Can a multifactorial geriatric assessment predict older adult’s adherence to a fall prevention program?

Running title - Adherence to fall prevention program

Abstract

Background: There is evidence in the literature of the effectiveness of multifactorial interventions in reducing the occurrence of falls in elderly residents in the community. However, low adherence to prevention programs is cited in the literature as a recurring problem, questioning the effectiveness and sustainability of these programs. The aim of this study is to compare subgroups of fallers with different levels of adherence to a multifactorial fall prevention program in terms of a broad range of sociodemographic, medical, disability, physical functioning, and psychological measures in a multifactorial geriatric assessment, and identify which of these measures explain optimal adherence.

Methods: A prospective study conducted with two hundred and fifty-seven community-dwelling people aged ≥ 60 years who participated in a multifactorial fall prevention program. All participants underwent assessments on sociodemographic, medical, disability, physical functioning, and psychological measures. The presence on weekly sessions over 12 weeks was used to ascertain adherence. Subgroups of participants with low, moderate and high adherence were determined by k-means cluster analysis, and were compared regarding variables of interest. A multivariate regression analysis was conducted to identify participants with an optimal adherence (median; ≥ 10 sessions).

Results: Participants with low (1 up to 4), moderate (5 up to 8) and high adherence (≥ 9 sessions) corresponded to 13.2%, 19.5% and 67.3%, respectively. Of all measures, only the low perceived risk of falling was able to discriminate subgroups of adherence. Multivariate regression analyses adjusted for covariates identified that older people with optimal adherence were less likely to be depressed and were more likely to present a higher score in a global cognition measure.
Conclusions: Implementation strategies should be undertaken to understand the views and beliefs of older people with low perceived risk of falling and offer person-centered rationale to increase engagement. Treating and closely monitoring older adults with depression early in the pathway of care for falls prevention so as to optimize enablers may promote adherence to programs.

Keywords: patient adherence; accidental falls; primary prevention; depression; aged.

Background

Worldwide, a rapidly population ageing poses enormous challenges for the implementation of public policies. Health care systems need urgently respond to the complex needs of older people, optimizing their intrinsic capacity and functional ability.[1] Falls are recognized to increase the risk for mobility limitation and care dependency, with a substantial impact on the demand for long-term health care.[1] Injuries due to falls are the leading cause of 41% of the total years lived with disability.[2] The number of older people who will sustain a fall and a fall-related injury is expected to increase in coming years.[3] This increase will be more intense in middle and low-income countries where 80% of the older population will be living by 2050.[4]

Multifactorial programs are effective in reducing the rate of falls.[5] However, studies analyzing factors related to the adherence in multifactorial fall prevention trials are scarce.[6] Non-adherence is considered critically important to the effectiveness of interventions to prevent falls.[7] Multidimensional geriatric assessment of risk factors for falls is recommended as the first intervention to outline modifiable risk factors, particularly among those who had already fallen and are considered to be at high risk of falling again.[8]

Identifying characteristics of older adults that may lead to poor adherence in fall prevention programs in a multifactorial assessment can lead to more assertive care planning for each individual, including changes in the chain of long-term interventions. Furthermore, the results of studies on adherence can help with the implementation of programs to prevent falls, by optimizing
processes and resources, particularly in low and middle-income countries where there is competing demands on health care systems. We hypothesized that participants with low adherence would be those with overall poor medical status, higher disability levels and who reported high-perceived risk of falling more frequently.[9, 10]

The aim of this study is to compare subgroups of fallers with different levels of adherence to a fall prevention program in terms of a broad range of sociodemographic, medical, disability, physical functioning, and psychological measures in a multifactorial geriatric assessment and identify which of these measures explain optimal adherence.

Methods

Design and Ethical Consideration

A prospective study was conducted with secondary data of a multicenter multifactorial fall prevention program (XXXX RCT).[11] The program was carried out once a week for 3 hours and consisted of medical guidance, on-site exercises, guidance for home exercises and an educational group to change risky behavior. Older men and women aged 60 and over who lived in the community in the city of São Paulo with a history of at least one fall in the last 12 months were included. Fall was defined as "an unexpected event in which the participants come to rest on the floor, floor or lower level".[12] Recruitment and exclusion criteria details were previously described.[13] Ethical approval for the study was obtained from the author’s institute.

Measures and instruments

Adherence Assessment

The presence of each participant over the 12 weeks of intervention was retrieved for identifying adherence. We consider that the presence or not in the sessions reflected the participants' behavior regarding their engagement in the program.[14] To analyze the factors related to program adherence, data from the multidimensional geriatric assessment carried out at baseline were used.
The assessment consisted of sociodemographic, medical, disability, physical functioning and psychological measures, and fall risk stratification using the Quick Screen Falls risk assessment.

**Sociodemographic Assessment**

Age, gender, educational level and distance to the center were collected. Educational level was classified according to the years of schooling as low (0 to 4 years), medium (5 to 8 years) and high education (≥ 9 years). The travel distance to each center was calculated using Google Maps®.

**Medical Assessment**

Self-rated health was assessed by a question about the overall perception of health in the individual’s usual week. The number of diseases and health conditions were ascertained using the Charlson Comorbidity Index.[15] The presence of chronic pain and dizziness/vertigo was assessed through self-report. The measure of blood pressure in the sitting and standing position was used to identify postural hypotension that was considered to be a drop in systolic blood pressure ≥ 20 mmHg and/or a drop in diastolic blood pressure ≥ 10 mmHg in the 3 minutes following the change from decubitus to orthostatic position. Regular use of medications was assessed, by inquiry and was checked in the prescriptions and / or the asking older adults to bring their medication box. The sum of medications was categorized into: 0 to 4, 5 to 7 and 8 or more medications. Polypharmacy was identified when participants took 5 or more medications regularly.[16] The number of falls in the last 12 months was collected by self-report, and the fall was categorized as being indoors or outdoors.

**Disability and Physical functioning Assessment**

Usual walking speed was assessed in three attempts using a path of 4.6-meter, with 2 m for acceleration and 2 m for deceleration.[17] Participants were categorized using the 0.7m / s cut-off point.[18] Older adults’ disability was assessed using the Brazilian Multidimensional Functional Assessment Questionnaire (BOMFAQ)[6] composed of 15 basic and instrumental activities of daily living. Participants were categorized according to the number of activities performed with difficulty: 0, 1 to up 3, 4 to up 6 and 7 or more activities.
The degree of risk of falling was assessed using the Quick Screen Clinical Falls Risk Assessment.[19] Participants were classified as having a very low and low risk of falling and moderate and high risk of falling.

*Psychological Assessment*

The presence of fear of falling was assessed by self-report. Depressive symptoms were screened using the Brazilian version of the Geriatric Depression Scale (GDS - 15 items).[20] Older adults with a positive screening for depression were those who reported ≥ 6 depressive symptoms. The Mini-Mental State Examination (MMSE) was used to assess global cognition.[21]

The Falls Efficacy Scale International (FES-I)[22] was used to assess the perception of the risk of falling through the older response to concerns about the possibility of falling when performing 16 activities and were classified into low perception (16 to 22 points) and high perceived risk of falling (≥23 points).

In order to explore the interaction of variables, participants were grouped according to the co-existence of six conditions: 1. Slow walking speed (≤0.7 m/s) and depression; 2. Slow walking speed (≤0.7 m/s) and chronic pain; 3. Chronic pain and depression; 4. Chronic pain and fear of falling; 5. Fear of falling and had fallen outdoors; 6. Fear of falling and depression.

*Statistical Analysis*

We excluded older adults who did not attend at least one session based on the definition of adherence suggested by WHO[13] that is ‘the extent to which a person’s behavior – taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider’. Taking into consideration that adherence is an attitude and behavior in dyadic relationship, we considered that those older people who were eligible, but were not exposed to at least the first session of the program, could not be exposed to the recommendations. In the first session the activities were explained and agreements were made. The *K*-means cluster analysis method was used to classify participants into three adherence groups regarding the number of sessions they had attended: low (1 - 4), moderate (5 - 8) and high (9 to
The adherence groups were compared in relation to the variables of interest using the Chi-square test or Fisher’s Exact test for categorical variables, and using the T test or the Mann-Whitney test for quantitative variables, according to the to normal distribution.

Participants with optimal adherence were considered those who attended 10 or more sessions (median over 12 sessions). A stepwise multivariate logistic regression analysis was conducted to estimate the association of each variable of interest on the odds of being the in the optimal adherence group. A screening criterion of p< 0.05 was used to select independent variables for entry into the multiple analyses. The final model from the multivariate regression analysis was adjusted by covariates (age, number of diseases, polypharmacy, hypertension, atrial fibrillation, diabetes, osteoporosis, osteoarthritis, urinary incontinence). The combined variable ‘fear of falling and depression’ was identified as a confounder (considered a change of > 20% in the β coefficient). Odds ratios (95% CI) and p-values were reported. The fit of the multiple logistic regression models was evaluated using the Hosmer-Lemeshow goodness-of-fit test. Analysis were performed using the SPPS program version 23.0 and a p-value <0.05 with two-tailed distribution were considered as a significant association.

**Results**

Of the total 306 older adults who were referred to the fall prevention program, 49 (16%) did not attend at least one session. There was no difference between participants that did not attend at least one session and those who attended in terms of sociodemographic, clinical and functional variables (Appendix).

Amongst the 257 participants the mean age (SD) was 73.5 (7.4) years and the majority were women (86%). Table 1 describes participants’ characteristics. Overall, mean (SD) session’s attendance was 8.7 (3.1) and the median were 10 sessions, ranging from 1 to 12. The distribution of participants according to adherence was 13.2% in the low, 19.5% in the moderate and 67.3% in the
high adherence group. The median adherence rate was 83.3% (95% CI 69.2 - 75.7), varying from 8.3% to 100%.

Comparisons of subgroups of adherence are presented in table 2. Of all measures, only the low perceived risk of falling were able to distinguish participants in the low adherence group (44.1%) when compared to those in the moderate adherence group (18.0%) and the high adherence group (25.2%) (p = 0.025).

Participants were compared in terms of the optimal adherence (table 3). The group of participants with optimal adherence had a better overall cognition assessed by MMSE (26.3 ± 2.6 points), a lower prevalence of depression (18.9%) and a lower prevalence of the combination of fear of falling and depression (14%) when compared to the all other participants. Adjusted model from the multivariate logistic regression revealed that participants who reported not having depression and with higher score on the MMSE were more likely to be in the group with optimal adherence (Hosmer and Lemeshow p= 0.375), (AUC= 0.662; 95% CI 0.595 – 0.729; p <0.001).

Discussion

By comparing different levels of adherence to a multifactorial fall prevention program we found that amongst a broad range of measures in a comprehensive geriatric assessment only the low perceived risk of falling were able to distinguish those with a low adherence level in comparison with participants with a moderate and high adherence levels. However, when we considered optimal adherence, we observed that participants in this group were more likely to have a higher score in a measure of global cognition and decreased prevalence of depressive symptoms.

The median adherence rate in our study was 83%. This result is similar to the median adherence to exercise-based interventions (89.2% ranging from 85.4% to 91.0%) and to the median overall adherence rate to assessment-based recommendations (76.0%) reported in a systematic review.[10] However, lower mean adherence rates in physical exercise groups (58%), in lectures (33%) and in psychosocial groups (25%) have been previously reported.[9, 10] Since in our study
exercise and educational/behavioral interventions were conducted one immediately after the other in the same day, it was not possible to measure adherence for different group-activities.

Our result that the low perceived risk of falling was able to identify participants with low adherence to the program is not consistent with prior studies.[9] A greater self-efficacy was associated with greater adherence in studies of adherence to exercise programs to prevent falls.[9] Better self-perception of own abilities resulting in a increased confidence in performing the proposed tasks is a possible explanation to enhance participation.[9] A high self-efficacy is shown not only to positively influence adherence to exercise sessions, but also the maintenance of exercises over time.[10, 23]

The contradictory finding observed in our study may be explained by some feasible assumptions, such as that participants did not value their risk, or did not believe that falls can be prevented, or that the proposed interventions did not fit their needs. In our study participants in the low adherence group seemed to be better educated, had decreased number of diseases and lower levels of self-reported disability. This profile is similar to the ‘stoic’ group proposed in a previous study. The stoics had a high physiological risk of falling, but perceived their risk as being low.[24] Possibly fallers with low perceived risk of falling may not notice changes in strength and balance. Old fallers with a low perceived risk of falling presented a lower grip strength and decreased stance time in one-legged test compared with non-fallers with low perceived risk.[23] Our finding may also reflect that participants believed that the activities in the fall prevention program were unnecessary for them personally, either because they feel fit and healthy or did not perceive falling to be a serious issue.[24] Furthermore, other ways of confronting one’s self-appraisal and risk of falling is also to consider falling as a normal consequence of the aging process or as lack of control, dependence and incompetence, and these judgments can lead to a reluctance to participating in fall prevention program.[25]

The associations between optimal adherence and better global cognition, and less self-reported depression have some plausible explanations. It is possible that a better cognition have
provided a greater ability to manage the challenges imposed by the displacement to the centers and also to retain or recall educational information and instructions to cope with the exercises.[26] Older people with poor executive function living in the community had lower life-space mobility compared to those with intermediate or good executive function. This difference was due to a higher prevalence of transportation difficulties and poor lower extremity physical functioning.[27] Older people in general tend to value practical aspects, such as travel time and venue accessibility while deciding to participate in exercise programs to prevent falls.[28] Prior study had also observed that higher MMSE scores were related to full-adherence to on-site exercise program to prevent falls.[9, 28, 29] Several studies on adherence to exercise programs to prevent falls indicated that depression was associated with poor adherence.[30] Life-space mobility is significantly influenced by depression, and this interrelationship seems to be mediated by person’s walking difficulties, chronic conditions and more limited sense of autonomy in outdoors activities.[9] Particularly for women, who were the majority of participants in our study, somatic symptoms associated to depression seems to be closely linked to the perception of autonomy outdoors.[29] Furthermore, depression can also affect attention, executive function and processing speed, resulting in poorer sense of capability of fulfilling the requirements to participate in the group activities.

It is acknowledged that as participants were mostly women, the findings are unlikely to be fully generalized to men. However, in clinical scenario women suffer falls more than men and seek health services more frequently than men. Secondly, during the clinical trial period that lasted five years there were diverse conditions outside the program that may have influenced adherence to the program.

We believe that our study is one of the few conducted in low and middle-income countries with a large sample. There are opportunities for decision makers, service managers and clinical practitioners to avoid that older people do not engage in fall prevention programs. Not only, the identification of to whom preventive interventions can be successfully targeted, but how it can be
better delivered it is important. As a result, it’s expected that older people can benefit from the intervention and health care resources can be optimized. The inherent concept of adherence is complex and the presence in sessions may be viewed as a simplification, yet a consistent measure of adherence and a consensus on how it should be reported in multifactorial interventions to prevent falls is lacking.

**Conclusions and Implications**

Implementation strategies should be undertaken to understand the views and beliefs of older people with low perceived risk of falling and offer person-centered rationale and evidence-based recommendations to increase engagement. Treating and closely monitoring older adults with depression early in the pathway of care for falls prevention so as to optimize enablers may promote adherence to programs. Health care professionals and service managers should be aware that adherence involve a process of self-appraisal about the risk of falling, and take this into considerations to develop more assertive pathways of care and tailored messages for keeping optimal adherence levels.

**Abbreviations:**

RTC: Randomized Controlled Trials

BOMFAQ: Brazilian Multidimensional Functional Assessment Questionnaire

GDS: Geriatric Depression Scale

MMSE: Mini-mental State Examination

FESI: Falls Efficacy Scale International

ADL: Activities of Daily Living

IACL: Instrumental activities of Daily Living

WHO: World Health Organization

SD: Standard Deviation

CI: Confidence Intervals
Declarations

Ethics approval and consent to participate:
All participants gave written consent for the use of their data through the informed consent form. The consent form was signed by the participants themselves at the beginning of the RCT multicenter multifactorial fall prevention program (ClinicalTrials.gov: NCT01698580)

Consent for publication:
Not applicable

Availability of data and materials
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of interest:
Authors have no conflicts of interest.

Funding:
This work was supported by the São Paulo Research Foundation (FAPESP) (grant number 12/51216-0). Professor MRP is productivity research fellow at Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq).

Authors' contributions
This manuscript was drafted by RRV and MRP. RRV, MAZM, LEGL, SMPP and MRP contributed to the study concept and design. RRV, EYI, MAZM, ASP, SMMP and MRP contributed to acquisition of data. RRV, SMPP and MRP contributed to analysis and interpretation of data. RRV, EYI, MAZM, ASP, LEGL, SMMP and MRP contributed to critical revision of the manuscript for important intellectual content. All authors read and approved the final manuscript.
Acknowledgements:

We are grateful to the multidisciplinary teams at the execution centers for providing clinical and research support (Instituto Paulista de Geriatria e Gerontologia, Centro de Referência do Idoso da Zona Norte, Hospital do Servidor Publico Estadual) and to Maria D’Andrea Greve (LEM - Laboratorio de Estudos do Movimento) for providing institutional support.

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