family/caregivers of OP.

### Education material identification

The principal investigator (MSS) conducted the Internet search in January 2022 utilising several search term combinations. These terms were divided into two themes: (1) Theme 1: “EMs” (Booklet, Brochure, Education Material, Fact Sheet, Leaflet); and (2) Theme 2: “Fall Risk/Falls Prevention” (Drug-Related Falls, Falls, Fall Prevention, Fall Risk, Fall-risk Increasing Drugs).

Employing the method described in a previous study,<sup>30</sup> each Internet search for “Theme 1” was combined with each term from “Theme 2”, resulting in 25 searches overall. The uniform resource locator (URL) of

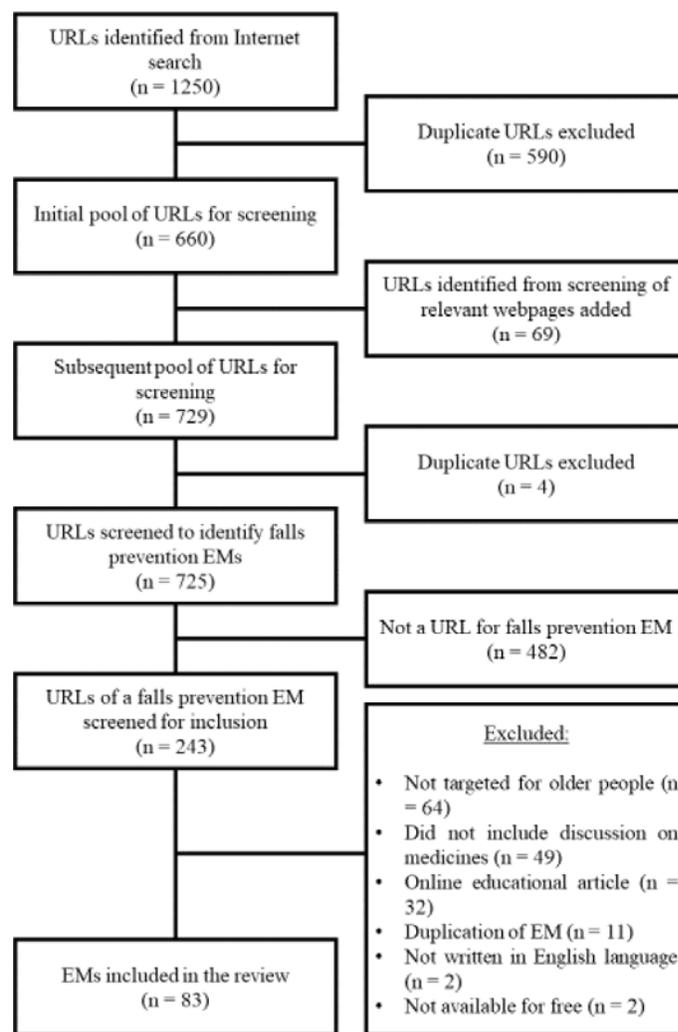


Figure 1: Study diagram for the Internet search.

the first 50 search results for each term combination was recorded. To optimise Google Search, the web browser cache was cleared after each search had been completed.

Figure 1 shows the flow for the Internet search. The search strategy resulted in 1250 URLs being recorded. Duplicated URLs were identified and removed, resulting in 660 URLs being screened. This list of URLs included web pages relevant to falls prevention. These pages were further explored to identify falls prevention EMs. This approach resulted in the identification of an additional 69 URLs. With four URLs removed due to duplication, the subsequent URL pool contained 725 URLs. These URLs were then assessed consecutively to identify falls prevention EMs. A total of 482 URLs were not falls prevention EMs, and were therefore removed. This resulted in 243 URLs of falls prevention EMs to be further screened for inclusion in the study. The URLs of falls prevention EMs that did not meet the inclusion criteria were removed ( $n = 160$ ), providing 83 EMs for inclusion in the study.

### Education materials assessment

The eligible URLs of falls prevention EMs were compiled by MSS, each of which was then downloaded in portable document format (PDF). A standardised data collection form was used to extract information from

the EMs. This form was developed by the research team and was piloted on ten EMs on falls prevention.

The data collection form compiled the following details:

1. Characteristics of EMs (i.e., title, county of origin, year of publication, developer, and type of EM);
2. Information highlighting medications as a risk factor for falls;
3. Type of medications highlighted as being associated with falls;
4. Information on the adverse effects of medications;
5. Information about medication reviews;
6. Advice that OP should communicate with healthcare providers about medication use; and
7. Advice for ensuring the safe use of medications.

Data from each EM was extracted by MSS, checked by MSAW, and later discussed among the research team. Any disagreements concerning the data extracted were resolved through discussion.

### Statistical Analysis

The descriptive data analysis was performed using the SPSS version 24. Data were presented in frequencies and percentages.

## RESULTS

Using an Internet search, 83 EMs on falls prevention were included in this study. Table 1 shows the characteristics of these EMs. Most originated from the United Kingdom (UK) (24/83, 29%), the US (17/83, 20%), and Australia (17/83, 20%). A trend was observed that an increasing number of EMs on falls prevention were published between 2017 and 2021, compared to the previous years. The majority of EMs were in the form of booklets (33/83, 40%), brochures (21/83, 25%), and leaflets (15/83, 18%). Out of 83 EMs, 60 (72%) discussed medications as a falls risk factor.

Only 33% (27/83) of the EMs provided examples of drug classes associated with falls (Table 1). Among the EMs containing information on the medication classes associated with falls ( $n = 27$ ), CNS (26/27, 96%) and CV (12/27, 44%) drugs were the types of drugs mentioned most frequently (Table 2). In terms of drug classes, sedative-hypnotics (22/27, 81%), antihypertensives or drugs for heart disease (11/27, 41%), and antidepressants (11/27, 41%) were the most commonly highlighted. Antipsychotics, although in the CNS drug class, were mentioned the least in the EMs (2/27, 7%) (Table 2).

Only about half (42/83, 51%) of the EMs in this study contained information on the adverse effects of the medications associated with falls (Table 1). Out of these 42 EMs, the majority highlighted light-headedness/dizziness (35/42, 83%) or drowsiness (21/42, 50%) (Table 2). Interestingly, only 14% (6/42) of these EMs highlighted OSH as an adverse effect of medications associated with falls. A small minority of EMs (3/42, 7%) highlighted confusion, blurred vision, or musculoskeletal symptoms as the main adverse effects of these medications (Table 2).

Additionally, information about medication reviews was available in only 39% (32/83) of the EMs (Table 1). Among these EMs ( $n = 32$ ), information highlighting the role of HCPs in medication reviews (31/32, 97%) was the most common (Table 2). Additionally, statements that encouraged OP to have their medications reviewed at least annually, or that a medication review was needed if a medication regimen changes, were found in only 25% (8/32) of the EMs (Table 2).

Advice that OP should communicate with HCPs about medication use and that they should ensure the safe use of their medications was available in 51% (42/83) and 49% (41/83) of the EMs, respectively (Table 1). Out of the 42 EMs including the former type of recommendation, the advice to discuss the adverse effects of medications and drug interactions with HCPs (23/42, 55%), and medication reviews (16/42,

**Table 1: Characteristics of included EMs ( $n = 83$ ).**

Characteristics	Total EMs ( $n = 83$ ) $n$ (%)
<b>Country</b>	
United Kingdom	24 (29)
United States	17 (20)
Australia	17 (20)
Canada	13 (16)
Ireland	4 (5)
New Zealand	3 (4)
Singapore	2 (2)
Israel	1 (1)
Netherlands	1 (1)
Norway	1 (1)
<b>Year of publication</b>	
Before 2007	4 (5)
2007 - 2011	6 (7)
2012 - 2016	21 (25)
2017 - 2021	25 (30)
Not mentioned	27 (33)
<b>Type of EMs</b>	
Booklet	33 (40)
Brochure	21 (25)
Leaflet	15 (18)
Fact sheet	10 (12)
Poster	4 (5)
<b>Content</b>	
Medications as a risk factor for falls	60 (72)
Classes or examples of medications that are associated with falls	27 (33)
Information about adverse effects of medications that are associated with falls	42 (51)
Information about medication review	32 (39)
Advice for OP to communicate with HCPs about medication use	42 (51)
Advice for OP to ensure safe use of medications	41 (49)

*HCPs, healthcare providers; OP, older people*

38%) were the most common. Only one EM (1/42, 2%) included the advice that OP should consult HCPs before taking any new medications (Table 2).

On the other hand, of all the EMs describing advice for the safe use of medications ( $n = 41$ ), the most common were those advising OP to take medications as directed (22/41, 54%), to be aware of how medications work, and to be aware of the adverse effects (22/41, 54%). The least common advice in this category was related to the proper storage of medications (2/41, 5%) (Table 2).

## DISCUSSION

In this study, 83 EMs on falls prevention that included a discussion of the use of medications were assessed. To the best of our knowledge, this is the first study to determine the content and extent of information about medication use in EMs on falls prevention. The study revealed that the

**Table 2: Content about medication use in EMs on falls prevention.**

Content	n (%)
<b>Classes and examples of FRIDs included in the EMs</b>	<b>Total EMs (n = 27)<sup>a</sup></b>
<b>Classification by system</b>	
Central nervous system drugs	26 (96)
Cardiovascular drugs	12 (44)
Musculoskeletal conditions drugs	4 (15)
<b>Classification by drug class</b>	
Sedative-hypnotics	22 (81)
Antihypertensives or drugs for heart diseases	11 (41)
Antidepressants	11 (41)
Diuretics	4 (15)
Anxiolytics	4 (15)
Mood stabilizers	4 (15)
Muscle relaxants	4 (15)
Analgesics	3 (11)
Opioid analgesics	2 (7)
Antipsychotics	2 (7)
<b>Information on adverse effects of the medications</b>	<b>Total EMs (n = 42)<sup>a</sup></b>
Light-headedness/dizziness	35 (83)
Drowsiness	21 (50)
Instability	10 (24)
Orthostatic hypotension	6 (14)
Tiredness	5 (12)
Confusion	3 (7)
Blurred vision	3 (7)
Musculoskeletal symptoms: weakness/stiffness/lack of muscle coordination	3 (7)
<b>Information about medication review</b>	<b>Total EMs (n = 32)<sup>a</sup></b>
Healthcare providers are able to conduct medication review for older people	31 (97)
Medication review should be conducted at least once a year	8 (25)
Medication review should be conducted if there are changes in medication regimen	8 (25)
All type of medications (including herbal medicines and over-the-counter drugs) used by older people should be reviewed	6 (19)
Medication review should be conducted if adverse effects from medications are suspected	4 (13)
Older people are encouraged to bring their medications to healthcare providers for medication review	2 (6)
Medication review should be conducted if multiple medications are used	2 (6)
<b>Advice for OP to communicate with healthcare providers about medication use</b>	<b>Total EMs (n = 42)<sup>a</sup></b>
Discuss with HCPs about adverse effects of medications and drug interactions	23 (55)
Ask HCPs about medication review	16 (38)

Talk with HCPs about any concerns related to medications	7 (17)
Inquire about alternatives to current medications that may increase the risk of falls	5 (12)
Discuss with HCPs about the indication of prescribed medications	3 (7)
Consult the HCPs before taking any new medications	1 (2)
<b>Advice for OP to ensure safe use of medications</b>	<b>Total EMs (n = 41)<sup>a</sup></b>
Take medication as directed by healthcare providers	22 (54)
Be aware on how medications work and the adverse effects	22 (54)
Never share medications with others despite having the same indication	10 (24)
Keep an updated list of medications	9 (22)
Obtain medications from the same health facility	4 (10)
Use medication management device	4 (10)
Store medications properly	2 (5)

*EMs, education materials; FRIDs, fall-risk increasing drugs; HCPs, healthcare providers; OP, older people*

<sup>a</sup> Total number of EMs included the topic.

information about medication use varied in content and extent among the included EMs. Only about half of the EMs included advice that OP should communicate with HCPs about their medication use and ensure the safe use of medications. Additionally, information on FRID examples and medication reviews were found in less than 40% of the EMs.

Despite the evidence that many OP did not recognise medications as a risk factor for falls,<sup>18-20</sup> the current findings show that almost 30% of the EMs on falls prevention lack this information. Additionally, only one-third of the EMs included details of common FRID examples. The lack of awareness among OP of the risk that medications could induce falls often led to OP associating their falls with other causes (e.g., worsening eyesight, other diseases, or the environment).<sup>20</sup> Additionally, without this awareness, OP may not be cognisant of the adverse effect of medications that can increase their ROF such as drowsiness, dizziness, and OSH. This unawareness may cause them to ignore such effects, or regard them as normal. This would potentially lead to a lack of discussion between OP and HCPs about the adverse effects of medications that may increase their ROF.

However, one could argue that highlighting medications as a falls risk factor can cause fear among OP, potentially causing them to reject their medications, which may lead to further health implications.<sup>32</sup> Therefore, it is imperative to identify how to effectively present this information in EMs on falls prevention to improve the understanding among OP of FRIDs, and ensure their safe use of medications. The authors' recommendation is to highlight the benefits of the medications while simultaneously emphasising the potential effect of such medications in increasing the ROF in OP.

It was also noted that of all the EMs included, many highlighted CNS and CV drugs as FRIDs. While these two drug classes are the major FRID types,<sup>12-13</sup> other FRIDs such as antihyperglycaemic agents (e.g., oral hypoglycaemic drugs and insulin) were not mentioned by any EMs, while less than 15% mentioned analgesics. Antihyperglycaemic agents may induce hypoglycaemia, resulting in symptoms such as trembling, shakiness, decreased cognitive ability, and palpitations. These symptoms may consequently lead to falls.<sup>33</sup> A previous study has shown that OP who were using antihyperglycaemic agents with tight glycaemic control experienced higher ROF.<sup>34</sup> Therefore, it is imperative to educate OP who

are using antihyperglycemic agents about the ROF due to the side effects of these medications.

On the other hand, analgesics (e.g., NSAIDs and opioids analgesics) have been considered FRIDs in certain reports.<sup>31,13</sup> Both NSAIDs and opioids analgesics can produce CNS adverse effects such as dizziness and confusion,<sup>35-36</sup> putting OP at ROF. A review by Hegeman *et al.* (2009) demonstrated an increased risk of accidental falls among OP who were exposed to NSAIDs.<sup>6,36</sup> Another review by Yoshikawa *et al.* (2020) suggested that OP who used opioids were at increased risk of falls, fall injuries, and fractures.<sup>37</sup> These findings warrant measures to educate OP that a potential effect of these medications is increased ROF.

CNS adverse effects are common adverse effects of FRIDs in the CNS drug class. However, some CNS drugs (e.g., antipsychotics and antidepressants) can also cause OSH.<sup>14</sup> Additionally, CV drugs, the other major class of FRIDs, may also increase the ROF since one of their effects is to lower the blood pressure, potentially resulting in OSH.<sup>6</sup> Nevertheless, in this study, only six EMs were found to specifically highlight OSH as one of the adverse effects of medications associated with falls. Due to the high prevalence of CV diseases (e.g., hypertension, coronary heart disease, and congestive heart failure) among OP,<sup>38</sup> the use of multiple CV drugs is common among them. Moreover, it is also common for OP to have multiple co-morbidities including psychiatric disorders,<sup>39</sup> resulting in their use of psychotropics. The use of CV drugs, especially in multiple types and concomitantly with psychotropics, puts OP at a higher risk of OSH, and potentially falls. Thus, educating OP about medications that can induce OSH is crucial so that they may recognise the symptoms and take the necessary action when such effects occur. OP with OSH should be advised to discuss possible treatment changes (e.g., dose reduction, and changes or stopping of medications) with HCPs.<sup>40</sup>

With that being mentioned, in this study, only about half the EMs included advice that OP should communicate with HCPs about their medication use. While it is crucial to enhance awareness in OP about medication that may increase their ROF, it is also important to encourage OP and HCPs to regularly discuss the FRIDs that they are using. We also noted the alarmingly low occurrence of advice to consult HCPs before taking any new medications. This should be a cause for concern since OP may obtain medications from various sources<sup>41</sup> and may use new medications that can potentiate their ROF. Regular discussions with HCPs about medication use and communication regarding the use or intention to use new medications will allow HCPs to assess the suitability of the medications and address any concerns regarding medication use among OP. The current study also revealed a low occurrence in the reviewed EMs of advice to promote the safe use of medications. This indicates a gap in the existing EMs on falls prevention. When attempting to minimise medication-related falls, OP should be continuously reminded to practise the safe use of medications, a point that should always be emphasised in future falls prevention EMs.

Since medications are one of the modifiable risk factors for falls, efforts to minimise the use of FRIDs in terms of their number, dose, and duration should be warranted.<sup>42</sup> This could be achieved through medication reviews by HCPs, especially pharmacists.<sup>43</sup> These reviews can be effective methods of assessing medication use and resolving drug-related problems such as therapy duplication, adverse effects, and drug-drug interactions.<sup>44</sup> Medication reviews that serve as 'top-down' interventions have been widely advocated as a strategy to reduce fall risk by stopping a FRID or reducing the dose.<sup>45-46</sup> Unfortunately, the current study showed that only 39% of the EMs included discussed medication reviews. Therefore, falls prevention EMs are recommended to include information about the benefits of medication reviews and to encourage OP, especially those with a ROF, to ensure their medications are reviewed regularly.

## Strengths and Limitations

This is the first study to determine the content and extent of information about medication use in EMs on falls prevention, thus providing an insight into the current discussions about this topic in falls prevention EMs. Furthermore, the study highlights the gap in the existing falls prevention EMs regarding the inclusion of information about medication use. One of the strengths of this study is the use of the search terms that enabled the identification of various EMs from different countries and in different formats.

Nevertheless, several limitations of the study were noted. First, the present study only included EMs in the English language; thus, EMs in other languages that might nevertheless be relevant to other international patient populations were excluded. Secondly, since the results from Google search can change constantly, the current results may not be replicable. Additionally, as only an online search approach was used to identify EMs, other EMs on falls prevention that are currently available to OP in the healthcare settings may not have been captured. Therefore, our findings may not be representative of all EMs on falls prevention.

## CONCLUSION

This study revealed that the information about medication use in EMs on falls prevention varies in its content and extent. The study highlights the content gap in the existing EMs on falls prevention. Future developers of EMs on falls prevention may consider strengthening the medication use content by incorporating adequate information about medications as a risk factor for falls, examples of FRIDs, and the adverse effects associated with these medications. Additionally, the EMs should include advice that OP should communicate with HCPs about their medication use, measures to ensure the safe use of medications, and information to encourage OP to have their medication reviewed regularly.

## ACKNOWLEDGEMENT

The study was funded by the Ministry of Science, Technology and Innovation, Malaysia, under the Fundamental Research Grant Scheme (FRGS/1/2019/SS09/UTM/03/2).

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

## ABBREVIATIONS

**OP:** Older people; **FOF:** Fear of falling; **FRIDs:** Fall-risk increasing drugs; **ROF:** Risk of falls; **CNS:** Central nervous system; **OSH:** Orthostatic hypotension; **CV:** Cardiovascular; **US:** United States; **EuGMS:** European Geriatric Medicine Society; **EMs:** Education materials; **PDF:** Portable document format; **HCPs:** Healthcare providers; **NSAIDs:** Non-steroidal anti-inflammatory drugs; **URL:** Uniform resource locator; **UK:** United Kingdom.

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**Article History:** Received: 06-02-2022; Revised: 21-02-2022; Accepted: 19-03-2022.

**Cite this article:** Shaari MS, Wahab MSA, Alias R, Zaki IAH, Yassen AO. Evaluation of Information about Medication use in Education Materials on Falls Prevention. *J Young Pharm.* 2022;14(2):221-6.