Identification of Medications that Increase Fall Risk among Residents in Residential Aged Care Facilities in Klang Valley, Malaysia

(Pengenalpastian Ubat-Ubatan yang Meningkatkan Risiko Jatuh di Kalangan Penghuni Rumah Jagaan Warga Tua di Lembah Klang, Malaysia)

Arif Zikri Mazlan, Marhanis Omar*, Adliah Mhd-Ali & Mohd Makmor-Bakry

ABSTRACT

Frailty in the elderly is considered a contributor to falls and is increasingly recognized as a public health priority. Certain type of drugs is associated with the risk of falling. This study aimed to identify the use of drugs that may cause falls (FRIDs) among frail elderly residents in residential aged care facilities (RACF). A cross-sectional study was conducted among RACF residents in Klang Valley, Malaysia, who are 65 years old and above from December 2019 to March 2020 using a set of researcher-assisted and validated questionnaires upon their consent. A total of 72 elderly residents were included in this study. More than 90% of the residents were classified as the frail or pre-frail. The majority of them were taking fall-risk increasing drugs (n=53, 73.6%). The calcium channel blocker is the most common drug identified that may cause falls among the participants. No significant association was found between demographic data, frailty status, and fall risk with FRIDs usage in this study. The majority of the elderly residents were using drugs that may cause falls. Therefore, a periodical medication review is needed to prevent any potential harms towards the residents.

Keywords: Accidental falls; aged; fall- risk increasing drugs; frailty

ABSTRAK

Sindrom lemah pada orang tua dianggap sebagai penyumbang kepada kejatuhan dan semakin dikenali sebagai masalah kesihatan awam. Terdapat ubat-ubatan tertentu dikaitkan dengan risiko untuk jatuh. Kajian ini bertujuan untuk mengenal pasti penggunaan ubat-ubatan yang boleh menyebabkan kejatuhan (FRIDs) di kalangan warga tua yang lemah di kemudahan jagaan warga emas (RACF). Satu kajian keratan rentas dilakukan di kalangan penghuni RACF di Lembah Klang, Malaysia yang berumur 65 tahun ke atas dari Disember 2019 hingga Mac 2020 menggunakan satu set soal selidik yang dibantu oleh penyelidik dan berdasarkan persetujuan. Seramai 72 penghuni terlibat dalam kajian ini. Lebih daripada 90% penghuni terlibat dikelaskan sebagai lemah atau pra-lemah. Sebilangan besar daripada mereka mengambil ubat yang boleh menyebabkan kejatuhan (n = 53, 73.6%). Penyekat saluran kalsium adalah ubat yang paling lazim menyebabkan kejatuhan di kalangan penghuni warga tua. Tidak ada hubungan yang signifikan antara data demografi, status lemah dan risiko jatuh dengan penggunaan FRIDs dalam kajian ini. Sebilangan besar penghuni warga tua menggunakan ubat-ubatan yang boleh menyebabkan jatuh. Oleh itu, pemantauan ubat secara berkala diperlukan untuk mengelakkan bahaya kepada penghuni.

Kata kunci: Berumur; jatuh tidak sengaja; sindrom lemah; ubat yang mempunyai risiko jatuh

INTRODUCTION

In Malaysia, the population aged 65 and over is projected to increase more than three-fold of the 2010 population (DSM 2016). This will lead Malaysia to become an aging population in 2021. There are many health issues associated with the physical changes in elderly such as acute and chronic diseases that requires more complex medication management as they are taking a few medications for their comorbidities and cognitive problems (Mafauzy 2000). As elderly tend to have at least one chronic disease which requires multiple use of the medication, this polypharmacy practice will further increase the risk of adverse drug events such as falls, confusion, and functional decline.

Frailty is defined as clinically recognizable state in which the ability of older people to cope with every day or acute stressors is compromised with an increased vulnerability and characterized by multisystem dysregulations, leading to the loss of dynamic homeostasis and reduced in physiological reserve (WHO 2016). Physical frailty, as a contributor to falls, is increasingly recognized as a public health priority with experts recommending routine frailty screening in clinical settings (Cesari et al. 2016). The number of fall cases also increases with age (Gillespie et al. 2012).

Medications are one of the most important risk factors for falls, and one effective intervention to prevent falls is by withdrawal of fall-risk-increasing drugs or FRIDs (Mair et al. 2017). In one systematic review, it was reported that loop diuretics were significantly associated with increased fall risk, while beta-blockers were significantly associated with decreased fall risk (de Vries et al. 2018). Withdrawal of FRIDs has been shown to be potentially beneficial in decreasing falls risk in elderly. In Europe, a list of drugs that may increase the risk of falls in elderly has been published which include the drugs that may cause orthostatic hypotension such as opioids (N02A), antipsychotics (N05A excluding N05AN), anxiolytics (N05B), hypnotics and sedatives (N05C), and antidepressants (N06A). It is important to have a routine medication reviews and the need for deprescribing in order to reduce polypharmacy and fall risk.

In Malaysia, there is no establish list of FRIDs which can be referred in local medical field to assess the drugs which cause fall. The existing FRIDs list are adapted from Europe in which psychotropic and cardiovascular medicines are the most important FRID classes (Seppala et al. 2019). Digitalis, beta-blockers, diuretics, anti-hypertensive agents, analgesics, proton pump inhibitors and antiplatelet are classified as possible FRIDs. However, there are many drugs listed such as antidepressant, antipsychotic or benzodiazepine is not common to be found in our local residential aged care facilities (RACF) as compared to the nursing homes abroad. This is further complicated by the presence of geriatric syndrome such as confusion, malaise, incontinence, and immobility in elderly. Recognising the presence of a serious illness and making an accurate diagnosis are important challenges for medical practitioner, hence a suitable FRIDs list that would cover common drugs used locally is warranted. The future list of local FRIDs can be made as to be use as reference not only in hospitals but also in RACF.

There are different practice models of RACF in Malaysia (Nizaruddin et al. 2017). For example, a number of RACF has a visiting doctor or nurse to manage the health of their residents. Whereas other RACF did not have such privilege due to the financial pressure and the residents need to be referred directly to the hospital by the care-taker or family members. Therefore, a community pharmacist may contribute in reviewing medications and improving the health of older adults. As part of intervention to reduce the incidence of falls in elderly residents in RACF, a community pharmacist may offer a unique and additional public health services to frail elderly residents in RACF by reviewing their medication periodically. It is useful as frailty is now has been recognized as a condition that can be prevented or delayed. For this reason, the development of services supporting appropriate medication management in the elderly residents in RACF is important (Chen et al. 2019).

However, at the moment, such medication use review to the residents in RACF has not been offered by community pharmacists in Malaysia unlike other developed countries such as Australia and Swiss (Rogers et al. 2014). To enable this service by a community pharmacist, further details are required such as list of FRIDs that usually used and what are the chances of falling among the elderly residents in RACF. Such information is also important in order for the community pharmacists to outline a suitable intervention plan for the residents with high risk of falling. Therefore, this study is aimed to identify the common FRIDs used by frail elderly residents in a RACF as well as to assess their fall-risk factors.

METHODS

A cross-sectional survey was conducted among elderly patients who are 65 years old or above from 13 RACF in Kuala Lumpur and Selangor from December 2019 to March 2020 upon their informed consent. Participants were recruited based on the following criteria: age 65 years old or above, staying in the facilities for at least 3 months as well as able to understand and speak Malay or English language. They were excluded if they did not meet the minimum score requirement of cognitive function test. All the residents were approached with the permission of RACF management and explained on the study objectives, process and confidentiality. The residents were asked to provide the informed consent before answering all the questions verbally with assistance by the researcher. This study was approved by Universiti Kebangsaan Malaysia Research Ethic Committee (UKM PPI/111/8/JEP-2017-706).

In this study, the demographic data of the residents such as age, gender, ethnicity, education level, body mass index (BMI), and person in charge for medication was collected. The Fall-risk Questionnaire (Rubenstein et al. 2011) was used to assess the fall risk of the participants. It consists of 12 questions, including history of fall, problem in walking, using any instrument for aid in walking, and medication related problems. Participants were required to answer 'Yes' or 'No' to all the questions. The response of each question was reported in descriptive manner. In addition, the FRAIL Questionnaire (Morley et al. 2012) was also used to determine the frailty status among the participants. The FRAIL Questionnaire measured all the five components: Fatigue, Resistance, Ambulation, Illness, and Loss of weight and provided the frail scale scores range from 0 to 5 (0 = best and 5 = worst) and represent frail (score of 3 to 5), pre-frail (score 1 to 2), and robust (0) health status. The fall risk status was assessed using a questionnaire comprised of 12 items with 'yes' and 'no' answers (Rubenstein et al. 2011). In this study, all the medications used by the participants were classified based on the Anatomical Therapeutic Chemical (ATC) Code. The medications were further classified into FRIDs and orthostatic drugs (ODs) based on the list provided by Swedish National Board of Health and Welfare (NBHW) (Milos et al. 2014). All data was analysed by using Statistical Package for Social Science (SPSS) version 25.0 (IBM Corp. NY). Participants' demographic was presented in descriptive manner. The chi-square test was performed to determine the association between the demographic and the frailty status, fall-risk and medication classification. In all tests performed, the p-value of less than 0.05 was considered significant.

RESULTS

A total of 93 residents from 13 RACF in Klang Valley were approached in the beginning of the study. 21 residents were excluded as they were not able to complete the questionnaire resulting in final number of 72 participants who successfully answered all sections of the questionnaire. Demographic characteristics are summarized in Table 1. There were 34 (47.2%) male and 38 (52.8%) female residents. A total of 14 (19.4%) of residents were between 65 and 69 years old, 40 (65.6%) residents were aged between 70 and 79 years old and 19 (25.0%) were aged 80 years old and above. In terms of ethnicity, there were 57 (79.2%) Malay, 13 (18.1%) Chinese and 2 (2.8%) Indian included in this study. Out of 72 residents, 18 (25.0%) residents were overweight, 10 (13.9%) residents were obese and 5 (6.9%) residents were underweight. In our study, 51 (70.8%) of the residents had their caretaker to in-charge of their medication in daily basis.

A total of FRIDs user in this study is 53 (73.7%) as compared to 19 (26.3%) of non-FRIDs users. It is observed that female participants used more FRIDs compared to male. The majority of FRIDs users in our study belongs to the age group of 70 to 79 years old. Based on the ATC code, there were three main FRIDs categories recorded in this study, namely N05A (antipsychotic), N06A (antidepressant) and N05B (anxiolytic). Meanwhile, a total of 111 medications were recorded as an orthostatic drug. In specific, C08 (calcium channel blockers) is the highest fall-induced risk medication that are used by the participants in this study, followed by C09 (renin-angiotensin system inhibitors) and G04CA (alpha-adrenoreceptor antagonists).

In general, the residents in our study were classified as pre-frail (n=34, 47.2%), frail (n=32, 44.4%) and robust (n=6, 8.3%) (Table 2). It was found that majority of the elderly residents who were taking FRIDs belongs to the pre-frail group (n = 34, 47.2%) or frail (n = 32, 44.4%). Among the FRIDs users, the majority of them had the risk to fall (n= 39, 54.2%). It was further reported that 20 (37.7%) out of 53 residents had actually experienced fall. Further analysis did not find any significant association between demographic data, frailty status and risk of fall with FRIDs usage.

TABLE 1. Demographic data of participants based on FRIDs use (N= 72)

Demographic characteristic		Total, n (%)	FRIDs User, n (%)	Non FRIDs Users, n (%)	P-value
Age	65 - 69	14 (19.4)	10 (13.9)	4 (5.6)	0.955
	70 - 79	40 (55.6)	30 (41.7)	10 (13.9)	
	80 and older	18 (25.0)	13 (18.1)	5 (6.9)	
Gender	Male	34 (47.2)	24 (33.3)	10 (13.9)	0.582
	Female	38 (52.8)	29 (40.3)	9 (12.5)	

Ethnicity	Malay	57 (79.2)	40 (55.6)	17 (23.6)	0.196
	Chinese	13 (18.1)	12 (16.7)	1 (1.4)	
	Indian	2 (2.8)	1 (1.4)	1 (1.4)	
	Others	0 (0.00)	0 (0.0)	0 (0.0)	
Education	No formal education	10 (13.9)	7 (9.7)	3 (4.2)	0.941
	Primary school and below	25 (34.7)	18 (25.0)	7 (9.7)	
	Secondary school	31 (43.1)	23 (31.9)	8 (11.1)	
	University and above	6 (8.3)	5 (6.9)	1 (1.4)	
BMI	Underweight	5 (6.9)	4 (5.6)	1 (1.4)	0.940
	Normal	39 (54.2)	28 (38.9)	11 (15.3)	
	Overweight	18 (25.0)	14 (19.4)	4 (5.6)	
	Obese	10 (13.9)	7 (9.7)	3 (4.2)	
Frailty status	Robust	6 (8.3)	3 (4.2)	3 (4.2)	0.387
	Pre-frail	34 (47.2)	26 (36.1)	8 (11.1)	
	Frail	32 (44.4)	24 (33.3)	8 (11.1)	
Risk of fall	Yes	53 (73.6)	39 (54.2)	14 (19.4)	0.993
	No	19 (26.4)	14 (19.4)	5 (6.9)	

TABLE 2. Demographic data of participants based on the frailty status (N= 72)

Demographic characteristic		Total, n (%)	Robust, n (%)	Pre-frail, n (%)	Frail, n (%)	P-value
Age	65 - 69	14 (19.4)	2 (2.8)	7 (9.7)	5 (6.9)	0.750
	70 - 79	40 (55.6)	3 (4.2)	20 (27.8)	17 (23.6)	
	80 and older	18 (25.0)	1 (1.4)	7 (9.7)	10 (13.9)	
Gender	Male	34 (47.2)	4 (5.6)	16 (22.2)	14 (19.4)	0.587
	Female	38 (52.8)	2 (2.8)	18 (25.0)	18 (25.0)	
Ethnicity	Malay	57 (79.2)	4 (5.6)	27 (37.5)	26 (36.1)	0.878
	Chinese	13 (18.1)	2 (2.8)	6 (8.3)	5 (6.9)	
	Indian	2 (2.8)	0 (0.0)	1 (1.4)	1 (1.4)	
	Others	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	

Education	No formal education	10 (13.9)	0 (0.0)	5 (6.9)	5 (6.9)	0.237
	Primary school and below	25 (34.7)	3 (4.2)	11 (15.3)	11 (15.3)	
	Secondary school	31 (43.1)	1 (1.4)	15 (20.8)	15 (20.8)	
	University and above	6 (8.3)	2 (2.8)	3 (4.2)	1 (1.4)	
BMI	Underweight	5 (6.9)	1 (1.4)	2 (2.8)	2 (2.8)	0.347
	Normal	39 (54.2)	1 (1.4)	19 (26.4)	19 (26.4)	
	Overweight	18 (25.0)	3 (4.2)	10 (13.9)	5 (6.9)	
	Obese	10 (13.9)	1 (1.4)	3 (4.2)	6 (8.3)	
Person in charge for medication	Resident	21 (29.2)	2 (2.8)	9 (12.5)	10 (13.9)	0.888
	Caretaker	51 (70.8)	4 (5.6)	25 (34.7)	22 (30.6)	

DISCUSSION

In these recent years, the implication of frailty among the geriatric population has gained significant attention. Elderly is at higher risk for the fall related complications such as fracture (WHO 2016). Majority of the elderly residents in our study came from the age group of 70 to 79 years old and most of them were in pre-frail and frail status. Aging has higher tendency for the elderly to be frail and frail is one of the risk factors that might increase chances of the elderly to be falling. This is alarming because falling might cause more serious health issues, injuries or problems to the elderly.

It was reported that nearly quarter of elderly had at least one fall yearly, and about 20% from these falls problem lead to severe injuries (CDCP 2017). However, among elderly residing in institutions in Malaysia, there is a scarcity in the information on falls. Elderly residing in nursing homes have higher prevalence and risk of falls as compared to community-living elderly have been shown in previous studies conducted in other countries (Dhargave & Sendhilkumar 2016). In Kuala Lumpur, there is only one published study among elderly living in nursing home which reported the prevalence of fall as 30% (Ghazi et al. 2017). Environmental and behavioural factors are most often seen as causing falls, however, health factors are rarely recognized due to the illness's complexity.

Furthermore, it is highlighted in our current study that more than half of FRIDs users were at risk of falls. For example, due to common illness such as hypertension, elderly residents tend to consume anti-hypertensive drugs and most of the anti-hypertensive drugs are included as FRIDs and indirectly poses higher risk of falling (Harun & Agrawal 2015). It is alarming that majority of the frail residents in our study are taking FRIDs, as frail individuals pose higher risk of falling two or more times over the subsequent year. The risk of falls also increases with disease severity and presence of comorbidity which is associated with worse health outcomes, more complex clinical management, and increased health care costs.

Patients who admitted to the hospital due to an injurious fall had more FRIDs consumption in their medication treatments than those who did not fall (Milos et al. 2014). The most common drugs that have been identified were calcium channel blockers (C08) and also renin-angiotensin system inhibitors (C09). Our study also highlighted differences in medication management system for elderly residents in RACF. While in certain RACF, the caretaker became the main person in charge for medication taken by the residents daily, some residents might also need to handle their own medication without any close supervision (Nizaruddin et al. 2017). This will lead to potentially inappropriate medication use that the risk of the medication itself outweighed its benefits to

the elderly. Self-reporting of falls may be difficult due to the residents` advanced age (Sanghavi et al. 2020). The caretaker in RACF may also face some difficulties in accurately recalling the occurrence of falls in previous periods among the residents or identifying possible reason of fall. Therefore, the community pharmacist might be able to play a role in managing resident`s medication due to their close proximity which enable an easy of access to a better healthcare service. The community pharmacy may be the referral for local community to seek any information. To improve health outcomes and prevent any potential fall, the community pharmacists would review the common medications that potentially causing falls and facilitate any concerns, consequently improving the residents` medication use behaviour.

STUDY LIMITATION AND RECOMMENDATION

There are some limitations in this study and future study is recommended to include these limitations. The bedridden residents or those having cognitive impairment were excluded from this study. This could be one of the vital groups of elderly in RACF that we should be pay more attention since they may pose high risk of falling by using FRIDs compared to the rest. Although this study is able to identify medications that increase fall risk among residents, due to the limited sample size in this study, it was difficult to identify any significant relationships from the data.

CONCLUSION

In this study, our result showed that majority of the elderly residents in RACF who are using FRIDs had a high risk of falling. Their medication should be monitored to avoid any possible fall event.

ACKNOWLEDGEMENTS

REFERENCES

Centre for Disease Control and Prevention (CDCP). 2017. *Falls among Older Adults: An Overview.* Centre for Disease Control and Prevention (CDCP).

Cesari, M., Prince, M., Thiyagarajan, J.A., De Carvalho, I.A., Bernabei, R., Chan, P., Gutierrez-Robledo, L.M., Michel, J.P., Morley, J.E., Ong, P. & Manas, L.R. 2016. Frailty: An emerging public health priority. *J. Am. Med. Dir. Assoc.* 17(3): 188-192.

Chen, E.Y., Wang, K.N., Sluggett, J.K., Ilomäki, J., Hilmer, S.N., Corlis, M. & Bell, J.S. 2019. Process, impact and outcomes of medication review in Australian residential aged care facilities: A systematic review. *Australas. J. Ageing* 38: 9-25.

Department of Statistics Malaysia (DSM). 2016. *Press Release Population Projection (Revised) Malaysia 2010-2040.* Department of Statistics Malaysia (DSM).

de Vries, M., Seppala, L.J., Daams, J.G., van de Glind, E.M., Masud, T., van der Velde, N., Blain, H., Bousquet, J., Bucht, G., Caballero-Mora, M.A. & van der Cammen, T. 2018. Fall-risk-increasing drugs: A systematic review and meta-analysis: I. Cardiovascular drugs. *J. Am. Med. Dir. Assoc.* 19(4): 371.e1-371.e9.

Dhargave, P. & Sendhilkumar, R. 2016. Prevalence of risk factors for falls among elderly people living in long-term care homes. *J. Clin. Gerontol. Geriatrics* 7(3): 99-103.

Ghazi, H.F., Elnajeh, M., Abdalqader, M.A., Baobaid, M.F., Rosli, N.S.R. & Syahiman, N. 2017. The prevalence of falls and its associated factors among elderly living in old folks home in Kuala Lumpur, Malaysia. *Int. J. Community Med. Public Health* 4(10): 3524-3529.

Gillespie, L.D., Robertson, M.C., Gillespie, W.J., Sherrington, C., Gates, S., Clemson, L.M. & Lamb, S.E. 2012. Interventions for preventing falls in older people living in the community. *Cochrane Database Syst. Rev.* 2012(9): CD007146.

Harun, A. & Agrawal, Y. 2015. The use of fall risk increasing drugs (FRIDs) in patients with dizziness presenting to a neurotology clinic. *Otol. Neurotol.* 36(5): 862-864.

Mafauzy, M. 2000. The problems and challenges of the aging population of Malaysia. *Malays. J. Med. Sci.* 7(1): 1-3.

Mair, A., Fernandez-Llimos, F., Alonso, A., Harrison, C., Hurding, S., Kempen, T., Kinnear, M., Michael, N., McIntosh, J. & Wilson, M. 2017. *Polypharmacy Management by 2030: A Patient Safety Challenge.* 2nd ed. World Health Organization (WHO).

Milos, V., Bondesson, Å., Magnusson, M., Jakobsson, U., Westerlund, T. & Midlov, P. 2014. Fall risk-increasing drugs and falls: A cross-sectional study among elderly patients in primary care. *BMC Geriatr.* 14(1): 40.

Morley, J.E., Malmstrom, T.K. & Miller, D.K. 2012. A simple frailty questionnaire (FRAIL) predicts outcomes in middle aged African Americans. *J. Nutr. Health Aging* 16(7): 601-608.

Nizaruddin, M.A., Omar, M.S., Mhd-Ali, A. & Makmor-Bakry, M. 2017. A qualitative study exploring issues related to medication management in residential aged care facilities. *Patient Prefer. Adherence* 11: 1869-1877.

Rogers, S., Martin, G. & Rai, G. 2014. Medicines management support to older people: Understanding the context of systems failure. *BMJ Open* 4(7): e005302.

Rubenstein, L.Z., Vivrette, R., Harker, J.O., Stevens, J.A. & Kramer, B.J. 2011. Validating an evidence-based, self-rated fall risk questionnaire (FRQ) for older adults. *J. Safety Res.* 42(6): 493-499.

Sanghavi, P., Pan, S. & Caudry, D. 2020. Assessment of nursing home reporting of major injury falls for quality measurement on nursing home compare. *Health Serv. Res.* 55(2): 201-210.

Seppala, L.J., van der Velde, N., Masud, T., Blain, H., Petrovic, M., van der Cammen, T.J., Szczerbińska, K., Hartikainen, S., Kenny, R.A., Ryg, J., Eklund, P., Topinková, E., Mair, A., Laflamme, L., Thaler, H., Bahat, G., Gutiérrez-Valencia, M., Caballero-Mora, M.A., Landi, F., Emmelot-Vonk, M.H., EuGMS Task and Finish Group on Fall-Risk-Increasing Drugs; Cherubini, A., Baeyens, J.P., Correa-Pérez, A., Gudmundsson, A., Marengoni, A., O'Mahony, D., Parekh, N., Pisa, F.E., Rajkumar, C., Wehling, M., Ziere, G. & EuGMS Special Interest Group on Pharmacology. 2019. EuGMS task and finish group on fall-risk-increasing drugs (FRIDs): Position on knowledge dissemination, management, and future research. *Eur. Geriatr. Med.* 10(2): 275-283.

WHO. 2016. *Clinical Consortium on Healthy Ageing.* Geneva: World Health Organization (WHO).

Faculty of Pharmacy
Universiti Kebangsaan Malaysia
Jalan Raja Muda Abdul Aziz
53000 Kuala Lumpur, Federal Territory
Malaysia

*Corresponding author; email: marhanis@ukm.edu.my