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Prevalence of falls among older adults in the Gulf Cooperation Council countries: A systematic review and meta-analysis

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ABSTRACT

Aim: The aim of this study was to conduct a systematic review and meta-analysis for studies that have examined the prevalence and risk factors of falls in older adults living in the Gulf Cooperation Council countries (GCC).
Methods: A literature search was performed using PubMed, Web of Science, Physiotherapy Evidence Database; and SCOPUS up to October 2018 to identify studies that have examined prevalence, risk factors, or consequences of falls in older adults living in the GCC.
Results: A total of 6 studies met the inclusion criteria. The pooled prevalence of falls among older adults residing in GCC countries was 46.9%. Falls among included studies were associated with older age, female gender, low educational level, and number of medications.
Conclusions: The study shows a high prevalence of falls in older adults living in the GCC countries. The risk factors in the current study must be interpreted with caution, since some of the included studies did not report any risk factors. Due to the limited number of evidence evaluating risk factors and consequences of falls in the GCC countries population, a further longitudinal research is needed.

1. Introduction

The World Health Organization (WHO) has defined a fall as an unintentional event that results in the person coming to rest on the ground or another lower level. Falls are among the most serious public health problems facing older adults (Rubenstein & Josephson, 2002). In the U.S., more than one-third of community dwelling older adults fall each year, and half of them will experience recurrent falls (Rubenstein & Josephson, 2002). Falls have been associated with higher rates of morbidity, reduced function, decreased quality of life, and premature nursing home and hospital admissions. About 20–30% of people who fall suffer injuries that lead to decreased mobility that restricts subsequent independence (Rubenstein, 2006; Sterling, O'Connor, & Bonadies, 2001; Tinetti, Williams, & Mayewski, 1986).

In the Gulf Cooperation Council (GCC) countries, the elderly population has increased in the last decades due to increased average life expectancy across the GCC region. This significant growth in the older population presents numerous challenges to the health care system as normal aging is related to declines in several body systems including cardiovascular, sensory, musculoskeletal, and cognitive function, all of which have been associated with an increased risk of falling (Gangavati et al., 2011; Lord, 2006; Segev-Jacubovski et al., 2011). It is imperative to know the prevalence of falls in the GCC countries elderly population in order to implement effective and efficient prevention and intervention programs.

Limited research has examined the prevalence of fall among older adults in GCC countries with conflicting results (Abdalagleel Alsaif & Ahmed Alsenany, 2018; Al Saif, 2012; Almawlawi, Al Ansari, & Ahmed, 2011; Almegbel et al., 2018; Alshammari et al., 2018; Sharif & Al-daour, 2018). Some studies reported that the prevalence of fall was approximately 34% (Almawlawi et al., 2011) while others reported 57% (Alshammari et al., 2018). This difference is relatively large between studies and require further investigation. It is critical to understand the overall prevalence of fall in this population as well as associated risk factors to establish appropriate prevention approaches. Therefore, the objective of this study was to conduct a systematic review and meta-analysis for studies that have examined the frequency, risk factors, and consequences of falls in older adults living in the GCC.

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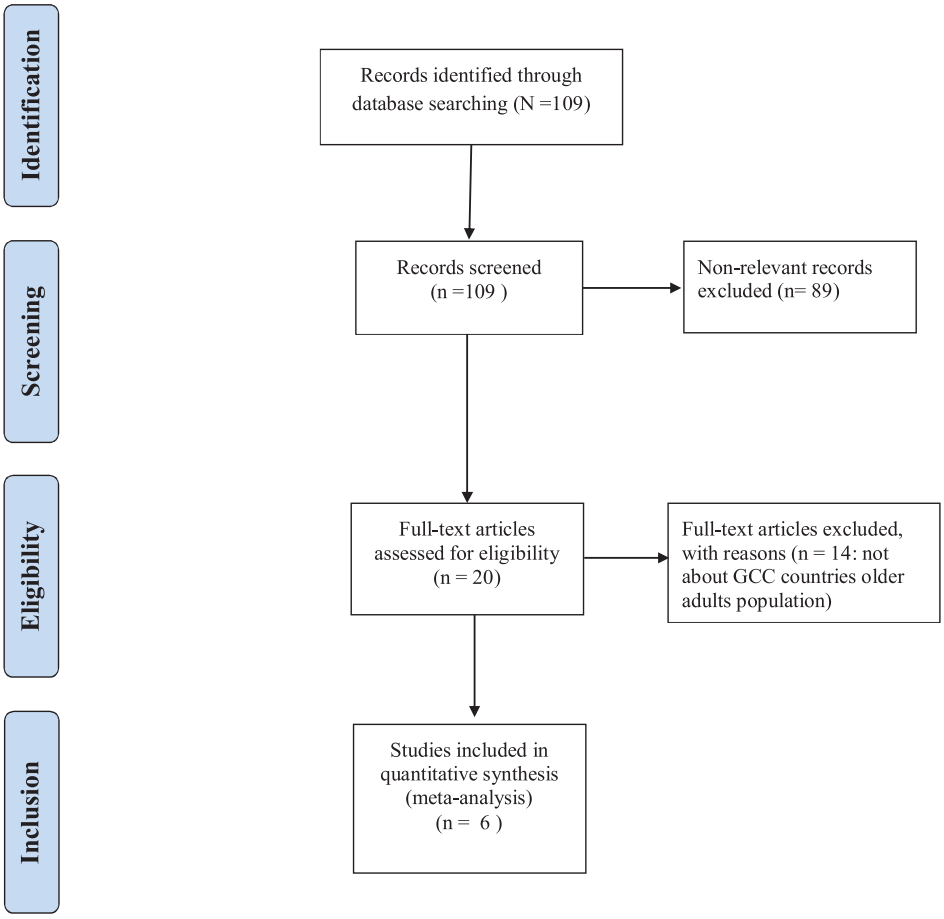

Fig. 1. Flowchart of the systematic review and meta-analysis according to the PRISMA guidelines.

2. Methods

2.1. Protocol

The systematic review protocol was registered in PROSPERO (CRD42018094555). The present systematic review follows the PRISMA guidelines (Moher et al., 2009).This study has been approved by the ethical committee at Prince Sattam Bin Abdulaziz University.

2.2. Eligibility criteria

Observational epidemiological studies with a registry of retrospective and prospective falls, published in peer reviewed journals, and conducted in the GCC countries older population (60 years or older) were eligible.

2.3. Search strategy

We performed a computerized systematic literature search of PubMed, Web of Science, PEDro (Physiotherapy Evidence Database); and SCOPUS from inception to October 2018, without language limits to capture all possible relevant titles. The key words and phrases (in different combinations) searched were *risk factors, accidental falls, falls and age, falling in older adults, and prevalence of falls*. The search was limited to articles that made reference to any country of the GCC in any part of the text. References listed in papers were also used to identify additional studies.

2.4. Study selection

Studies were evaluated for meeting the eligibility criteria. All the prevalence studies, incidence, risk factors, or consequences of the falls of the elderly that were conducted in any of the GCC countries, were selected for review. Reviewed outcomes were number of falls, number of fallers, or rate of falls. Screening of eligible studies was conducted by two reviewers (BA and AA). Disagreements were resolved by a third reviewer, if necessary.

2.5. Data extraction and quality assessment

A double coding approach was implemented to extract data. Two of the investigators (BA and AA) extracted data, using a standardized data extraction form. Any disagreements were discussed until a consensus was reached. Disagreements were resolved by discussion with a third investigator (MA). Data on description of the study sample, study design, sampling method, measures of falls incidence, inclusion and exclusion criteria of included studies, and falls rate were extracted.

The quality of included studies was assessed using the Newcastle-Ottawa Quality Assessment Scale (Wells, O'connell, & B. S., 2011). The scale examined three areas including study group selection, group comparability, and outcome of interest. The final maximum score was 9 stars for the nonrandomized studies. A consensus between reviewers was reached in the case of any scoring discrepancies.

2.6. Data synthesis and analysis

A random-effects meta-analysis on fall prevalence rates was conducted according to guidelines set forth by Barendregt et al

(Barendregt, Doi, Lee, Norman, & Vos, 2013). For a finer grained analysis, additional random-effects meta-analyses were performed on the disaggregated fall prevalence rates for males and females, and a univariate linear regression analysis was performed to analyze the effect of age on fall prevalence rates in the total population (i.e., males and females combined).

3. Results

The literature search resulted in a total of 109 studies (PubMed: 52, Web of Science: 34, PEDro:13, and SCOPUS:10), and only 6 studies met the inclusion criteria and were included in the meta-analyses. Fig. 1 shows the complete selection processes that was followed in this systematic review. Four studies were established in Saudi Arabia, one study was from Qatar and one study was from United Arab of Emirates.

The number of participants ranged between 120 and 1182 participants (age mean 64.72 ± 5.17 years). Three studies (Almawlawi et al., 2011; Almegbel et al., 2018; Sharif & Al-daour, 2018) categorically included the educational level of participants including no education, below university education, and higher education with mean percentages of 42.5%, 9.9%, and 14.18%, respectively. The prevalence of falls for all participants ranging between 34%–57.7%, with 31.9%–50% for males and 36.7%–69.2% for females. In addition, the educational level of fallers was 68.8% for those with no education, 35.12% for those with less than a university education, and 24.73% for those with higher education (Table1).

Risk factors of falling were not provided uniformly in the analyzed studies. Provided risk factors included age, gender, education, nationality, housing ownership, caregiver, medications, walking aids, stress, cardiovascular diseases, osteoporosis, poor vision, back pain, Missouri Alliance for Home Care, Morse Fall Scale variables, Berg Balance Scale (BBS), activity level, ambulatory status, Amer Dizziness Scale, walking aids, chronic diseases, and functional disabilities affecting daily life. Shared risk factors of fall including age, gender, medication, and education were reported in two studies (Almawlawi et al., 2011; Sharif & Al-daour, 2018). Two studies reported shared risk factors of fall including BBS, age, number of medications, and activity level (Abdalagleel Alsaif & Ahmed Alsenany, 2018; Al Saif, 2012). Education and number of medications were reported as shared risk factors of fall in three studies (Almawlawi et al., 2011; Almegbel et al., 2018; Sharif & Al-daour, 2018). Age and gender were shared risk factors of fall in three studies (Almawlawi et al., 2011; Alshammari et al., 2018; Sharif & Al-daour, 2018).

The quality of the studies ranged from 1 to 4, which indicates low quality/unsatisfactory studies. On the Newcastle-Ottawa Scale adapted scale, two studies scored 4 (Almawlawi et al., 2011; Almegbel et al., 2018), three studies scored 2 (Al Saif, 2012; Alshammari et al., 2018; Sharif & Al-daour, 2018), and one study scored 1 (Abdalagleel Alsaif & Ahmed Alsenany, 2018) (Table 2).

Table 2
Quality assessment the studies included in the review.

Study	Selection	Comparability	Outcome	Total
Almegbel et al. (2018)	*	**	*	4
Alshammari et al. (2018)	*	NA	*	2
Alsaif (2012)	*	NA	*	2
Abdalagleel Alsaif and Ahmed Alsenany (2018)	NA	NA	*	1
Almawlawi et al. (2011)	**	NA	**	4
Sharif and Al-daour (2018)	*	NA	*	2

3.1. Results of meta-analysis

A random-effects meta-analysis of six studies indicated that there was a pooled prevalence fall rate of 46.9% with a standard error of 3.3%. This fall prevalence point estimate (46.9%) was statistically significant ($p < .001$) with a 95% confidence interval of (.400, .530). There was significant between-study variation in fall prevalence rates that may be due to heterogeneity given $I^2 = 91.57\%$ and $H^2 = 11.86$. Fig. 2 presents the results of the meta-analysis along with upper and lower 95% confidence interval bounds for the fall prevalence estimates. Using Egger's regression test to examine the risk of the results be skewed due to publication bias (Egger et al., 1997), the 46.9% fall prevalence point estimate does not appear to have been skewed by publication bias ($z = -0.27$, $p > 0.1$). Fig. 3 provides the funnel plot of the observed fall prevalence rates.

3.1.1. Meta-analysis for males

In four studies analyzing males in the GCC, there was a pooled prevalence fall rate of 42% with a standard error of 4.1%. This fall prevalence point estimate (42%) was statistically significant ($p < .001$) with a 95% confidence interval of (.340, .500). There was significant between-study variance in fall prevalence rates for males that may be due to heterogeneity given $I^2 = 82.41\%$ and $H^2 = 5.68$. Fig. 4 presents the results of the meta-analysis along with the upper and lower confidence interval bounds for the male fall prevalence estimates. Using Egger's regression test to examine the risk of publication bias (Egger et al., 1997), the 42% fall prevalence point estimate for males does not appear to have been skewed by publication bias ($z = -0.71$, $p > .1$).

3.1.2. Meta-analysis for females

In four studies analyzing females in the GCC, there was a pooled prevalence fall rate of 60.2% with a standard error of 3.7%. This fall prevalence point estimate (60.2%) was statistically significant ($p < .001$) with a 95% confidence interval of (.530, .673). There was significant between-study variance in fall prevalence rates for females that may be due to heterogeneity given $I^2 = 84.22\%$ and $H^2 = 6.34$. Fig. 5 presents the results of the meta-analysis along with the upper and

Table 1
Characteristics of studies included in systematic review.

Author (year)	Country	Study design	Sample size (% female)	Mean age	Outcomes	Falls incidence and period prevalence
Almegbel et al. (2018)	Saudi Arabia	Cross-sectional	1182 (54%)	68.8	At least one fall over the past year	49.9% (12 months)
Alshammari et al. (2018)	Saudi Arabia	Cross-sectional	357 (53%)	NR[b]	Missouri Alliance for Home Care (MAHC-10) and Morse Fall Scale	57.7% (12 months)
Alsaif (2012)	Saudi Arabia	Cross-sectional	120 (37%)	64.7	History of falls and BBS[c]	44.2% (12 months)
Abdalagleel Alsaif and Ahmed Alsenany (2018)	Saudi Arabia	Cross-sectional	600 (37%)	60.6	History of falls and BBS	44.2% (12 months)
Almawlawi et al. (2011)	Qatar	Cross-sectional	355 (53%)	NR[b]	History of falls in the past year	34% (12 months)
Sharif and Al-daour (2018)	UAE[a]	Cross-sectional	370 (69%)	NR[b]	History of falls in the past 24 months	50.8% (24 months)

[a] UAE: United Arab Emirates.
[b] NR: Not Reported.
[c] BBS: Berg Balance Scale.

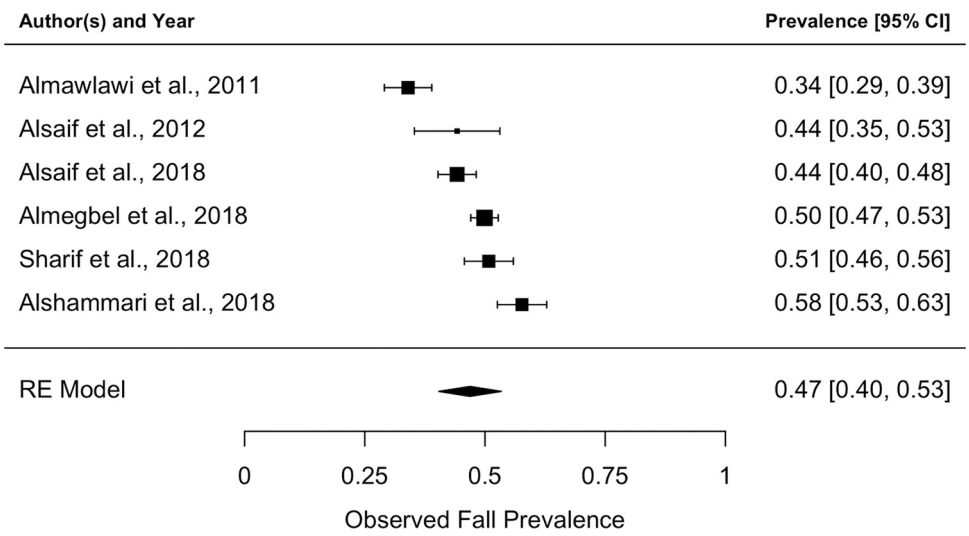

Fig. 2. Forest plot of the observed fall prevalence.

lower confidence interval bounds for the female fall prevalence estimates. Using Egger's regression test to examine the risk of publication bias (Egger et al., 1997), the 60.2% fall prevalence point estimate for females may have been skewed by publication bias ($z = 2.70$, $p < .01$).

Based on the 95% confidence intervals for male and female fall prevalence rates, there is a statistically significant difference between the fall prevalence rates between males and females, with females having a higher fall prevalence rate. That being said, the results of the publication bias analyses indicate that this significant difference may be due in large part to publication bias. Given that the results of the total sample and the male sample did not appear to be influenced by publication bias, it is quite possible that the actual female fall prevalence rate is much more similar to the fall prevalence rate for the total sample and for males.

In the three studies presenting mean age values, linear regression analyses indicated that age was not a significant predictor ($p > .05$) of fall prevalence rates. Similarly, the linear regression model with age as a predictor did not account for a significant amount of variance in fall prevalence rates ($p > .05$).

4. Discussion

This study examined the prevalence of fall and the associated risk factors in older adults living in the GCC. The results found that about half of older adults experienced a fall. The rate of falling was statistically significantly higher in females (60%) compared to males (42%), but the risk of publication bias causes doubt regarding the actual statistical significance of that difference as well as to the clinical significance of that difference. The quality of included studied ranges from weak to moderate. However, the heterogeneity of included studies was relatively high.

The pooled prevalence of fall among older adults residing in GCC countries was 46.9%, and this prevalence is much higher than previous reports in other western countries. The prevalence of falls was much lower in the United States 22% (Stevens et al., 2012) and England 28%(Gale, Cooper, & Aihie Sayer, 2016) when compared to the current study. These differences in the prevalence of falls between western countries and the current study might be related to the ethnicity, culture, study designs, or other factors. However, one study in Egypt reported a higher prevalence of falls in older adults (60.3%) (Kamel, Abdulmajeed, & Ismail, 2013), and this is even higher than our pooled prevalence in the GCC. The higher prevalence of falls could be related

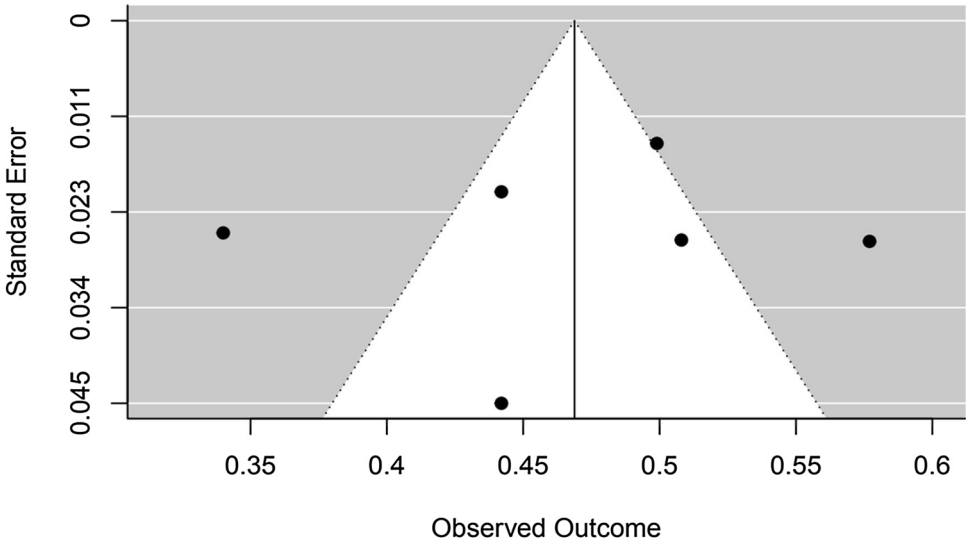

Fig. 3. Funnel plot of the observed fall prevalence.

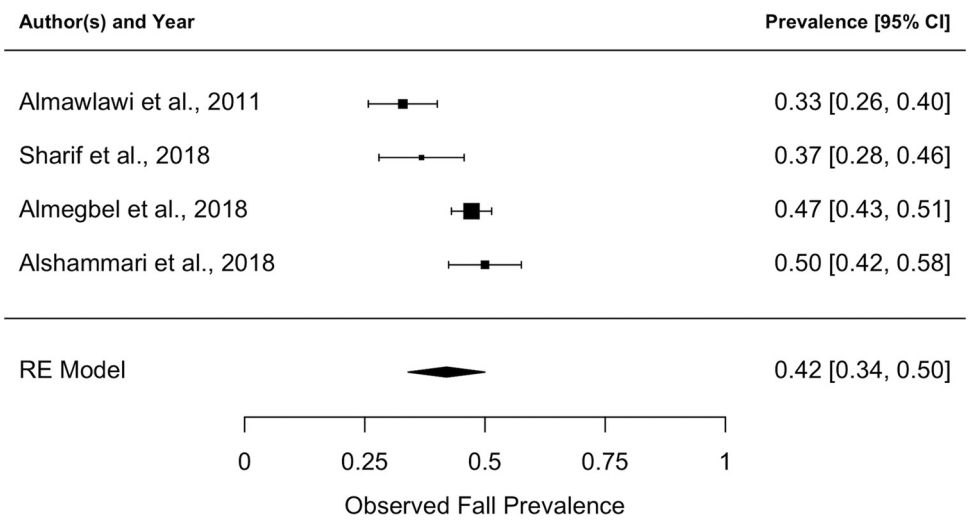

Fig. 4. Forest plot of the observed male fall prevalence.

to the presence of multiple risk factors that are associated with falls. In the middle east region, there is a critical need to examine the risk factors of falls among older adults in order to establish appropriate prevention programs.

Differences in prevalence of fall among older adults in the included studies ranged from 34 to 57.7%. This difference is relatively high and could be attributed to many factors. Sample size, age, definition of fall and sampling methods may play a role in the discrepancy of prevalence of falls in the included studies. For example, the sample ranged from 120 to 1182 participants and this could affect their results. Another factor was age that was reported as means in only three studies and ranged from 60 to 68 years. The definition of falls varied between studies, and some studies defined a fall to include a fall in the past 12 months while another study defined a fall to include a fall in the past 24 months. Other studies did not specify the range of fall recall. Finally, sampling methods used mainly convenient sampling that may not be generalizable to the population. Only one study employed random sampling and reported the lowest prevalence of fall among other included studies (34%). Future research should investigate the prevalence of fall among older adults using well designed and high quality population based studies.

Females showed higher prevalence of falls compared to males in the current study, although the actual extent of this difference is in question. The finding of a higher fall prevalence rate for females was, however, consistent with previous studies in different populations (Bekibele & Gureje, 2010; Bergen, Stevens, & Burns, 2016). Females have different hormonal changes during aging or after menopause. These changes could be associated with loss in bone mass faster than males. Another risk factor that has been associated with falls in females is sarcopenia that is characterized by loss of skeletal muscles (Landi et al., 2012; Leonetti & Lee, 2014).

Some included studies reported associated risk factors of falls among older adults, but some other studies did not. Common risk factors of falls among included studies were older age and gender. Older age has been shown to be associated with falls in previous research (Bird, Pittaway, Cuisick, Rattray, & Ahuja, 2013; Iinattiniemi, Jokelainen, & Luukinen, 2009). This might be explained by aging process that affects balance and skeletal system leading to fall (Landi et al., 2012). However, the current meta-analysis showed that older age was not significantly associated with falls. This might be explained by the very limited number of studies (n = 3) reported mean age. Females are more likely to fall in previous evidence, and this could be attributed to the hormonal changes and other comorbidities that may be associated with falls (Landi et al., 2012; Leonetti & Lee, 2014). Other risk factors were associated with falls in some of the included studies such as educational level and number of medications. These results were consistent with previous research that reported that being uneducated was associated with falls in older adults (Abreu, Azevedo, Silva, Reiners, &

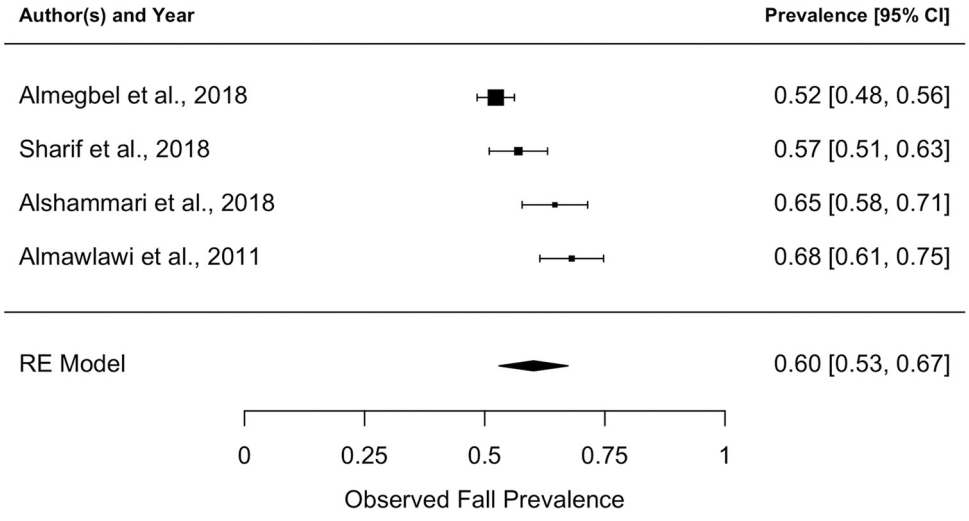

Fig. 5. Forest plot of the observed female fall prevalence.

Abreu, 2016; Alexander, 1996; Kumar, Carpenter, Morris, Iliffe, & Kendrick, 2013;). Low educational level was associated with falls in older adults in three of the included studies (Almawlawi et al., 2011; Almegbel et al., 2018; Sharif & Al-daour, 2018). This relationship could be attributed to the lack of awareness for older adults about their health. Therefore, this population could have lack of acceptance to healthcare advice regarding prevention strategies. Polypharmacy is another challenge for older adults and associated with falls. This association was reported in five of the included studies except Alshammari et al. (Alshammari et al., 2018). Previous research has identified that four or more medications increased the risk of falls among older adults (Sousa et al., 2017).

One of the strength of the current systematic review and meta-analysis was the first study that examined the prevalence of falls among GCC countries populations. However, this study has some limitations. The very limited number of studies may limit the generalizability of the results. No reports were found for some GCC countries such as Kuwait and Oman regarding the prevalence of falls among older adults. Future research should consider examining risk of falls in older adults in those countries. Subgroup analyses based on gender should be interpreted with caution since only four studies presented data for fall based on gender. High heterogeneity between included studies indicates several factors that may affect the pooled prevalence of fall including study design, demographic, environmental and other unknown factors.

5. Conclusion

This systematic review and meta-analysis found that older adults living in the GCC countries had high prevalence of fall (46%). Subgroup analyses found that females showed higher fall rates (60.2%) compared to males (42%). These prevalence rates are higher than previously reported fall rates in different populations. Further research is needed to explore the possible factors related to fall in older adults living in the GCC.

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Conflict of interest

The authors declare no conflict of interest

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