

Fall calendar as a tracking and monitoring tool for older adults with a history of falls: a longitudinal study

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Abstract

Objective: To verify adherence to and the applicability of a fall calendar as a tracking and monitoring tool among older people with a history of falls, and to identify which factors influenced their use of the calendar in their daily lives.

Methods: This longitudinal study is derived from a randomized clinical trial conducted remotely in 2021 and 2022. Older people with a history of falls included in the MAGIC Program (Brazil) took part in the study. After an initial assessment that collected sociodemographic, health, and functional data, 16-week and 12-month follow-ups on falls were performed. Fall data were collected through monthly phone calls and the use of a fall calendar. Adherence to the fall calendar was investigated through descriptive analysis, fall rates were compared between calendar and monthly telephone data, the calendar was analyzed for sensitivity and specificity, and possible influences on adherence to the fall calendar were identified through regression analysis.

Results: In this sample of 56 older adults, adherence to the calendar was unsatisfactory. The fall calendar presented 21.2% sensitivity and 18.7% specificity compared to monthly phone calls. Moreover, sociodemographic, health, and functional factors did not influence adherence to the calendar.

Conclusion: There was low adherence to the fall calendar, and clinical and sociodemographic factors did not influence adherence. Further randomized clinical trials that screen falls through monthly phone calls are recommended in Brazil.

Keywords: Accidental falls. Risk factors. Aged. Epidemiological monitoring.

INTRODUCTION

As individuals age, they become vulnerable to physical and psychosocial conditions.¹ Fall rates among older adults vary by region, ranging from 20%–33% in Western countries, with 27.6% in Brazil.^{2,3} Globally, falls cause over 680,000 deaths annually and approximately 172 million falls result in fractures, physical disabilities, and short-, medium- or long-term consequences.⁴ The incidence of falls in older people has increased and falls are considered one of the main public health problems worldwide.⁴

Studying the fall rate in older people with a history of falls helps researchers and health professionals plan preventive measures and guide public health policies.⁵ Tools for tracking and monitoring falls and their consequences are essential for prevention.^{3,6,7} Fall calendars and phone calls are commonly used for this purpose, with good adherence among older people in developed countries.⁶

In some developed countries, fall calendars are considered the gold standard for fall rate monitoring among older people.⁸ In addition, direct contact through phone calls, which can be weekly, fortnightly, or monthly, help remind them to fill out the calendar and highlight its importance as a tool for tracking falls and monitoring their health status.⁸

In view of this, there is a need for studies that use effective and safe methods to screen falls among older people in developing countries, such as Brazil.⁶ In the USA, care managers monitored 22 older adults via telephone over 2 years, collecting data on the fall rate and the factors most associated with it, including reduced strength, balance, sensory issues (hearing/vision loss), and dementia or cognitive impairment.⁹ Further studies are needed to verify which factors influence adherence to fall screening methods.

This study aimed to assess adherence to a fall calendar among older adults with a history of falls in comparison to monthly phone calls, as well as to identify factors that influence adherence. We hypothesized that the calendar would provide reliable results on falls and their consequences.

METHODS

This longitudinal study was based on data from a single-center randomized controlled clinical trial (1:1 ratio) that was conducted remotely (2021–2022). Older people with a history of falls included in the Case Management Program at Home to Reduce Fall Risk in Older Adults (MAGIC study) took part in the study. The aim of the MAGIC was to reduce fall risk factors through case management,

multidimensional assessment, and targeted health care over 16 weeks.¹⁰ The study was approved by the institutional research ethics committee (34350620.7.0000.5504). After the procedures were explained, the participants provided written informed consent.

The eligibility criteria were age ≥ 60 years, residence in Brazil, non-institutionalized status, a history of falls in the past year, and a contact phone number. The program was promoted via pamphlets, posters, social media, radio, and TV. The specific inclusion criteria were ≥ 2 falls in the last 12 months, independent walking (with or without assistance), willingness to be assessed, and ability for virtual communication with audio and camera.

The exclusion criteria were: uncorrected hearing or vision impairments, motor sequelae from stroke, active inflammatory or neurological diseases (advanced Parkinson's diseases, multiple sclerosis, Huntington's diseases, dementia, uncontrolled vestibulopathy, epilepsy, traumatic brain injury, etc.), and no Internet connection for assessment and monitoring.

The sample size followed the rule of 10 events per logistic regression variable (success or failure, depending on which is rarer).¹¹ Thus, based on a previous study by our research group, fall calendar adherence and nonadherence were expected to be 63.4 and 36.6%, respectively. Each risk factor required 28 participants and, accounting for 20% loss, the final sample was 34 volunteers.

The assessments, which were conducted remotely by trained researchers, included comorbidities, fall history, general health, functional capacity (Lawton & Brody Scale), fall risk perception (Falls Risk Awareness Questionnaire – FRAQ-Brazil), cognitive function (Addenbrooke's Cognitive Examination – revised version – ACE-R), fear of falling (Falls Efficacy Scale – International – FES-I), anxiety (Geriatric Anxiety Inventory – GAI), depressive symptoms (Geriatric Depression Scale – GDS), and sociodemographic data (age, sex, education, and income).

To assess falls over 12 months, the following definition was used: “involuntary displacement of the body to a lower level, caused by multiple factors, with or without injuries”. A fall is considered to be when a person is found on the ground or needs support when moving, even without reaching the ground. Falls can occur from one's own height, from a stretcher/bed or from seats (wheelchairs, armchairs, chairs, toilet seats, bathtubs, etc.).¹²

Three trained researchers made monthly calls based on the participants' availability. The calls aimed to discuss recent events with simple questions such as: “Did you fall this month?”

“How many times?”, “There were consequences?”, “Did you see a doctor or get hospitalized?”, “Did you spend money on hospitalization or medications?”, “Did any important family events occur?”, “Have you had the flu, COVID-19, or dengue?”, and “Have you received a COVID-19 booster shot” or “other relevant updates?”

After the initial assessment, the volunteers received a printed calendar by mail, with instructions on how to fill it out and its importance for tracking falls. They were told to keep it accessible and return it by photo after 12 months, stressing the importance of not losing it. The calendar was designed to be simple and easy to understand. It included instructions on marking the date of any fall with an “X” and a table with details on the fall, its consequences, and its severity (“The date of the fall”, “Did you trip, slip or fall?”, “How many times?”, “Where did you fall?”, “Were you hospitalized?”, “Did you have a fracture?”, “Did you hit your head?”, “Did you need surgery?”).

We used the following data from monthly phone calls and fall calendars: “number of falls”, “number of falls per person”, “when was the first fall (month)?”, “when was the second fall (month)?”, “consequences”, “injurious falls”, “falls that resulted in financial expense”, “fractures”, “mortality”.

The significance level was $\alpha = 0.05$; SPSS 20.0 was used for the statistical analysis. Descriptive analysis assessed adherence to the fall calendar (satisfactory: the calendar matched the telephone data; unsatisfactory: the fall rate was lower than the telephone data or was not filled in). The χ^2 test was used to compare the fall rates between the calendar and telephone data.

The results of both tools were compared in terms of sensitivity and specificity. Sensitivity is the ratio between the number of individuals who reported falls and the number who actually suffered falls during the study period according to a standard monitoring tool (i.e., phone calls). Specificity is the ratio between the number of individuals who reported not falling and the number who actually did not fall during the period.¹³

Bivariate logistic regression was used to analyze how sociodemographic, clinical factors, and functional capacity influenced adherence to the fall calendar (satisfactory or unsatisfactory adherence).

RESULTS

The initial sample had 62 participants, 49 of whom remained after 12 months due to dropouts. Regarding clinical and sociodemographic characteristics ($n = 49$), there was a high prevalence of women (89%) and widows (48%); the mean

number of falls in the last year was between 2 and 3; the mean age was between 72 and 73 years; the mean number of comorbidities was 2; and the mean education level was between 9 and 10 years.

Adherence to the fall calendar was unsatisfactory. After 12 months, only 10 volunteers (20.4%) returned the calendar. Significantly more falls were recorded in the monthly phone calls than in the calendars (Table 1). The sensitivity and specificity values were 21.2 and 18.7%, respectively. No single factor significantly interfered with calendar adherence (Table 2).

DISCUSSION

This study analyzed adherence to a fall calendar among older people with a history of recurrent falls in comparison to

TABLE 1. Fall calendar and monthly phone call results ($n = 49$).

Falls calendar – n (%)	Monthly phone call – n (%)		Calendar total – n (%)
	Falls	No falls	
Delivered, no falls	0 (0.0)	3 (6.1)	3 (6.1)
Delivered, falls	7 (14.3)	0 (0.0)	7 (14.3)
Lost, forgotten, or discarded	26 (53.0)	13 (26.5)	39 (79.6)
Total phone calls	33 (67.3)	16 (32.6)	49 (100)

n (%): number of individuals (percentage); $p=0.008$ (χ^2 test).

TABLE 2. Factors associated with adherence to the fall calendar ($n = 49$).

Factors	Adherence to the fall calendar		
	OR (95%CI)	p-value	Power
Age	0.969 (0.891–1055)	0.467	0.468
Sex	0.756 (0.078–7.308)	0.809	0.860
Years of education	1.064 (0.926–1.222)	0.382	0.388
Monthly income*	5.400 (0.438–66.671)	0.188	0.998
Presence of comorbidities	1.189 (0.716–1.974)	0.505	0.549
History of falls	1.072 (0.755–1.522)	0.698	0.703
General health	0.000 (0.000)	0.999	1.000
Lawton & Brody scale	1.039 (0.848–1.272)	0.712	0.713
FRAQ-Brasil	1.055 (0.843–1.319)	0.641	0.644
ACE-R	1.025 (0.982–1.069)	0.256	0.257
FES-I	1.016 (0.946–1.090)	0.668	0.668
GAI	0.952 (0.845–1.073)	0.419	0.423
GDS	0.944 (0.740–1.203)	0.641	0.645

Bivariate logistic regression analysis; *of at least the federal minimum wage.

OR: odds ratio; CI: confidence interval; MW: minimum wage; FRAQ-Brasil: Falls Risk Awareness Questionnaire; ACE-R: Cognitive examination of Addenbrooke – revised version; FES-I: Falls Efficacy Scale – International; GAI: Geriatric Anxiety Inventory; GDS: Geriatric Depression Scale; Power value (1- β) calculated using G*Power software (3.1.9.7).

monthly phone calls, in addition to identifying which factors influenced them to complete the calendar. Adherence to the calendar method was only 20.4% and the investigated factors did not affect adherence.

The incidence of falls in this study was higher than that reported in the literature.^{2,14} Continuous monitoring through monthly phone calls is essential in older adult care, with or without the use of a calendar. The sensitivity and specificity of the calendar were unsatisfactory compared to phone calls, which had 100% adherence. Phone calls, which are essential for data collection, reinforce the importance of health and fall tracking among older people.

A systematic review found that individuals often forget to report falls on calendars or by telephone, especially after long intervals (1 year). Telephone calls in the previous year had higher specificity (91–95%) and lower sensitivity (80–89%) than continuous data collection from questionnaires involving calendars or postcards. Sensitivity and specificity may be influenced by the time interval (1–12 months) for reporting a fall. The authors recommend weekly or monthly¹³ collection of questionnaire information, as was done in this study. The reporting of falls may be influenced by sociocultural factors, such as financial resources, cultural differences, and educational level. Therefore, it is crucial to select the best tracking tool for different settings to ensure reliable data collection.^{3,7,13}

Our sensitivity and specificity results indicated low adherence to the calendar as a main screening tool, which suggests that older Brazilians are unfamiliar with this type of intervention. This contrasts with studies conducted in developed countries, where using calendars both familiar and the gold standard.^{3,13,15}

Although no clinical, sociodemographic, or functional factors influenced calendar adherence in our study, other factors can contribute to adherence, such as screening time.^{3,15} Interventions with shorter screening times^{3,15} than ours found greater adherence to a fall calendar.^{3,15} This difference is due to cultural factors, technology use, education levels, and strong encouragement to adhere to health screening tools and prevention programs.¹⁵

A longitudinal Canadian study that investigated fall rates between men and women through a calendar found the calendar to be an effective tool.¹⁶ Our results confirmed high adherence to telephone calls for tracking and exercise reminders, as well as that older adults prefer telephone calls to calendars.¹⁷

Secondary analysis of an English trial showed that monthly diaries were more effective than mailed questionnaires in a sample of 9,803 older adults. In the present study, data collection by telephone was complemented with a calendar,¹⁸ which was not an effective tool for assessing falls in this Brazilian sample. The authors acknowledged study limitations, such as a lack of national representativity, although the sample consisted of volunteers from all regions. The sample was also restricted to individuals with access to digital communication technology due to the pandemic, a small proportion of men, and a small sample size in some models (age, education, Addenbrooke Cognitive Examination-Revised results, and Geriatric Anxiety Inventory results). Nevertheless, the program successfully monitored older adults from different regions. The authors highlighted non-adherence to the fall calendar, which seemed to be due to sociocultural and technological reasons. Monthly phone calls were more accepted than the calendar. The authors emphasized the importance of fall prevention protocols for older adults of different age groups and social and financial status to reduce the social impact of falls and their consequences, including fewer institutionalizations, hospitalizations, family dependency, and deaths.

The present study's results are valuable for fall prevention, screening, and intervention programs. The protocol is remote, low-cost, and easily reproducible, requiring few professionals. Future research should develop reliable assessment tools, such as phone calls or apps that include reminders, especially for Brazilian older adults with a history of falls. Future research should also implement training strategies for older adult participants and their support network, facilitating data collection with the screening tools. It should also be noted that hybrid intervention models encourage a greater bond between older adults and their support network, which can help overcome the challenges identified here.

CONCLUSION

In conclusion, fall calendar adherence was unsatisfactory and was not influenced by either functional capacity or clinical or sociodemographic factors. Tailored fall tracking methods are needed for older adults in developing countries. Future studies should explore hybrid models that integrate calendars with digital tools or family involvement to track falls.

DECLARATIONS

Conflict of interest

The authors declare no conflicts of interest.

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Author contributions

Mariana Ignácio Sossai: conceptualization, data curation, formal analysis, investigation, visualization, writing – review & editing. Camila Bianca Falasco Pantoni: methodology, validation, visualization, writing – review & editing. Livea Cristina da Silva: investigation, visualization, writing – review & editing. Mariana Luiz de Melo: investigation, visualization, writing – review & editing. Mel Silva de Sá: investigation, visualization, writing – review & editing. Karina Gramani-Say: conceptualization, funding acquisition, investigation, methodology, resources, software, supervision, validation. Juliana Hotta Ansai: conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, validation, visualization, writing – original draft.

Ethical approval and informed consent

The study was approved by the UFSCar Research Ethics Committee (34350620.7.0000.5504). After the procedures were explained in detail, all participants provided written informed consent.

Data availability statement

Data available on request from the authors.

Reporting standards guidelines

This manuscript has been prepared following the STROBE checklist for reporting longitudinal studies.

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