

UNIVERSIDADE FEDERAL DE SÃO CARLOS
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**EFEITOS CUMULATIVOS DO COMPROMETIMENTO COGNITIVO, DA
FRAGILIDADE, DO ESTRESSE E DA SOBRECARGA SOBRE O RISCO PARA
MORTALIDADE, HOSPITALIZAÇÕES, QUEDAS E DECLÍNIO FUNCIONAL EM
IDOSOS CUIDADORES: *FOLLOW-UP* DE QUATRO ANOS**

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Tese apresentada ao Programa de Pós-Graduação em Enfermagem do Centro de Ciências Biológicas e da Saúde da Universidade Federal de São Carlos como requisito para obtenção do título de Doutor em Ciências da Saúde.

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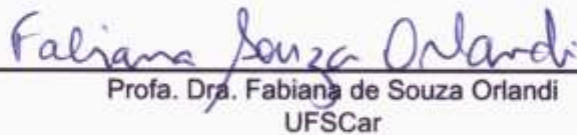
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DEDICATÓRIA

Dedico essa Tese de Doutorado a todos os participantes desse estudo.

#ProtejamOSUS

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APRESENTAÇÃO

Essa tese de doutorado é resultante dos estudos “Variáveis associadas à cognição de idosos cuidadores”, realizado em 2014 e “Acompanhamento de idosos cuidadores na Atenção Básica” conduzido durante os anos posteriores a 2014 pelo Grupo de Pesquisa Saúde e Envelhecimento da Universidade Federal de São Carlos (UFSCar), coordenado pela Profa. Dra. Sofia Cristina Iost Pavarini. A dissertação de mestrado do candidato a título de doutor foi realizada entre 2014 e 2016 no âmbito do estudo “Variáveis associadas à cognição de idosos cuidadores” com idosos cuidadores e não-cuidadores recrutados nos distritos rurais. A pesquisa mencionada evidenciou que os idosos cuidadores que apresentavam baixo desempenho cognitivo eram consequentemente os mais frágeis e sobrecarregados, comparados com aqueles com desempenho cognitivo esperado para sua escolaridade (Brigola, 2016; Brigola *et al.*, 2017). Considerando esses achados, a presente tese foi proposta na mesma linha de investigação, buscando entender se essas condições inerentes aos idosos cuidadores poderiam atuar como fatores de risco para desfechos adversos à saúde. Dessa forma, foram desenvolvidos quatro estudos apresentados como artigos científicos. Os artigos científicos foram baseados em dados empíricos e discorrem desde a associação da fragilidade e seus componentes com o comprometimento cognitivo, aos efeitos acumulados dessas condições com estresse percebido e sobrecarga do cuidado nos participantes do estudo e a discussão das diferenças entre mortalidade em cuidadores e não-cuidadores. Para cada artigo foram utilizados números de participantes diferentes em função dos métodos e dos objetivos de pesquisa. Os quatro estudos estão apresentados em estilos de formatação diferentes, uma vez que foram submetidos a periódicos que adotam formatações diferentes ao estilo ABNT.

RESUMO

Introdução: a ocorrência simultânea de comprometimento cognitivo e fragilidade física é apontada como um fator de risco para desfechos adversos à saúde, como ocorrência de quedas, hospitalização e óbito em pessoas idosas. Em contexto de cuidado, soma-se ainda o estresse e a sobrecarga como desencadeadores de tais desfechos. Não existem evidências de que as condições citadas, quando acumuladas, compreenderiam risco à saúde e apresentariam efeitos sobre os desfechos adversos em idosos que ofertam cuidado a outro idoso, no Brasil. **Objetivos:** O objetivo desta tese foi analisar os efeitos da fragilidade física, do comprometimento cognitivo, da sobrecarga e do estresse percebido sobre a mortalidade *all-cause*, ocorrência de hospitalizações e quedas no último ano e declínio da funcionalidade (*outcomes*) em idosos cuidadores moradores na comunidade, em uma perspectiva de acumulação de condições clínicas e do cuidado. Para atender o objetivo maior, quatro estudos foram realizados, tendo como objetivos: (1) analisar a relação entre comprometimento cognitivo e os critérios de fragilidade em uma amostra geral de idosos; (2) explorar se essas duas condições clínicas desempenham efeitos sobre declínio funcional, quedas e hospitalizações em uma amostra de idosos; (3) analisar se existem efeitos acumulativos dessas duas condições, e se adicionando a sobrecarga do cuidado e o estresse percebido, mostraria risco para hospitalizações e mortalidade em quatro anos para uma amostra apenas de idosos cuidadores; (4) calcular a taxa de óbito para cuidadores e não-cuidadores e explorar os efeitos do sexo, idade e escolaridade. **Configuração e Desenho:** são apresentados quatro artigos, resultados referentes a cada objetivo supracitado. O primeiro estudo se configura como transversal e os outros três são longitudinais. **Participantes:** A amostra provem de estudos realizados entre 2014 e 2018 no âmbito da Estratégia Saúde da Família do Município de São Carlos, localizado no Estado de São Paulo, Brasil. A coleta compreendeu a ampla avaliação geriátrica-gerontológica de 702 participantes, incluindo dados de 351 cuidadores e seus 351 respectivos idosos receptores de cuidado (não-cuidadores). **Questionários e Variáveis:** na *baseline*, funções cognitivas global e específicas (bateria *Addenbrooke Cognitive Examination* -ACE- R; Mini Exame do Estado Mental- MEEM), fragilidade física (cinco critérios do *Cardiovascular Health Study*) e o bem-estar psicológico e emocional relacionado ao cuidado (Escala de Estresse Percebido, Inventário de Sobrecarga de Zarit-versão reduzida) foram as principais variáveis coletadas. Os efeitos acumulativos foram definidos quando os participantes apresentavam concomitantemente comprometimento cognitivo, fragilidade física, sobrecarga do cuidado e nível maior de estresse percebido na *baseline*. No acompanhamento foram coletadas informações de quedas, hospitalização e óbito. Nos dois momentos do estudo os participantes responderam ao Índice de Katz e ao Questionário de Lawton e Brody, sendo possível definir o declínio funcional. **Análise e Estatística:** para cada estudo foram utilizadas análises que atendessem a proposta de investigação. Foram calculadas média, desvio-padrão, análises de sobrevivência e regressões multivariadas e controladas, com categorizações distintas das variáveis. **Resultados:** (1) foram analisados dados de 667 idosos, com a proporção de 13% dos participantes com ocorrência simultânea de comprometimento cognitivo e fragilidade física. Além disso, as chances de apresentar comprometimento cognitivo aumentaram em até 330% nos frágeis e 70% nos pré-frágeis. Os critérios de fragilidade física associados ao comprometimento cognitivo foram lentidão e fadiga; (2) analisou dados de 405 idosos e encontrou que o comprometimento cognitivo foi associado à futura hospitalização e ao declínio funcional em duas atividades instrumentais da vida diária (AIVD), enquanto fragilidade física além de estar associada com esses desfechos, também mostrou associação com a ocorrência de quedas. Ambas as condições acumuladas estiveram associadas à hospitalização e ao declínio em três AIVDs, mas não à ocorrência de quedas, após quatro

anos; (3) compreendeu informações de 33 idosos cuidadores falecidos e 228 cuidadores idosos sobreviventes. Dos sobreviventes, 24% foram admitidos à hospitalização no ano anterior, e o desfecho foi associado com as condições acumuladas de comprometimento cognitivo e fragilidade, comprometimento cognitivo e estresse, comprometimento cognitivo e sobrecarga, fragilidade e estresse. A taxa de mortalidade foi maior entre os idosos cuidadores frágeis (33,3%), com comprometimento cognitivo (23,1%) e estresse percebido (20,4%). Entre as condições acumuladas, os cuidadores frágeis e cognitivamente comprometidos tiveram maior taxa de mortalidade (43,8%), seguida dos cuidadores mais estressados e cognitivamente comprometidos (32,4%); (4) apresenta dados de 261 cuidadores e 279 não-cuidadores. A taxa de mortalidade em quatro anos foi de 12,6% entre cuidadores e 31,2% em não-cuidadores. O tempo da ocorrência do óbito foi similar entre os grupos - em média dois anos após a *baseline*. Não foram observados padrões de mortalidade para o grupo de idosos cuidadores considerando as características demográficas. Contudo, no grupo de cuidadores, o óbito foi mais frequente nas mulheres idosas e aconteceu em um menor intervalo de tempo desde a *baseline* nos homens não-cuidadores. **Implicações/Discussão:** o estudo corrobora com os achados na literatura quanto à estreita relação entre a cognição e a fragilidade física e que essas condições, independentemente e acumuladamente, podem estar associadas à piora no estado em saúde em geral e a outros desfechos como o declínio funcional, hospitalização e ao óbito em uma população idosa geral. O estudo inova ao apresentar que essas condições também podem ser vistas como indicadores de risco à saúde de idosos que cuidam de outros idosos. Além disso, essas condições clínicas inerentes ao envelhecimento podem interagir com o ônus do cuidado, como a sobrecarga e o estresse, e tornarem o idoso cuidador mais vulnerável comparado ao idoso não-cuidador. Em geral os idosos cuidadores apresentaram em menor frequência os desfechos adversos à saúde comparados ao não-cuidadores, entretanto a taxa de mortalidade dos idosos cuidadores mais frágeis foi similar aos não-cuidadores. Os idosos cuidadores que apresentam comprometimento cognitivo, fragilidade e estresse concomitantes apresentaram maiores taxas de mortalidade que os idosos não-cuidadores. **Conclusão:** há um consenso de que ofertar cuidado pode ser visto como um fator protetor aos eventos adversos à saúde, todavia quando o cuidado gera estresse e sobrecarga, o cuidador se tornaria tão vulnerável quanto aos seus pares não-cuidadores. Esse estudo corrobora com a literatura e acrescenta que as condições frequentemente presentes no envelhecimento, como a fragilidade e o comprometimento cognitivo, de forma acumulada, podem tornar o idoso cuidador mais vulnerável em relação aos seus pares não-cuidadores.

Palavras-chave: Cuidadores. Mortalidade. Gerontologia. Geriatria. Enfermagem.

ABSTRACT

Cumulative effects of cognitive impairment, frailty, stress and burden on risk for mortality, hospitalizations, falls, and functional decline in older caregivers: four-year follow-up

Introduction: The simultaneous occurrence of cognitive impairment and physical frailty is considered a risk factor for negative health outcomes in older adults, such as falls, hospitalization, and death. In the context of caring, stress and burden are also added as causes of such outcomes. However, there is no evidence that the conditions mentioned - when cumulated – constitute a health risk and exert effects on negative outcomes among older adults who provide care to other older adults in Brazil. **Aims:** The purpose of this thesis was to analyse the effects of physical frailty, cognitive impairment, burden, and perceived stress on all-cause mortality, the occurrence of hospitalizations and falls in the previous year, and functional decline in community-dwelling older carers from the standpoint of the accumulation of clinical conditions. To meet the larger objective, four studies were conducted with the following aims: (1) to analyse the relation between cognitive impairment and frailty criteria in a general sample of older persons; (2) explore whether these two clinical conditions have effects on functional decline, falls, and hospitalizations in a sample of older adults; (3) analyse whether there are cumulative effects of these two conditions and whether adding the burden of care and perceived stress would increase the risk of hospitalization and four-year mortality in a sample of older carers; and (4) calculate mortality rates for carers and non-carers and explore the effects of gender, age, and education. **Configuration and Design:** Four manuscripts are presented with results regarding each the aims listed above. The first study is cross-sectional and the other three are longitudinal. **Participants:** The sample is from studies conducted between 2014 and 2018 at primary care services in the city of São Carlos, state of São Paulo, Brazil. Data collection involved a broad, geriatric-gerontological assessment of 702 participants, including data from 351 carers and their respective 351 older care recipients (non-carers). **Questionnaires and Variables:** At baseline, global and specific cognitive functions (Addenbrooke Cognitive Examination Battery [ACE-R] and Mini Mental State Examination [MMSE]), physical frailty (five Cardiovascular Health Study criteria), and self-reported psychological/emotional well-being (Perceived Stress Scale and Zarit Burden Interview – brief version) were the main variables collected. Cumulative effects were defined when the participants concomitantly exhibited cognitive impairment, physical frailty, care burden, and a high level of perceived stress at baseline. During follow-up, information was collected on the occurrence of falls, hospitalization, and death. At both moments of the study, the participants answered the Katz Index and the Lawton and Brody Questionnaire to enable the determination of functional decline. **Analysis and Statistics:** We used analyses that met the research proposal for each study. Mean and standard deviation values were calculated. Survival analyses and controlled, multivariate analyses were performed with distinct categorizations of variables. **Results:** (1) We analysed data from 667 older adults, 13% of whom had the simultaneous occurrence of cognitive impairment and physical frailty. The chances of cognitive impairment increased by up to 330% in frail individuals and 70% in pre-frail individuals. The physical frailty criteria associated with cognitive impairment were slowness and fatigue. (2) We analysed data from 405 older adults and found that cognitive impairment was associated with future hospitalization and functional decline in two instrumental activities of daily living (IADL). Physical frailty was also associated with these outcomes as well as the occurrence of falls. Both accumulated conditions were associated with hospitalization and decline in three IADLs but not falls after four years. (3) We analysed information on 33 older carers who had deceased and 228 surviving older carers. Among the survivors, 24% were admitted to hospital in the previous year and this outcome was

associated with the accumulated conditions of cognitive impairment and frailty, cognitive impairment and stress as well as cognitive impairment and burden, frailty, and stress. The mortality rate was higher among the frail older carers (33.3%), those with cognitive impairment (23.1%), and those with perceived stress (20.4%). Among the accumulated conditions, frail and cognitively impaired carers had a higher mortality rate (43.8%), followed by stressed and cognitively impaired carers (32.4%). (4) We analysed data on 261 carers and 279 non-carers. The four-year mortality rate was 12.6% among the carers and 31.2% among the non-carers. The time of death was similar between the groups – on average two years after baseline. No mortality patterns were found for the group of older carers regarding demographic characteristics. However, death was more frequent among women in the older carer group and occurred within a shorter time interval from baseline among the men in this group. **Implications/Discussion:** The present results are in agreement with findings described in the literature regarding the close relation between cognitive impairment and physical frailty and that these conditions are independently and cumulatively associated with a worsening general health status and other negative outcomes, such as functional decline, hospitalization, and death in the general population of older adults. This is a pioneering study, as it shows that these conditions can also be seen as indicators of health risk among older persons who provide care to other older persons. Moreover, these inherent clinical conditions of ageing may interact with the strain of providing care (burden and stress) and make older carers more vulnerable than non-carers. In general, older carers had fewer adverse health outcomes compared to non-carers, but the mortality rate of frail carers was similar to that of non-carers. Older carers with concurrent cognitive impairment, frailty, and stress had higher mortality rates than older non-carers. **Conclusion:** There is a consensus that providing care is as a protective factor against adverse health events. However, when providing care generates stress and burden, carers can become as vulnerable as their peers who do not provide care. The present results are in agreement with data described in the literature and contribute new knowledge that the conditions often found in the population of older adults, such as frailty and cognitive impairment, can make older carers more vulnerable than non-carers.

Keywords: Carers. Mortality. Gerontology. Geriatrics. Nursing.

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LISTA DE ABREVIATURAS E SIGLAS

95%CI	-	Intervalo de confiança ao nível de 95%
AAVD	-	Atividades Avançadas da Vida Diária
ABVD/BADL	-	Atividades Básicas da Vida Diária
ACE-R	-	Exame Cognitivo de Addenbrooke – Revisado
AIVD/IADL	-	Atividades Instrumentais da Vida Diária
AVD/ADL	-	Atividades da Vida Diária
CAAE	-	Certificado de Apresentação para Apreciação Ética
CCL/MCI	-	Comprometimento Cognitivo Leve
CDR	-	<i>Clinical Dementia Rating</i>
CES-D	-	<i>Center for Epidemiologic Studies – Depression</i>
CHS	-	<i>Cardiovascular Health Study</i>
DA/AD	-	Doença de Alzheimer/ <i>Alzheimer's disease</i>
Dp \pm	-	Desvio-padrão
ELSA	-	<i>English Longitudinal Study of Ageing</i>
FIBRA	-	Estudo sobre fragilidade em idosos brasileiros
GDS/EDG	-	Escala de Depressão Geriátrica
HR	-	<i>Hazard ratio</i> /razão de risco
IAGG/AIGG	-	Associação Internacional de Geriatria e Gerontologia
IBGE	-	Instituto Brasileiro de Geografia e Estatística
IMC	-	Índice de Massa Corporal
MMSE/MEEM	-	Mini Exame do Estado Mental
OR	-	<i>Odds ratio</i> /Razão de chances
PSF	-	Programa de Saúde da Família
PSS	-	Escala de Estresse Percebido
SABE	-	Estudo sobre Saúde, bem-estar e envelhecimento
SE	-	<i>Standard error</i> /Erro-padrão
SPSS	-	<i>Statistical Package for the Social Sciences</i>
SUS	-	Sistema Único de Saúde
TCLE	-	Termo de Consentimento Livre e Esclarecido
USF	-	Unidade de Saúde da Família
WHO/OMS	-	Organização Mundial da Saúde
ZBI	-	Escala de Sobrecarga de Zarit

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1 INTRODUÇÃO

A ocorrência simultânea do comprometimento cognitivo e da fragilidade física em idosos ganhou destaque nas investigações científicas clínicas e epidemiológicas na última década. Estudos constatando essa relação estão cada vez mais robustos, no entanto o método transversal já não se apresenta sensível às necessidades teóricas esperadas para o conhecimento amplo sobre as condições clínicas associadas ao comprometimento cognitivo e fragilidade

Os primeiros relatórios de investigações longitudinais sobre o acúmulo do comprometimento cognitivo e da fragilidade e sua associação com resultados clínicos são recentes (LEE *et al.*, 2018; JOHN *et al.*, 2017). Essas investigações buscaram compreender a síndrome como fator de risco para desfechos que incluíam mortalidade, hospitalizações, declínio na funcionalidade e na qualidade de vida das pessoas idosas.

Paralelamente, estudos longitudinais buscam investigar a importância do bem-estar psicológico para a sobrevivência e para a qualidade de vida e da saúde do cuidador de idosos (FREDMAN *et al.*, 2008, 2010, 2015; PERKINS *et al.*, 2013). O bem-estar tem sido estudado como uma alternativa conceitual ao termo qualidade de vida (QV) - apesar de ser apenas um subdomínio de QV - e no âmbito do cuidado e do envelhecimento tem se situado no contexto de saúde mental, refletindo pontos positivos e negativos do cuidar (CUNNINGHAM; CUNNINGHAM; ROBERTSON, 2019; DODGE *et al.*, 2012; THOMPSON *et al.*, 2007). Devido ao fato de que muitos dos cuidadores familiares de idosos também estão acima da faixa etária dos 60 anos, e que o ônus (psicológico, social e físico) do contexto do cuidado pode acelerar os problemas de saúde desses cuidadores (LOPES; CACHIONI, 2013), este campo de investigação possui relevância científica e social.

Essa tese de doutorado, traduzida na condução de múltiplos estudos, compreende unir os universos dos temas fragilidade e cognição e bem-estar psicológico de idosos cuidadores, testando seus potenciais efeitos em desfechos adversos à saúde selecionados (quedas, declínio funcional, hospitalizações e óbito) em um acompanhamento de quatro anos. Os resultados revelam um parâmetro do contexto do cuidado, no que tange a saúde do cuidador e seus possíveis riscos adversos à saúde. Considerando isso, a presente investigação possui singular importância para o planejamento, execução e implementação de ações que busquem intervir

sobre as variáveis modificáveis, reduzindo os riscos acima citados, além de estudos postulados no tema.

1.1 Objetivos

O principal intuito dessa investigação foi analisar os efeitos da fragilidade, do comprometimento cognitivo, da sobrecarga e do estresse percebido sobre a mortalidade *all-cause*, ocorrência de hospitalizações e quedas no último ano e declínio da funcionalidade (*outcomes*) em idosos cuidadores moradores na comunidade.

Para atender o objetivo geral, quatro estudos foram desenvolvidos com os seguintes objetivos específicos: (1) analisar a relação entre comprometimento cognitivo e os critérios de fragilidade em uma amostra geral de idosos; (2) explorar se essas duas condições clínicas desempenham efeitos sobre declínio funcional, quedas e hospitalizações em uma amostra de idosos; (3) analisar se existem efeitos acumulativos dessas duas condições, e se adicionando a sobrecarga do cuidado e o estresse percebido, mostraria risco para hospitalizações e mortalidade em quatro anos para uma amostra apenas de idosos cuidadores; (4) calcular a taxa de óbito para cuidadores e não-cuidadores e explorar os efeitos do sexo, idade e escolaridade.

1.2 Hipóteses

A hipótese esperada é que os cuidadores que apresentaram as condições acumuladas de comprometimento da função cognitiva, fragilidade, estresse e sobrecarga na *baseline*, apresentariam maiores riscos independentes e aditivos para os desfechos adversos (*outcomes*), comparados aos cuidadores mais preservados e aos não-cuidadores saudáveis.

2 MÉTODOS

2.1 O estudo Variáveis Associadas à Cognição de Idosos Cuidadores (*baseline*)

O estudo transversal “Variáveis Associadas à Cognição de Idosos Cuidadores” (CAAE 22956313.6.0000.5504) foi um projeto de pesquisa realizado pela Universidade Federal de São Carlos (UFSCar) em parceria com a Universidade de São Paulo (USP) e a Universidade de Campinas (Unicamp), coordenado pela Profa. Dra. Sofia Cristina Iost Pavarini, Professora Titular do Departamento de Gerontologia da Universidade Federal de São Carlos. O projeto foi desenvolvido com idosos cuidadores de idosos cadastrados nas Unidades de Saúde da Família (USF) do município de São Carlos, localizado no interior do Estado de São Paulo. O grande intuito do projeto foi realizar um inquérito domiciliar com cuidadores idosos e seus receptores de cuidado e analisar as variáveis potencialmente associadas ao desempenho da função cognitiva de idosos brasileiros no contexto de cuidado. O inquérito envolveu 351 idosos cuidadores de idosos, e seus 351 idosos receptores de cuidados corresidentes, todos com 60 anos ou mais, ambos cadastrados em uma das 17 USF do município de São Carlos, incluindo as duas unidades da área rural. Os potenciais participantes foram provenientes de uma listagem de 594 residências elaborada pelas equipes das USF. Os dados foram coletados no período de abril a novembro de 2014, no domicílio dos idosos. A amostragem detalhada e o processo de seleção foram descritos em detalhes em publicações do Grupo de Pesquisa (PAVARINI et al., 2017; 2018). A cognição, avaliada pelo Exame Cognitivo de Addenbrooke-Revisado (ACE-R), foi o principal desfecho de interesse desse projeto maior. A ampla avaliação gerontológica-geriátrica foi realizada com os participantes e informações demográficas, do cuidado, avaliação subjetiva da saúde, fragilidade, sintomas depressivos, sobrecarga e estresse percebido foram coletadas por instrumentos validados na literatura para uso no Brasil. O estudo foi realizado por pesquisadores treinados nas áreas da enfermagem e da gerontologia e a identificação de idosos cuidadores e idosos não-cuidadores foi realizada por meio de avaliação padronizada e combinada das atividades básicas (ABVD) e instrumentais (AIVD) da vida diária de ambos os idosos. Os resultados dessa pesquisa compuseram relatórios de pós-doutoramento, teses de doutorado, dissertações de mestrado, trabalhos de iniciação científica, entre dezenas de artigos científicos publicados em periódicos nacionais e internacionais, e apresentados em congressos e conferências no Brasil e no exterior, com contemplações de prêmios como o ‘Longevidade Bradesco Seguros – Categoria Gerontologia’.

2.2 O estudo Acompanhamento de idosos cuidadores na Atenção Básica (*follow-up*)

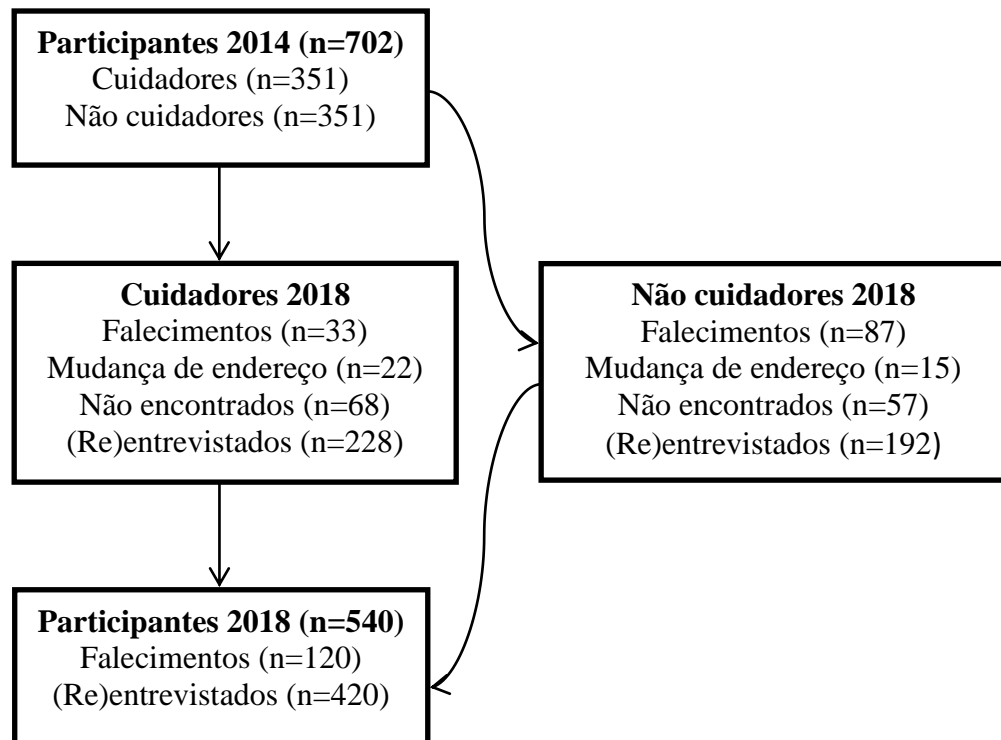
O estudo “Acompanhamento de idosos cuidadores na Atenção Básica” (CAAE 46431315.3.0000.5504) tratou-se de um estudo longitudinal com a amostra de cuidadores provenientes da investigação “Variáveis Associadas à Cognição de Idosos Cuidadores”. O acompanhamento teve início em 2015 e igualmente recrutou novos participantes, incluindo grupos controles compostos por idosos não-cuidadores e não corresidentes com outros idosos. O projeto compreendeu acompanhar e reavaliar idosos cuidadores da atenção básica e incluiu avaliações especializadas em cognição, como a avaliação eletrofisiológica do processamento cognitivo por meio de estímulo auditivo (P300). Durante o acompanhamento os cuidadores e seus receptores de cuidado foram (re)contatados e convidados para a participação da pesquisa. Foi possível coletar informações secundárias como mortalidade, hospitalização e institucionalização. Os resultados desse projeto originaram também relatórios de pós-doutoramento, teses de doutorado, dissertações de mestrado, trabalhos de iniciação científica, produções científicas em periódicos e apresentações em eventos.

2.3 Processos de recrutamento dos participantes para o presente estudo

As informações coletadas nesse estudo ocorreram no âmbito do estudo “Acompanhamento de idosos cuidadores na Atenção Básica”. Na Figura 1 está sintetizado o processo de recrutamento dos participantes. Para o segundo momento do estudo, os participantes foram contatados e responderam as questões pessoalmente ou por telefone.

Os participantes considerados *idosos cuidadores* nesse estudo foram aqueles que preencheram os critérios de inclusão para cuidador no estudo “Variáveis Associadas à Cognição de Idosos Cuidadores”. Os participantes *idosos não-cuidadores* foram considerados os pares corresidentes dos participantes *idosos cuidadores*, os quais estavam sob cuidado no estudo da *baseline* (BRIGOLA et al., 2017; PAVARINI et al., 2017; 2018).

Figura 1. Recrutamento dos participantes para o estudo longitudinal. São Carlos, 2014-2018.



Dentre os idosos não cuidadores (n=351) avaliados em 2014, 87 casos de óbito (24,8%) foram confirmados pelas equipes das USF durante o acompanhamento. Setenta e dois não cuidadores (20,5%) foram perdidos no acompanhamento (entre mudanças de endereço e não localização após três visitas). Os 192 não cuidadores restantes (54,7%) foram contatados e reavaliados em 2018.

Entre os 351 idosos cuidadores da *baseline* (2014), 33 casos de óbitos (9,4%) foram confirmados durante o ano de 2018. As perdas no acompanhamento foram de 90 cuidadores (25,6%) (mudanças de endereços e não localização). As variáveis de 2018 foram coletadas com 228 cuidadores, ou seja, 65,0% dos cuidadores de 2014. Dos cuidadores entrevistados em 2018, 49 deixaram de cuidar do idoso por motivo de óbito do receptor de cuidado.

Na seção 4 (Resultados) são detalhados os participantes, os procedimentos e os resultados específicos de cada estudo.

2.4 Avaliações e variáveis

Caracterização sociodemográfica e do cuidado (baseline)

As informações demográficas foram coletadas unicamente na *baseline* (2014). Elas compreenderam as variáveis como sexo, idade, estado civil, escolaridade, raça/cor e renda (Apêndice A). A caracterização do cuidado foi feita elencando as informações de parentesco/proximidade com o idoso cuidado, o tempo que é cuidador, quantas horas por dia e quantos dias da semana de dedicação ao cuidado (Apêndice B). O idoso cuidado foi avaliado quanto ao sexo, idade, estado civil, ocupação, escolaridade e raça/cor (Apêndice C).

Atividades básicas e instrumentais da vida diária (baseline e follow-up) e declínio funcional (follow-up)

A avaliação funcional foi realizada por meio dos questionários combinados: Índice de Katz (ABVD) e Escala de Atividades Instrumentais de Vida Diária (AIVD) de Lawton e Brody. O Índice de Katz (1963) acessa a funcionalidade em seis itens: alimentação, controle dos esfíncteres, transferência, higiene, aptidão para se vestir e para banhar-se (Katz *et al.*, 1963; Lino *et al.*, 2008) (Anexo C). A Escala de Atividades Instrumentais de Vida Diária de Lawton e Brody (1969) avalia o grau de independência para as seguintes AIVDs: usar o telefone, viajar, fazer compras, preparar refeições, realizar trabalho doméstico, usar medicamentos e manejar o dinheiro (Lawton e Brody, 1969; Santos e Virtuoso Júnior, 2008) (Anexo D).

Rastreamento cognitivo (baseline)

A cognição dos cuidadores e não-cuidadores foi avaliada por meio da bateria cognitiva Exame Cognitivo de Addenbrooke - Revisado (do inglês *Addenbrooke's Cognitive Examination - Revised - ACE-R*), composta por questões agrupadas em cinco domínios cognitivos (orientação/atenção, memória, fluência verbal, linguagem e habilidade construtiva visual) (Carvalho e Caramelli, 2007; Mioshi *et al.*, 2006). Da pontuação total (100) 30 itens correspondem a estrutura do Mini Exame do Estado Mental (MEEM). Do score do MEEM foi possível estabelecer o comprometimento cognitivo em função da escolaridade do participante por meio das notas de corte: <17 (sem escolaridade); <22 (entre 1 a 4 anos de

escolaridade); <24 (entre 5 e 8 anos de escolaridade); e <26 (9 ou mais anos de escolaridade) (Brucki *et al.*, 2003; Folstein, Folstein e McHugh, 1975) (Anexo E).

Fragilidade (baseline)

A fragilidade foi avaliada por meio do fenótipo de cinco componentes proposto pelo *Cardiovascular Health Study* (CHS), coordenado por Fried *et al.* (2001), que incluíam perda de peso não intencional, fadiga, fraqueza, lentidão e baixa taxa de gasto calórico. Perda de peso não intencional foi avaliada pela pergunta “*Nos últimos doze meses o(a) senhor(a) acha que perdeu peso sem fazer nenhuma dieta?*”. Respostas afirmativas com perda superior de 4,5kg ou 5% do peso corporal preenchiam o critério. Fadiga foi indicada por respostas “*sempre*” ou “*na maioria das vezes*” para qualquer um dos dois itens (7 – *Com que frequência na última semana sentiu que tudo que fez exigiu um grande esforço?* e 20 – *Com que frequência na última semana sentiu que não conseguiria levar adiante suas coisas?*) da *Center for Epidemiological Studies - Depression* (CES-D) (Radloff, 1977). Fraqueza foi avaliada pela baixa força de preensão palmar verificada pela média de três medidas consecutivas de força de preensão da mão dominante, em quilogramas força, por meio de um dinamômetro hidráulico, tipo Jamar, Modelo SH5001, fabricante SAEHAN®. Para preenchimento do critério, o resultado foi ajustado segundo gênero e o Índice de Massa Corporal (IMC). Lentidão foi mensurada pela velocidade da marcha indicada pela média de três medidas consecutivas do tempo em que o cuidador gasta para percorrer 4,6 metros no plano. A aceleração e desaceleração da caminhada não podem influenciar na medida, portanto dois metros antes e dois metros após o percurso são acrescentados, totalizando 8,6 m de caminhada. O caminho do percurso não pode conter irregularidades e o avaliado deve usar o calçado que utiliza a maior parte do dia e, caso utilize dispositivo de caminhada (bengala, andador), o mesmo deve ser utilizado na avaliação. A avaliação do resultado foi ajustada conforme gênero e altura. A baixa taxa de gasto calórico foi estabelecida pela diminuição da prática de atividades físicas comparada ao último ano, mensurada pela pergunta “*O(a) senhor(a) acha que faz menos atividades físicas do que há doze meses atrás?*”. Segundo resposta afirmativa, o avaliado preenchia o critério de fragilidade. Segundo os autores do constructo de modelo de fragilidade, a presença de três ou mais das cinco características do fenótipo caracteriza a pessoa como *frágil*, de um a dois componentes caracterizam como *pré-frágil* e a pessoa *não-frágil* é identificada com a ausência de nenhum dos critérios (Fried *et al.*, 2001; Morley *et al.*, 2013) (Anexo F).

Sobrecarga do cuidado (baseline)

O Inventário de Sobrecarga de Zarit (1980) versão de 22 itens foi aplicado na baseline. O questionário relaciona itens do cuidado com a sobrecarga percebida pelo cuidador, nos aspectos psicológicos, físicos, econômicos e relacionamento familiar do cuidador. Para os estudos dessa tese foi utilizada a versão reduzida de 12 itens, extraídos da versão original. A nota de corte utilizada foi a nota de corte >13 pontos para o rastreamento de sobrecarga do cuidado (Bedard *et al.*, 2001; Gratao *et al.*, 2019; Zarit, Reever e Bach-Peterson, 1980) (Anexo G).

Estresse percebido (baseline)

O estresse foi mensurado por meio da Escala de Estresse Percebido (PSS), desenvolvida para avaliar de forma escalar o estresse vivenciado no último mês da data da entrevista por meio de quatorze perguntas tipo *likert* (nunca a sempre). As questões com conotação positiva (4, 5, 6, 7, 9, 10 e 13) têm sua pontuação somada invertida, da seguinte maneira, 0=4, 1=3, 2=2, 3=1 e 4=0. As demais questões são negativas e são somadas diretamente. A pontuação varia de zero a 56 pontos, sendo que quanto maior a pontuação, maior o nível estresse. Para esse estudo foi utilizada a nota de corte ≥ 17 pontos (mediana encontrada na avaliação da *baseline*) para criar subgrupos de cuidadores mais e menos estressados (Cohen, Kamarck e Mermelstein, 1983; Luchesi *et al.*, 2016; Luft *et al.*, 2007) (Anexo H).

Quedas, hospitalizações e óbito (follow-up)

- Participantes sobreviventes: para coletar informações sobre hospitalizações, o participante foi perguntado “O(A) senhor(a) precisou ser hospitalizado(a), ou admitido em um serviço de saúde de alta complexidade, por pelo menos vinte e quatro horas nos últimos 12 meses? Se sim, quantas vezes e qual total de dias esteve hospitalizado?”. Para quedas, o participante foi perguntado – “O(A) senhor(a) sofreu alguma queda da própria altura, independente do local, nos últimos 12 meses? Se sim, quantas vezes?” (Apêndice D).

- Casos de óbito: para casos confirmados de óbito, a data do óbito foi coletada com a família e confirmada com a equipe da USF da área do domicílio do idoso.

2.5 Tratamento dos dados

O banco de dados foi construído e as informações do *follow-up* foram inseridas de maneira independente por dois digitadores, gerando duas versões de banco. As duas versões foram comparadas para checagem de discrepâncias e discordâncias. Adicionais avaliações da qualidade da entrada de dados foram feitas: (1) comparações do banco de 2018 contra o banco de 2014; (2) checagem randomizada de 10% da amostra inserida no banco contra os questionários *paper-based*; (3) cálculos descritivos da amostra feita por dois pesquisadores independentes. Após essas etapas, foi possível gerar uma única versão, a qual foi utilizada para análise dos dados.

O primeiro estudo compreendeu análises transversais com dados da baseline e compilados entre dados dos idosos cuidadores e não-cuidadores. Os demais estudos envolveram análises longitudinais. O segundo estudo foi compilado entre dados dos cuidadores e não-cuidadores, o terceiro estudo foi conduzido com dados apenas dos cuidadores, e o quarto estudo com dados dos cuidadores e não-cuidadores de maneira não-compilada. A análise dos dados está descrita com detalhes em cada estudo reportado na Seção 3 (Resultados).

3 RESULTADOS

3.1 Estudo 1: *Association between cognitive impairment and criteria for frailty syndrome among older adults*¹

Abstract

Background: Cognitive impairment and physical frailty have been associated in older adults. The criteria for frailty and degree of frailty may be keys to associated cognitive impairment. **Objective:** To analyze the association between cognitive impairment and the criteria for frailty. **Methods:** We cross-sectionally examined data from 667 older adults (≥ 60 years of age) from a study entitled ‘Variables associated to cognition in elderly caregivers’ involving patients at urban and rural primary healthcare center. We defined cognitive impairment based on different groups of scores on the Mini Mental State Examination and defined frailty and prefrailty using the criteria of the Cardiovascular Health Study. We performed multinomial regression models to analyze the association between levels of frailty and cognitive impairment. **Results:** Similar proportions of women (54.8%) and men (45.2%) participated in the study (mean age: 71 years). We found cognitive impairment, prefrailty and frailty in 34%, 54% and 24% of the participants, respectively. Concomitant cognitive impairment and frailty was found in 13%. The chances of cognitive impairment increased up to 330% (OR: 4.3; 95%CI: 2.4-7.7; $p < .001$) among frail individuals and 70% (OR: 1.7; 95%CI: 1.0-2.8; $p = .033$) among prefrail individuals compared to nonfrail individuals. After controlling for age, education, place of residence and functional dependence, slowness and fatigue criteria were significantly associated with cognitive impairment. **Conclusion:** Frail older adults have a greater likelihood of concomitant cognitive impairment than prefrail and nonfrail older adults. The prevalence of cognitive impairment and frailty is consistent with data reported in the literature.

Keywords: Aged; Cognitive Dysfunction; Frailty.

Introduction

A slight decrease in cognitive function is expected during ageing process. However, cognitive impairment can occur when one's performance regarding memory, judgment,

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language, and attention is lower than that expected for one's age and educational level^{1,2}. Cognitive impairment can be caused by neurodegeneration, vascular problems and metabolic problems. However, chronic stress, depressive symptoms and anxiety can contribute to a poorer mental performance in the old age³. Lately, the poor physical function, such as frailty, has been considered another strong factor linked to cognitive impairment, since these conditions share similar pathophysiological mechanisms on the cellular and systemic levels^{4,5}.

Different theories and particular (but complementary) evaluations of frailty in older adults have contributed to the health care, to the comprehensive geriatric and gerontological assessment and supported the interventions planning. The Cardiovascular Health Study (CHS) defined frailty as a geriatric syndrome that could be assessed using the measurement of five clinical criteria: unintentional weight loss, fatigue (exhaustion), muscle weakness, slow gait/slowness and low level of physical activity⁶. More recently, Morley et al. contributed to the definition to the clinical syndrome as multiple-cause condition that leads to vulnerability, functional dependence and death⁷.

Other frailty theories and measures also are useful to predict cognitive impairment⁸. However, a physical examination using the CHS frailty clinical criteria⁶ may indicate changes in cognitive function. Systematic reviews and meta-analyses have confirmed the existence of a strong link between physical and cognitive impairment^{5,9,10}. Although there is evidence associating frailty with cognitive impairment, a small number of studies on this subject have been conducted considering the five clinical criteria individually in low and middle-income countries.

In Brazil, an analysis of the FIBRA study described the criteria of slow gait speed (slowness) and low grip strength (weakness) as the strongest measures associated with cognitive performance among older adults¹¹. A further FIBRA study analyses with 384 community-dwelling older adults had confirmed that frailty and specific cognitive domains are linked, with a poorer performance regarding time orientation and working memory prevalent among frail older adults¹². Similar findings were observed in 737 participants of a study conducted in the Rio de Janeiro (city)¹³ and in a multi-centric Brazilian study¹⁴. Frail older adults had consistently lower Mini Mental State Examination (MMSE) scores compared to prefrail and nonfrail older adults^{13,14}. A systematic review with 29,664 participants in 19 studies, which most were conducted in Latin America, found that memory is the main

function affected in frail older adults and slowness and weakness are most prevalent frailty clinical criteria in cognitively impaired older adults¹⁵.

Despite the growing interest in investigating the association between cognitive status and physical, there remains a lack of surveys conducted with older adults living in low and middle-income countries. Therefore, the aim of the present study was to analyze the association between cognitive impairment and the clinical criteria for frailty syndrome. We hypothesized that some frailty clinical criteria are strongly associated with cognitive impairment in older adults. In addition, we want to confirm whether frailty presents close association with cognitive impairment, compared to prefrailty and nonfrail older adults.

Methods

Participants

The present cross-sectional study is part of a study entitled “Variables associated to cognition in elderly caregivers” conducted by the Health and Ageing Group of the Federal University of São Carlos involving individuals registered with Family Health Units in the city of São Carlos, state of São Paulo, Brazil. São Carlos is located in the southeastern region of the country and has an estimated population of 221,950 residents, among whom 13% were aged 60 years or older according to the 2010 Brazilian census¹⁶.

The study was conducted between April and December of 2014. The participant selection process is described elsewhere^{3,17,18}, but a brief description follows. All community-dwelling older adults (age ≥ 60 in Brazil, as defined by the World Health Organization) registered at 18 primary healthcare centers ($n = 1,188$) in Sao Carlos, Brazil, were contacted in person and invited to participate in the survey. Individuals with auditory, visual or language limitations that could constitute barriers to the data collection instruments were excluded. The response rate was 59.1%. The survey was conducted with 351 community-dwelling older caregivers and 351 community-dwelling older non-caregivers (total: 702 individuals) registered with primary care services in rural and urban regions. For the present study, 667 individuals were included and the single criterion for entry was having complete data available on demographics, cognitive status and frailty status.

This study received approval from the Human Research Ethics Committee of the Federal University of São Carlos (certificate number: 517.182) and all participants signed a statement of informed consent. Household interviews were conducted by trained professionals in the fields of gerontology and nursing.

Variables and evaluations

- *Demographic characteristics*: sex (male, female), age (continuous and age range), years of education (continuous and education level), retirement (yes, no), place of residence (rural, urban) and ethnicity (black/brown, white and others).

- *Activities of daily living (ADL)*: Functioning was assessed using the Lawton and Brody Scale for the determination of the degree of independence on basic activities, such as performing housework, handling money, using the telephone, administering medications, traveling, shopping and preparing full meals. The total score ranges from seven (complete dependence) to 21 (complete independence), with intermediate scores (8 to 20 points) indicative of partial dependence^{19,20}.

- *Cognitive impairment*: Cognitive screening was performed using the Mini Mental State Examination (MMSE), the score of which ranges from 0 to 30²¹. The cutoff points were adjusted for different levels of formal education: < 26 for those with \geq nine years of schooling; < 24 for those with five to eight years of schooling, < 22 for those with one to four years of schooling and < 17 for illiterate individuals²². Addenbrooke's Cognitive Examination - Revised (ACE-R; score: 0-100) was also used to assess global cognition^{23,24}.

- *Frailty syndrome and criteria*: The five frailty clinical criteria of the Cardiovascular Health Study were considered: unintentional weight loss in the past year, fatigue in the past week, muscle weakness, slowness and decreased physical activity level compared to the previous year. Unintentional weight loss in the past year, fatigue in the past week and decreased physical activity level were self-declared. Muscle weakness was assessed using a dynamometer and slowness was assessed by the time required to walk 4.6 meters. Based on Fried's phenotype, the number of criteria was used to determine the level of frailty: frail (three to five criteria), prefrail (one or two criteria) and nonfrail (negative for all five criteria)⁶.

Statistical analysis

The Statistical Package for Social Sciences - SPSS software, version 21.0 program was used for the data analysis. Descriptive statistics were performed to characterize the overall sample and the sample stratified by cognitive status. Frequency (n), percentage (%), mean and standard deviation (\pm) values were calculated. The independent t-test was used to compare means and the chi-square test was used to compare categorical variables between groups according to sex (Table 1). The prevalence of simultaneous cognitive impairment and frailty was estimated with 95% confidence intervals. One-way ANOVA was used with Tukey's post hoc test for comparisons of MMSE scores between frailty levels (Figure 1).

Multinomial regression models were run to analyze the associations between frailty syndrome/criteria (independent variable) and cognitive impairment (dependent variable). Crude models were run to determine associations between age (continuous), education (continuous), sex (reference: male), place of residence (reference: rural), degree of dependence on ADL (reference: independent), unintentional weight loss, fatigue, weakness, slowness, low physical activity (reference: absence of criteria), prefrailty and frailty (reference: no frailty). Variables with a p-value ≤ 0.20 were selected for the adjusted regression model. The first model (Table 2) included all criteria as controlling variables in the same model. Prefrailty (Table 3) and frailty (Table 4) were incorporated independently in adjusted models. Associations with a p-value ≤ 0.05 were considered statistically significant.

Results

Among the 702 participants, thirty-five were excluded from the analysis due the missing data on education, cognitive status and frailty status. The sample consisted of similar proportions of women (54.8%) and men (45.2%). The women tended to be younger (mean difference: -1.6 years; $p=0.012$), more independent regarding ADL (w: 33.6% vs. m: 8%) and fewer were retired compared to the men (w: 64.5% vs. m: 91.7%). The women also had higher proportions of slowness (w: 27% vs. m: 18.3%) and low physical activity compared to the men (w: 54.9% vs. m: 47.2%).

No differences between women and men were found regarding the prevalence of cognitive impairment (Table 1). Cognitively impaired older adults tended to be older (mean

difference: 2.8 years; $p < .001$) than those with normal cognition. Regarding performance on ADL, 15.5% of cognitively impaired and 25.4% of older adults normal cognitive were completely independent. Regarding frailty, with exception of unintentional weight loss, all criteria were more prevalent in the older adults with cognitive impairment.

Table 1. Characterization of participants stratified by cognitive status. São Carlos, Brazil, 2014.

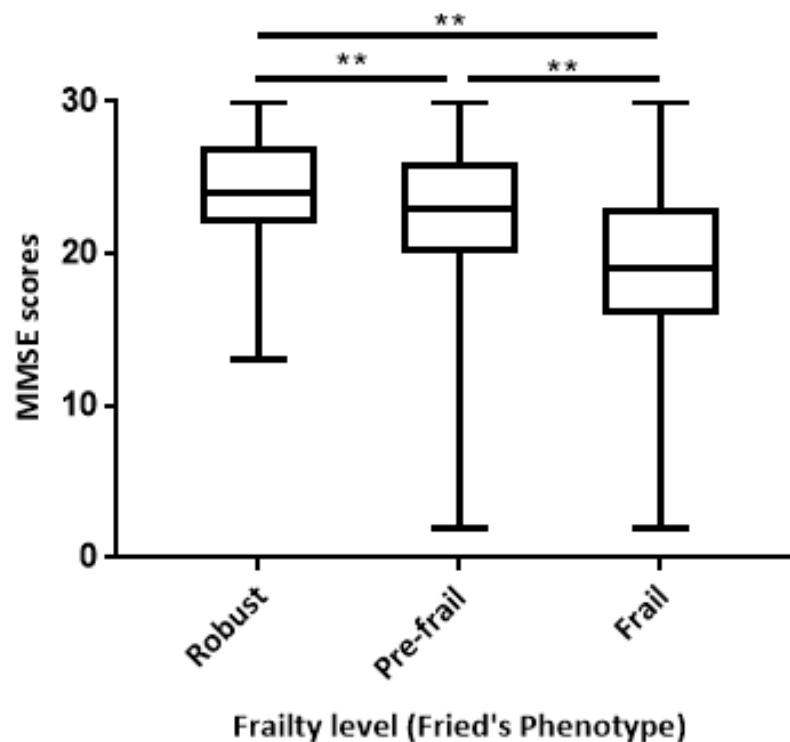
Characteristic	Total (N=667)	Cognitively impaired (n=226)	Cognitively unimpaired (n=441)	p-value
Males	301 (54.8)	96(42.5)	205(46.5)	.184 ²
Females	366 (57.8)	130(57.5)	236(53.5)	
Age, mean (±)	71.3 (7.8)	73.2 (8.9)	70.4 (7.0)	<.001 ¹
60-69 y, n (%)	328 (49.2)	95 (42.0)	233 (52.8)	REF
70-79 y, n (%)	234 (35.1)	78 (34.5)	156 (35.4)	.155 ²
≥80 y, n (%)	105 (15.7)	53 (23.5)	52 (11.8)	<.001 ²
Education, mean (±)	3.6 (3.5)	3.1 (3.5)	3.9 (3.5)	.006 ¹¹
Illiterate, n (%)	147 (22.0)	56 (24.8)	91 (20.6)	.477 ²
1-4 y, n (%)	395 (59.2)	133 (58.8)	262 (59.4)	.379 ²
5-8 y, n (%)	62 (9.3)	14 (6.2)	48 (10.9)	.065 ²
≥9 y, n (%)	63 (9.4)	23 (10.2)	40 (9.1)	REF
Retired, n (%)	512 (76.7)	180 (79.6)	332 (75.3)	.121 ²
Rural residence, n (%)	166 (24.9)	48 (21.2)	118 (26.8)	REF
Urban residence, n (%)	501 (75.1)	178 (78.8)	323 (72.2)	.070 ²
Black/Brown, n (%)	200 (30.0)	82 (36.3)	118 (26.8)	NA
White, n (%)	461 (69.1)	144 (63.7)	317 (71.9)	NA
Others, n (%)	6 (0.9)		6 (1.4)	NA
Lawton ADL Scale, mean (±)	16.8 (4.0)	14.7 (4.6)	17.8 (3.1)	<.001 ¹
Independent, n (%)	147 (22.0)	35 (15.5)	112 (25.4)	REF
Partially dependent, n (%)	493 (73.9)	169 (74.8)	324 (73.5)	.002 ^{2*}
Completely dependent, n (%)	27 (4.0)	22 (9.7)	5 (1.1)	
ACE-R, mean (±)	58.6 (20.7)	41.7 (18.4)	67.3 (16.0)	<.001 ¹
MMSE, mean (±)	21.8 (5.2)	16.8 (4.8)	24.4 (3.3)	<.001 ¹
Unintentional weight loss, n (%)	165 (24.7)	65 (28.8)	100 (22.7)	.052 ²
Fatigue, n (%)	169 (25.3)	87 (38.5)	82 (18.6)	<.001 ²
Weakness, n (%)	268 (30.2)	116 (51.3)	152 (34.5)	<.001 ²
Slowness, n (%)	154 (23.1)	90 (39.8)	64 (14.5)	<.001 ²
Low physical activity, n (%)	343 (51.4)	133 (58.8)	210 (47.6)	.004 ²
Nonfrail, n (%)	140 (21.0)	26 (11.5)	114 (25.9)	REF
Prefrail, n (%)	363 (54.4)	112 (49.6)	251 (56.9)	.003 ²
Frail, n (%)	164 (24.6)	88 (38.9)	76 (17.2)	<.001 ²
Cognitive impairment+frailty, n (%)	88 (13.2)			
Cognitive impairment+prefrailty, n (%)	112 (16.8)			

¹t-test. ²chi-square. REF= reference category. NA = variable not compared. MMSE= Mini Mental State Examination. ACE-R= Addenbrooke's Cognitive Examination-Revised. ADL=Activities of daily living.

*Partially dependent/Completely dependent analyzed together.

The prevalence of simultaneous condition cognitive impairment and frailty was 13.2% (95% CI: 11 to 16%) and the prevalence of concurrent cognitive impairment and prefrailty was 16.8 (95% CI: 14 to 20%). Figure 1 displays the MMSE scores among the levels of frailty. The mean MMSE score was 23.9 ± 3.8 among nonfrail individuals. Prefrail individuals had a poorer MMSE score compared to nonfrail individuals (mean difference: -1.5; $p < .01$) and the mean difference in the frail group compared to nonfrail individuals was -5.2 ($p < .01$).

Figure 1. Box plot of performance on MMSE among nonfrail, pre-frail and frail older adults (n = 667). São Carlos, Brazil, 2014. ** $p \leq 0.01$.



MMSE: Mini Mental State Examination

As shown in Table 2 and Figure 2, only fatigue/exhaustion and slowness remained associated with cognitive impairment in the model controlled for age, education, place of residence, dependence on ADL and other frailty criteria. Individuals with fatigue were 1.1-fold more likely to exhibit cognitive impairment compared to those without this criterion. Moreover, individuals with slowness were 2.6-fold more likely to exhibit cognitive impairment (Table 2; Model A). Frailty was more linked to cognitive impairment than

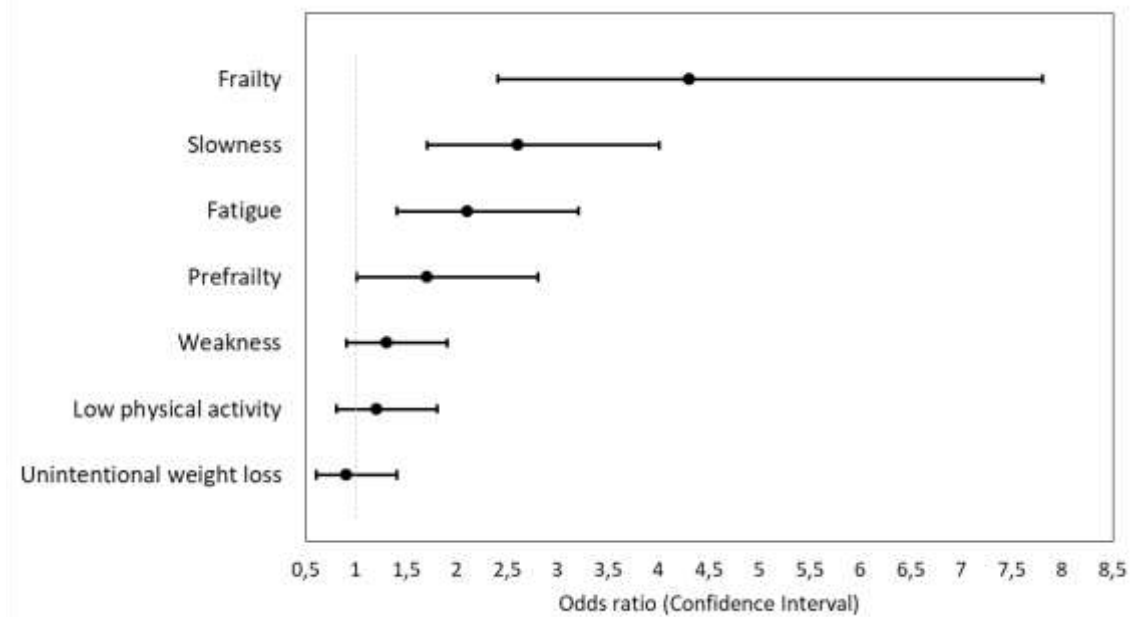
prefrailty. The chances of cognitive impairment increased up to 330% in frail individuals (Model B) and 70% in prefrail individuals compared to nonfrail individuals (Model C).

Table 2. Crude and adjusted regression models of association between criteria for frailty (Model A) prefrailty (Model B), frailty (Model C) and cognitive impairment (n=667). São Carlos, Brazil, 2014.

Variables	Crude model			Adjusted model		
	OR	95%CI	p	OR	95%CI	p
Model A						
No Unintentional weight loss (ref)	1.0			1.0		
Unintentional weight loss	1.3	0.9-1.9	.085	0.9	0.6-1.4	.877
No Fatigue (ref)	1.0			1.0		
Fatigue	2.7	1.9-3.9	<.001	2.1	1.4-3.2	<.001
No Weakness (ref)	1.0			1.0		
Weakness	2.0	1.4-2.7	<.001	1.3	0.9-1.9	.143
No Slowness (ref)	1.0			1.0		
Slowness	3.8	2.6-5.6	<.001	2.6	1.7-4.0	<.001
No Low physical activity (ref)	1.0			1.0		
Low physical activity	1.5	1.1-2.1	.006	1.2	0.8-1.8	.190
Model B						
Nonfrail (ref)	1.0			1.0		
Prefrailty	1.9	1.2-3.1	.006	1.7	1.0-2.8	.033
Model C						
Nonfrail (ref)	1.0			1.0		
Frailty	5.0	3.0-8.5	<.001	4.3	2.4-7.8	<.001

p-values in bold: statistically significant.. For each model (A, B, C), age and education (continuous), sex (ref: male), setting (ref: rural) and ADL performance (ref: independent) were controlling variables.

Figure 2. Adjusted values of regression models (Odds ratio and 95% confidence interval) of association between five frailty clinical criteria (Model A) prefrailty (Model B), frailty (Model C) and cognitive impairment.



Footnotes: Circle markers represent the odds ratio. Horizontal error bars represent the confidence intervals. Dashed gray line represents the threshold for considering association (when horizontal errors bar is fully placed to rightside of graph).

Discussion

One third of the participants presented cognitive impairment, one quarter was frail and fifty per cent were prefrail. The analyses confirmed that frailty was strongly associated with cognitive impairment and fatigue and slowness seemed to be the clinical criteria associated with cognitive impairment.

The prevalence of cognitive impairment in the population-based SABE study in Brazil was 7.9%²⁵. In other study, the proportion of elderly with some degree of cognitive impairment was 13.6%²⁶. Similar prevalence rates of frailty have been found in other middle-income and low-income countries. In studies conducted in Colombia, the prevalence of frailty was 12.2%^{27,28}. In Taiwan, the prevalence of frailty and prefrailty was 4.9% and around 40%, respectively²⁹. A systematic review analyzing nineteen studies held in Latin America found that the prevalence of cognitive impairment ranged from 16 to 25% and frailty was present in 10% of the population¹⁵. The proportion of cognitive impairment in studies may vary due to the profile of older adults in the sample as well as the measures and cutoff points employed. In the present study, the majority of participants had less than five years of schooling and the

full version of MMSE was used. Moreover, clinical frailty criterion of low physical activity was more prevalent, which can be explained by the demographics, characterized as female and older, which are conditions associated with physical inactivity³⁰.

In a study involving 2375 Chinese older adults, the estimated prevalence of frailty with cognitive impairment was 1.8% and the estimated prevalence of prefrailty with cognitive impairment was 8.9%³¹. Half of the population had completed high school and scored significantly higher on the MMSE. Moreover, 61 participants were categorized as frail using the frailty phenotype criteria and the prevalence of cognitive frailty increased fivefold among individuals aged 75 years and older³².

A Japanese study involving 4207 participants found a 2.7% combined prevalence of MCI and frailty (3% in women and 2.4% in men). This combination increased to 4.4% among individuals with a low level of schooling. The regression analysis adjusted by sex, age and education level showed that frail older adults had a 100% increased chance of presenting MCI³³. In a study involving Chilean older adults, frail individuals had a 3.93-fold greater chance of presenting MCI³⁴. A study conducted in Brazil with fifty-one prefrail and frail older adults used a similar MMSE cutoff. Frailty was treated as the dependent variable and global cognition explained up to 19% of the variation in the syndrome³⁵. Furthermore, a longitudinal study demonstrated that 27.8% of non-frail individuals will not experience cognitive decline, whereas only 2% of frail older adults improve or stabilize their cognitive status⁸.

Frailty criteria also seem to be associated with cognitive impairment. A longitudinal survey involving 2817 Japanese men showed that individual frailty factors were associated with a 16 to 18% reduction in global cognitive status³⁶. In another study, slowness and physical exhaustion (fatigue) were associated with a reduction in global cognition³⁷. Slowness is the strongest frailty criterion associated with cognitive impairment and this association has been frequently seen in the literature. Additionally, in this study with 4,649 participants aged ≥ 50 , prefrail individuals (n=1,444) had lower MMSE scores than nonfrail individuals (n=3,155) and frail individuals (n=90) had lower MMSE scores compared to the other two groups³⁷. A study involving 395 American older adults found that an increase in walking speed was associated with a subsequent improvement in cognitive performance, especially recall³⁸. This finding underscores the importance of measuring gait speed and other components of frailty to identify older adults at risk of dysfunctional cognition and its determinants^{39,40}.

In Brazil, the FIBRA study conducted in a low-income community used the same MMSE cutoff as that used in the present study and found that weakness was associated with global cognitive impairment, whereas slowness was specifically associated with a poorer performance regarding verbal fluency and the clock drawing test¹¹.

Some studies suggest biological pathways that may occur in both cognitive impairment and frailty. These mechanisms involve markers such as sociodemographic clinical, inflammatory/immunity and laboratorial characteristics as well as proteins, metabolism/oxidative stress and genetics. Sociodemographic factors include an advanced age, female gender, widowhood, low formal education and financial income^{5,41}. Clinical and others factors include cardiovascular conditions (diabetes, dyslipidemias and hypertension), nutritional deficiencies (malnutrition and vitamin D deficiency), functional dependence, hormonal dysregulation (reduction in testosterone and insulin resistance), inflammation and neurotoxic accumulation of the protein beta-amyloid in the brain, loss of neurons of the substantia nigra, symptoms of depression, use of medications and other drugs, lifestyle and worse perception of health^{5,41}.

The investigation of shared mechanisms in physiological conditions is a new field of study, which limits hypothesizing the pathways of clinical frailty criteria and the decline in cognitive functioning, despite the fact that the outcomes are known. Both frailty and cognitive impairment are risk factors for future adverse outcomes, such as dementia, disability, hospitalization and death. These outcomes have been confirmed in Brazilian and non-Brazilian older adults⁴²⁻⁴⁵.

The major limitation of the present study was the non-evaluation of dementia, which may affect the interpretation of the results. The cross-sectional study design also limited us from knowing causal effects. However, one of the strengths of the study was the use of the MMSE with different cutoff points based on education level, which lends credibility to the assessment of cognition among the participants.

In conclusion, frail older adults scored lower on the MMSE than the prefrail and nonfrail individuals. Moreover, the prevalence of cognitive impairment, frailty and prefrailty in the present sample is consistent with data reported in the literature. The frailty clinical criteria fatigue and slowness were associated to cognitive impairment and slowness seems to be the strongest criteria associated with this condition.

Referências

1. Acknowledgments Woodford HJ, George J. Cognitive assessment in the elderly: a review of clinical methods. *QJM*. 2007 Aug;100(8):469–84.
2. Eshkoor SA, Hamid TA, Mun CY, Ng CK. Mild cognitive impairment and its management in older people. *Clin Interv Aging* [Internet]. 2015 Apr 10;10:687–93. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/25914527>
3. Brigola AG, Luchesi BM, Alexandre T da S, Inouye K, Mioshi E, Pavarini SCI. High burden and frailty: association with poor cognitive performance in older caregivers living in rural areas. *Trends psychiatry Psychother*. 2017;39(4):257–63.
4. Aguilar-Navarro SG, Mimenza-Alvarado AJ, Anaya-Escamilla A, Gutierrez-Robledo LM. Frailty and Vascular Cognitive Impairment: Mechanisms Behind the Link. *Rev Invest Clin*. 2016;68(1):25–32.
5. Sargent L, Nalls M, Starkweather A, Hobgood S, Thompson H, Amella EJ, et al. Shared biological pathways for frailty and cognitive impairment: A systematic review. *Ageing Res Rev* [Internet]. 2018/08/10. 2018 Nov;47:149–58. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/30102995>
6. Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, Gottdiener J, et al. Frailty in older adults: evidence for a phenotype. *J Gerontol A Biol Sci Med Sci*. 2001 Mar;56(3):M146-56.
7. Morley JE, Vellas B, van Kan GA, Anker SD, Bauer JM, Bernabei R, et al. Frailty consensus: a call to action. *J Am Med Dir Assoc*. 2013 Jun;14(6):392–7.
8. Mitnitski A, Fallah N, Rockwood MRH, Rockwood K. Transitions in cognitive status in relation to frailty in older adults: a comparison of three frailty measures. *J Nutr Health Aging*. 2011 Dec;15(10):863–7.
9. Robertson DA, Savva GM, Kenny RA. Frailty and cognitive impairment--a review of the evidence and causal mechanisms. *Ageing Res Rev*. 2013 Sep;12(4):840–51.
10. Borges MK, Canevelli M, Cesari M, Aprahamian I. Frailty as a Predictor of Cognitive Disorders: A Systematic Review and Meta-Analysis [Internet]. Vol. 6, *Frontiers in Medicine*. 2019. p. 26. Available from: <https://www.frontiersin.org/article/10.3389/fmed.2019.00026>
11. Yassuda MS, Lopes A, Cachioni M, Falcao DVS, Batistoni SST, Guimaraes V V, et al. Frailty criteria and cognitive performance are related: data from the FIBRA study in Ermelino Matarazzo, Sao Paulo, Brazil. *J Nutr Health Aging*. 2012 Jan;16(1):55–61.
12. Macuco CRM, Batistoni SST, Lopes A, Cachioni M, da Silva Falcao DV, Neri AL, et al. Mini-Mental State Examination performance in frail, pre-frail, and non-frail community dwelling older adults in Ermelino Matarazzo, Sao Paulo, Brazil. *Int Psychogeriatr*. 2012 Nov;24(11):1725–31.
13. Faria C de A, Lourenco RA, Ribeiro PCC, Lopes CS. [Cognitive performance and frailty in older adults clients of a private health care plan]. *Rev Saude Publica*. 2013 Oct;47(5):923–30.
14. Neri AL, Yassuda MS, Araujo LF, Eulalio MC, Cabral BE, Siqueira MEC, et al. Metodologia e perfil sociodemográfico , cognitivo e de fragilidade de idosos comunitários de sete cidades brasileiras : Estudo FIBRA. *Cad Saude Publica*. 2013;29(4):778–92.
15. Brigola AG, Rossetti ES, dos Santos BR, Neri AL, Zazzetta MS, Inouye K, et al. Relationship between cognition and frailty in elderly: A systematic review | Relação entre cognição e fragilidade em idosos: Uma revisão sistemática. *Dement e Neuropsychol*. 2015;9(2):110–9.

16. Instituto Brasileiro de Geografia e Estatística. Censo demográfico 2010 [Internet]. 2010. Available from:
<http://www.ibge.gov.br/home/estatistica/populacao/censo2010/default.shtm>
17. Luchesi BM, Alexandre TDS, De Oliveira NA, Brigola AG, Kusumota L, Pavarini SCI, et al. Factors associated with attitudes toward the elderly in a sample of elderly caregivers. *Int Psychogeriatrics*. 2016;28(12).
18. Pavarini SCI, Brigola AG, Ottaviani AC, Luchesi BM, Souza ÉN, Rossetti ES, et al. Factors associated with cognitive performance in elderly caregivers. *Arq Neuropsiquiatr*. 2018;76(10):685--691.
19. Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental activities of daily living. *Gerontologist*. 1969;9(3):179–86.
20. Santos RL dos, Virtuoso Júnior JS. Reliability of the Brazilian version of the Scale of Instrumental. *Rev Bras em Promoção Saúde*. 2008;21(4):290–6.
21. Folstein MF, Folstein SE, McHugh PR. “Mini-mental state”. A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res*. 1975 Nov;12(3):189–98.
22. Brucki SMD, Nitrini R, Caramelli P, Bertolucci PHF, Okamoto IH. Suggestions for utilization of the mini-mental state examination in Brazil. *Arq Neuro-Psiquiatr*. 2003 Sep;61(3B):777–81.
23. Mioshi E, Dawson K, Mitchell J, Arnold R, Hodges JR. The Addenbrooke’s Cognitive Examination Revised (ACE-R): a brief cognitive test battery for dementia screening. *Int J Geriatr Psychiatry*. 2006 Nov;21(11):1078–85.
24. Carvalho VA, Caramelli P. Brazilian adaptation of the Addenbrooke’s Cognitive Examination-Revised (ACE-R). *Dement Neuropsychol*. 2007;2:212–6.
25. Dias EG, Andrade FB de, Duarte YA de O, Santos JLF, Lebrao ML. Advanced activities of daily living and incidence of cognitive decline in the elderly: the SABE Study. *Cad Saude Publica*. 2015 Aug;31(8):1623–35.
26. Gondim AS, Coelho Filho JM, Cavalcanti A de A, Roriz Filho J de S, Nogueira CB, Peixoto Junior AA, et al. Prevalence of functional cognitive impairment and associated factors in Brazilian community-dwelling older adults. *Dement Neuropsychol*. 2017;11(1):32–9.
27. Curcio C-L, Henao G-M, Gomez F. Frailty among rural elderly adults. *BMC Geriatr*. 2014;14:2.
28. Curcio C-L, Gomez F, Reyes-Ortiz CA. Related to Fear of Falling. *J Aging Health*. 2009;21(3):460–79.
29. Wu Y-H, Liu L-K, Chen W-T, Lee W-J, Peng L-N, Wang P-N, et al. Cognitive Function in Individuals With Physical Frailty but Without Dementia or Cognitive Complaints: Results From the I-Lan Longitudinal Aging Study. *J Am Med Dir Assoc*. 2015 Oct;16(10):899.e9-16.
30. Gomes GA de O, Luchesi BM, Gratão ACM, Orlandi F de S, Say KG, Inouye K, et al. Prevalence of Physical Inactivity and Associated Factors Among Older Caregivers of Older Adults. *Journal of Aging and Health*. 2018;
31. Feng L, Zin Nyunt MS, Gao Q, Feng L, Yap KB, Ng T-P. Cognitive Frailty and Adverse Health Outcomes: Findings From the Singapore Longitudinal Ageing Studies (SLAS). *J Am Med Dir Assoc*. 2017 Mar;18(3):252–8.
32. Feng L, Nyunt MSZ, Gao Q, Feng L, Lee TS, Tsoi T, et al. Physical frailty, cognitive impairment, and the risk of neurocognitive disorder in the Singapore longitudinal ageing studies. *Journals Gerontol - Ser A Biol Sci Med Sci*. 2017;72(3):369–75.
33. Shimada H, Makizako H, Doi T, Yoshida D, Tsutsumimoto K, Anan Y, et al. Combined Prevalence of Frailty and Mild Cognitive Impairment in a Population of Elderly

- Japanese People. *J Am Med Dir Assoc* [Internet]. 2013;14(7):518–24. Available from: <http://dx.doi.org/10.1016/j.jamda.2013.03.010>
34. Albala C, Lera L, Sanchez H, Angel B, Márquez C, Arroyo P, et al. Frequency of frailty and its association with cognitive status and survival in older Chileans. *Clin Interv Aging*. 2017;12:995–1001.
 35. da Silva Alves BB, de Oliveira Barbosa E, de Moraes Pimentel D, Carneiro LSF, Rodrigues ACMA, Deslandes AC, et al. Comparison of cognitive functions among frail and prefrail older adults: a clinical perspective. *Int psychogeriatrics*. 2019 Feb;31(2):297–301.
 36. Armstrong JJ, Godin J, Launer LJ, White LR, Mitnitski A, Rockwood K, et al. Changes in Frailty Predict Changes in Cognition in Older Men: The Honolulu-Asia Aging Study. *J Alzheimers Dis*. 2016 Jun;53(3):1003–13.
 37. Robertson DA, Savva GM, Coen RF, Kenny R-A. Cognitive function in the prefrailty and frailty syndrome. *J Am Geriatr Soc*. 2014 Nov;62(11):2118–24.
 38. Krall JR, Carlson MC, Fried LP, Xue Q-L. Examining the dynamic, bidirectional associations between cognitive and physical functioning in older adults. *Am J Epidemiol*. 2014 Oct;180(8):838–46.
 39. Artaud F, Singh-Manoux A, Dugravot A, Tzourio C, Elbaz A. Decline in Fast Gait Speed as a Predictor of Disability in Older Adults. *J Am Geriatr Soc*. 2015 Jun;63(6):1129–36.
 40. Avila-Funes JA, Pina-Escudero SD, Aguilar-Navarro S, Gutierrez-Robledo LM, Ruiz-Arregui L, Amieva H. Cognitive impairment and low physical activity are the components of frailty more strongly associated with disability. *J Nutr Health Aging*. 2011 Aug;15(8):683–9.
 41. Halil M, Cemal Kizilarlanoglu M, Emin Kuyumcu M, Yesil Y, Cruz Jentoft AJ. Cognitive aspects of frailty: mechanisms behind the link between frailty and cognitive impairment. *J Nutr Health Aging*. 2015 Mar;19(3):276–83. <https://doi.org/10.1007/s12603-014-0535-z>
 42. Montero-Odasso MM, Barnes B, Speechley M, Muir Hunter SW, Doherty TJ, Duque G, et al. Disentangling Cognitive-Frailty: Results from the Gait and Brain Study. *Journals Gerontol - Ser A Biol Sci Med Sci*. 2016;71(11):1476–82.
 43. Dumurgier J, Artaud F, Touraine C, Rouaud O, Tavernier B, Dufouil C, et al. Gait Speed and Decline in Gait Speed as Predictors of Incident Dementia. *J Gerontol A Biol Sci Med Sci*. 2016 Jun;
 44. Aprahamian I, Suemoto CK, Aliberti MJR, de Queiroz Fortes Filho S, de Araujo Melo J, Lin SM, et al. Frailty and cognitive status evaluation can better predict mortality in older adults? *Arch Gerontol Geriatr*. 2018 Jul;77:51–6.
 45. Aliberti MJR, Cenzer IS, Smith AK, Lee SJ, Yaffe K, Covinsky KE. Assessing Risk for Adverse Outcomes in Older Adults: The Need to Include Both Physical Frailty and Cognition. *J Am Geriatr Soc*. 2019 Mar;67(3):477–83.

3.2 Estudo 2: Cumulative effects of cognitive impairment and frailty on functional decline, falls and hospitalization: a four year follow-up study with older adults²

Abstract

Objective: Evaluate the cumulative effects of cognitive impairment and frailty on functional decline, falls and hospitalization in older adults over a four-year period. **Method:** Four hundred five older adults (60-95 years; mean age: 70.62 ± 7.12 years), 57% female. The frailty evaluation was performed using the clinical criteria of the Cardiovascular Health Study (CHS): weight loss, fatigue, weakness, slowness and low physical activity. Cognitive impairment was defined by cutoff scores of the Mini Mental State Examination (MMSE) based on schooling. Follow-up – functional decline was assessed using the Lawton&Brody scale of instrumental activities of daily living (IADL). An investigation was also performed of the occurrence of falls and admissions to the hospital in the previous twelve months. **Results:** Cognitive impairment was associated with admissions to the hospital and declines in the IADL category of using a telephone. Frailty was associated with admissions to hospital. Cumulative effects were observed for hospitalization and the decline in using the telephone and shopping. Frailty and cognitive impairment increased the risk of being admitted to hospital by 557% and increased the risk of a decline in using the phone by 262% and shopping by 208%. No conditions were associated to risk of falls. **Conclusion:** The combination of the MMSE and the CHS criteria was adequate for measuring the cumulative effects of cognitive impairment and frailty. Shared physiological mechanisms may explain the relation between cognitive impairment and frailty, but further investigations are needed in Brazil and other low/middle-income countries.

Keywords: Frailty. Cognition. Risk factors. Falls. Activity of Daily Living. Hospitalization.

Introduction

The Brazilian Institute of Geography and Statistics, which is the government agency responsible for the analysis of demographic data, estimates that the population aged 60 years or older will surpass 64 million people by the year 2050. Considering the rapid increase in life

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expectancy in the country, an individual born in the year 2017 is expected to live to the age of 76 years, which is an increase of thirteen months and eleven days compared to a person born in 2016.¹

The longevity achieved by the human race in recent centuries translates to an increase in years of living, but it is uncertain whether these additional years will be lived with quality. Vulnerability in old age is a multidimensional issue. The decline in biological functions over time is expected and this decline interacts with sociocultural processes, with low schooling and income favoring the emergence of vulnerability.^{2,3} A vulnerable individual is less likely to cope with stressful events,⁴ which can lead to adverse health outcomes, such as functional decline,⁵ and the aggravation of preexisting conditions, such as cognitive decline and physical frailty.⁶

A slight decrease in cognitive function is expected during the aging process. However, cognitive impairment regards a poorer performance in terms of memory, judgment, language and attention than that expected for one's age and educational level.^{7,8} Neurodegeneration, vascular and metabolic problems, chronic stress, depressive symptoms and anxiety can contribute to a poorer mental performance in the old age⁹ and cognitive reserves (plasticity) may be insufficient to neutralize or minimize the effects of stressors, leading to the impairment of cognitive function.

In both research and the clinical practice of health care, frailty is a frequent clinical condition in the older population. One of the main theories considers frailty to be a clinical syndrome defined as a multiple-cause condition.¹⁰ The Cardiovascular Health Study (CHS) offered one of the first definitions of frailty as a geriatric syndrome assessed using five clinical criteria: unintentional weight loss, fatigue (exhaustion), muscle weakness, slow gait/slowness and low level of physical activity.¹¹

Both cognitive impairment and frailty have been described as independent risk factors for adverse outcomes, such as vulnerability, functional dependence and death.^{10,12}

The main adverse outcomes expected in cognitively impaired and/or frail older adults are a reduction in functional capacity, the occurrence of falls and a greater likelihood of being admitted to high-complexity healthcare services, such as hospitals and emergency/urgent care units. Such outcomes constitute a burden to healthcare services as well as the affected older

adult, his/her family and his/her caregiver. Thus, a gerontological/geriatric assessment can serve as a warning so that steps can be taken for the prevention of these outcomes.

As stated above, a small decline in cognitive function is normal, but functional decline or the loss of functioning in comparison to previous functioning is worrisome. Approximately 10% of community-dwelling older adults need assistance for the performance of basic activities living (BADLs), which involve self-care, and approximately 30% either require supervision or are unable to perform more complex tasks, which are known as instrumental activities of daily living (IADLs),¹³ such as administering medications, managing finances and performing housework. In a study conducted in southern Brazil with a sample of 1593 older adults, the increase in age, low schooling, morbidities and the need for hospitalization were identified as factors associated with low functioning.¹³ The loss of functioning in older adults is the main reason for the need for new family arrangements and the designation of a caregiver.¹⁴

The occurrence of falls in the geriatric population is considered a major public health challenge. Approximately 30% of older adults experience a fall event at least once a year, the consequences of which may be fractures, muscle injuries, neurological damage and death.^{15,16} Other outcomes of falls include functional decline, a fear of falling, a reduction in social activities and the loss of autonomy.¹⁶

In low/middle-income countries, few longitudinal investigations have evaluated the cumulative effects of cognitive impairment and frailty on functional decline, the occurrence of falls and hospitalizations among older adults. A study of this type can generate important knowledge that assists in the prevention of such outcomes. Therefore, the aim of the present study was to analyze the cumulative effects of cognitive impairment and physical frailty on the risk of functional decline, the occurrence of falls and recent hospitalizations among the Brazilian older adults in a four-year period. We also investigated whether cognitive impairment and the concomitant occurrence of frailty have a greater effect on the occurrence of adverse outcomes or whether the effects are similar when analyzed individually.

Methods

Design

A longitudinal study with four-year follow-up was conducted by the Health and Ageing Group of the Federal University of São Carlos, Brazil.

Participants

We evaluated community-dwelling cohabitants older adults registered with primary care centers in the city of São Carlos, state of São Paulo, Brazil. São Carlos is located in the southeastern region of the country and has an estimated population of 221,950 residents, among whom 13% were aged 60 years or older according to the 2010 census.¹⁷

The baseline study was conducted in 2014. The participant selection process is described elsewhere,^{9,18,19} but a brief description is given here. Community-dwelling older adults (age ≥ 60 years, as defined by the World Health Organization for developing countries) registered with 18 primary care centers ($n = 1188$) in rural and urban areas of São Carlos were contacted in person and invited to participate in the survey. Individuals with hearing, visual or language limitations that could constitute barriers to the data collection process were excluded. The response rate was 59.1% (total: 702 individuals).

The follow-up data collection began in April 2018. Among the 702 participants of the baseline study, 37 participants had changed address and could not be contacted for the 2018 wave. Two hundred forty-five participants were lost to the follow-up (were not located at home after three attempts [$n = 125$] or had died [$n = 120$]). Fifteen were excluded due incomplete data on cognitive level, educational background and frailty. Thus, the longitudinal study involved data on 405 individuals (57.7% of the baseline sample).

This study received approval from the Human Research Ethics Committee of the Federal University of São Carlos (certificate number: 1.123.813/2015) and all participants signed a statement of informed consent. At-home interviews were conducted by trained professionals in the fields of gerontology and nursing.

Baseline assessments

- *Demographic characteristics*: sex (male, female), age group (continuous variable), schooling (continuous variable), retirement (yes, no), place of residence (rural or urban area) and ethnicity (black/brown, white or other).

- *IADLs*: Functioning was assessed using the Lawton and Brody Scale for the determination of the degree of dependence on instrumental activities, such as performing housework, managing finances, using a telephone, administering medications, traveling, shopping and preparing meals. The total score ranges from seven (complete dependence) to 21 (complete independence), with intermediate scores (8 to 20 points) indicative of partial dependence.^{20,21}

- *Cognitive impairment*: Cognitive screening was performed using the Mini Mental State Examination (MMSE), the score of which ranges from 0 to 30.²² The cutoff points were adjusted for different levels of schooling: < 26 for those with nine or more years of schooling, < 24 for those with five to eight years of schooling, < 22 for those with one to four years of schooling and < 17 for illiterate individuals.²³

- *Frailty syndrome and criteria*: The five CHS clinical criteria for frailty were considered: unintentional weight loss in the previous year (self-declared) were assessed with the question “Have you lost any weight in the last 12 months without dieting?” Affirmative answers of weight loss greater than 4.5 kg or 5% of body weight were considered positive for this criteria. Fatigue in the previous week (self-declared) was assessed with two questions from the Center for Epidemiological Studies–Depression (CES-D) (a) “How often in the last week did you feel that everything demanded great effort?” and (b) “How often in the last week did you feel you could not carry on with your activities?” Answers of “always” or “most of the time” for either question were considered positive for this criteria. Muscle weakness was assessed by the mean of three consecutive measures of grip strength on dominant side in kilogram-force using a Jamar hydraulic dynamometer (model SH5001; SAEHAN®, Lafayette, IL, USA). Strength categorized in the lowest quintile after controlling for sex and body mass index (BMI) was considered positive for this criteria. Slowness was assessed by the mean of three consecutive measures of the time to walk 4.6m. Two meters were added to the beginning and end of the track to allow for acceleration and deceleration. Mean speed categorized in the lowest quintile after controlling for sex and height was considered positive

for this criteria. Decreased physical activity level compared to the previous year (self-declared) was assessed with the question, “Do you believe you practice less physical activities when compared with 12 months ago?”. Based on Fried’s phenotype, individuals with three to five criteria were considered frail, those with one or two criteria were considered pre-frail and those negative for all five criteria were considered non-frail.¹¹

Follow-up assessments

- *IADL*: Described above.

- *Occurrence of falls*: Self-declared based on the answer to the following questions: ‘Have you suffered a fall from your own height anywhere in the last 12 months? If so, how many times?’

- *Admission to hospital or complex healthcare service*: Self-declared based on the answer to the following questions: ‘Did you need to be hospitalized or admitted to a complex healthcare service for at least 24 hours in the last 12 months? If so, how many times and what was the total number of days you were hospitalized?’

Statistical analysis

The Statistical Package for Social Sciences (SPSS software, version 21.0) was used for the data analysis. Descriptive statistics were performed to characterize the sample. Frequency (n), percentage (%), mean and standard deviation (\pm) values were calculated for the description of the participants at baseline (Table 1) and the prevalence of the outcomes assessed at follow-up (Table 2).

Single multinomial regression models were run to analyze the effects (odds ratio[OR] and respective 95% confidence intervals [CI]) of cognitive impairment (independent variable; Figure 1) and frailty (independent variable; Figure 2) on the outcomes hospitalization, falls and decline in IADLs (dependent variables).

A third multinomial regression model tested the cumulative effect of cognitive impairment occurring concomitantly with frailty on these outcomes (Figure 3). The reference group for this model was composed of nonfrail participants with intact cognition. Age

(continuous), education (continuous), BMI in kg/m^2 (continuous) and sex (reference: male) were the controlling variables in all models. Effects with a two-sided p-value ≤ 0.05 were considered statistically significant.

Results

From 282 participants lost on the follow-up, n=120 were death confirmed. We analyzed characteristics on n=156 lost on follow-up with complete baseline data. The mean age was 69.87 years and 61.5% had between 60-69 years old. Formal schooling time was 3.92 years and 91% were living a marital-like status. Regarding ethnicity, 30.8% self-declared black/brown and 67.3% self-declared white. Regarding cognitive status, 25% scored lower than cutoff, 34,6% were characterized as frail and 8.3% presented both conditions together.

Women accounted little more than half of the sample (Table 1). Mean age was 71.59 ± 6.71 years among the men and 69.90 ± 7.35 years among the women ($t = 2.33$; $p = 0.018$). No significant difference was found in mean schooling between men (3.78 ± 3.52 years) and women (3.36 ± 3.23 years) and both sexes had similar MMSE scores (men: 22.55 ± 4.96 ; women: 21.48 ± 4.98). The prevalence of cognitive impairment, frailty and the two conditions concomitantly was respectively 29.3%, 17.2% and 8.6% among the men and 35.5%, 26% and 12.6% among the women.

Table 1. Description of participants at baseline. São Carlos, Brazil, 2014. (n = 405)

Profile	n (%) or mean \pm SD
Male	174 (43.0)
Female	231 (57.0)
<i>Age, baseline</i>	70.62 \pm 7.12
60-69	204 (50.4)
70-79	152 (37.5)
80+	49 (12.1)
<i>Marital status</i>	
Married or stable partner	363 (89.6)
Without partner	42 (10.7)
<i>Schooling</i>	3.54 \pm 3.54
Illiterate	91 (22.5)
1-4 years	233 (57.5)
5-8 years	46 (11.4)
9+ years	35 (8.6)
<i>Ethnicity</i>	
Black/Brown	126 (31.1)
White	277 (68.4)
Others	2 (0.5)
<i>MMSE, points</i>	21.84 \pm 4.99
Cognitive decline (below cutoff)	133 (32.8)
<i>Frailty (3-5 criteria)</i>	90 (22.2)
<i>Cumulative cognitive impairment and frailty</i>	44 (10.9)

\pm SD: standard-deviation. MMSE: Mini Mental State Examination

Ninety-eight participants (24.2%) were classified as independent in 2014 and this percentage dropped to nearly half (12.8%) in 2018. An increase in partial dependence was also found (24.6% in 2014 and 82.5% in 2018). In contrast, the complete dependence rate dropped from 41.2% in 2014 to 4.7% in 2018.

Table 2 shows the outcomes evaluated in the four-year follow-up. Regarding IADLs, the most prevalent decline (no longer independent or aggravation of pre-existing dependency) was found for traveling, followed by managing finances and shopping. For men, the mean IADL score was 16.02 \pm 3.47 in 2014 and 14.96 \pm 3.88 in 2018 (mean difference: 1.06; p <0.000). For women, the mean IADL score was 18.26 \pm 3.57 in 2014 and 16.87 \pm 4.05 in 2018 (mean difference: 1.39; p <0.000).

Table 2. Prevalence of outcomes assessed at follow-up. São Carlos, 2018. (n = 405)

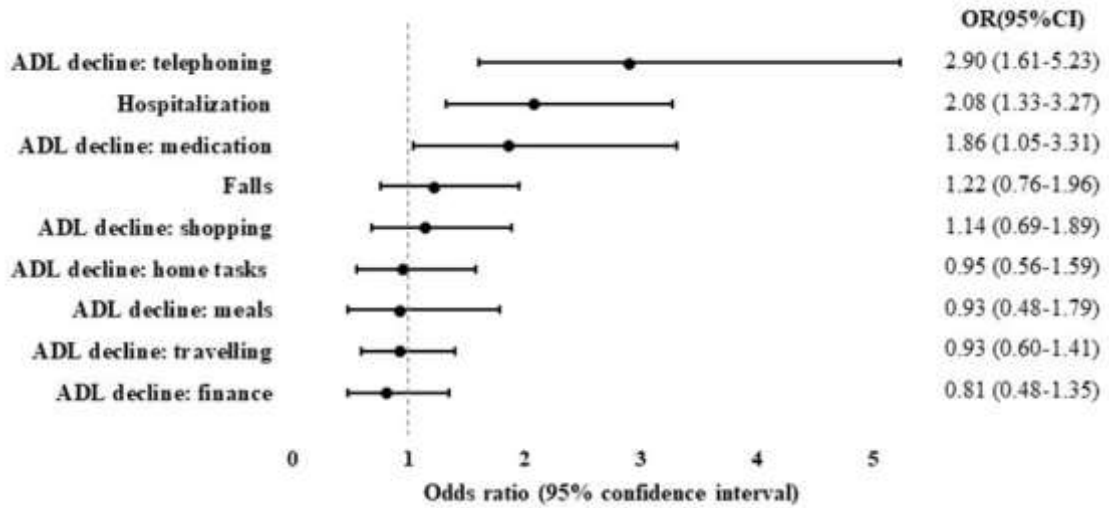
Follow-up assessments	n (%)	95% CI of prevalence (%)
Functional decline (IADLs)		
Using telephone	54 (13.3)	10-17
Travelling	159 (39.3)	34-44
Shopping	85 (21.0)	17-25
Preparing meals	49 (12.1)	9-15
Housework	84 (20.7)	17-25
Administering medications	60 (14.8)	11-18
Managing finances	90 (22.2)	18-26
Falls		
Occurrence of fall in previous year	103 (25.4)	21-30
Number of falls (mean \pm SD)	1.28 (0.65)	
Hospitalization in previous year		
Admission to hospital	118 (29.1)	25-34
Number of hospitalizations (mean \pm SD)	1.29(0.76)	
Hospitalization stay in days (mean \pm SD)	3.40 (3.90)	

CI: confidence interval. IADL decline: functional decline in instrumental activity of daily living between 2014-2018,

The occurrence of falls in the previous year was only assessed in 2018. Fewer men reported falls than women (19.5% vs. 30.3%). In contrast, self-reported admissions to hospital were higher among men than women (33.9% vs 25.5%).

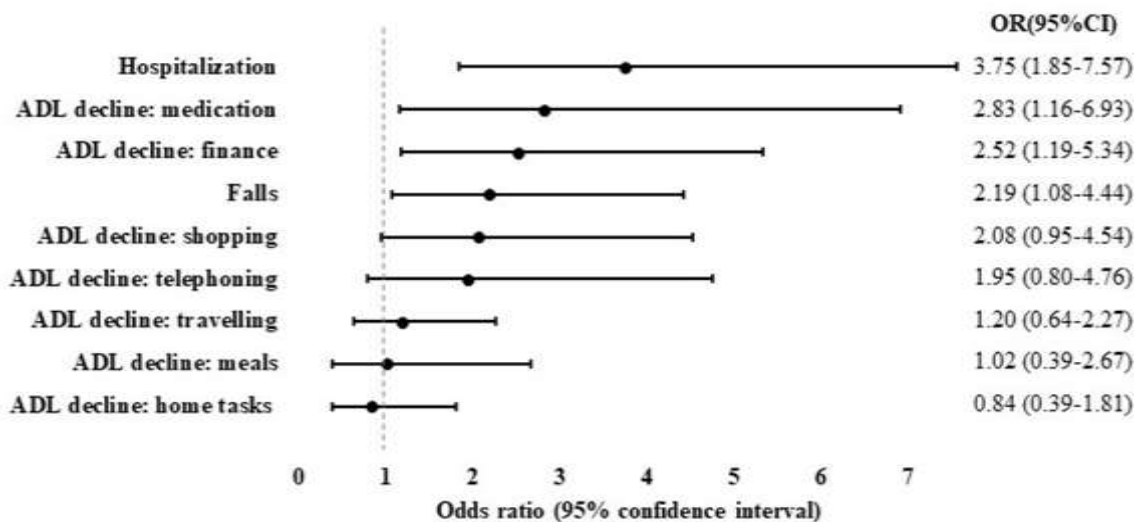
As shown in Figure 1, cognitive impairment at baseline was associated with future functional declines in using a telephone (OR = 3.01). . Participants with cognitive impairment also had a 95% greater risk of being admitted to hospital in comparison to those with intact cognition.

Figure 1. Forest plot indicating odds ratios for cognitive impairment as factor associated with listed outcomes over four-year follow-up adjusted for sex, age, education and BMI.



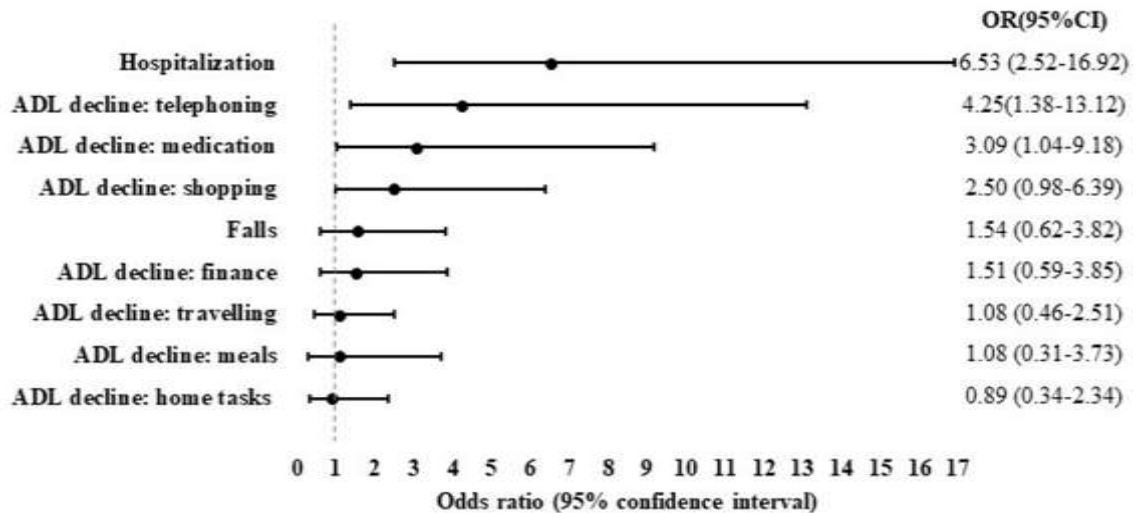
As shown in Figure 2, being frail at baseline was associated with a greater risk of hospitalization than cognitive impairment. Frail participants were 2.19-fold more likely to be admitted to hospital than non-frail participants.

Figure 2. Forest plot indicating odds ratios for frailty as factor associated with listed outcomes over four-year follow-up adjusted for sex, age, education and BMI



The cumulative effect of cognitive impairment and frailty was evident in the occurrence of hospitalizations, with a 557% higher risk compared to non-frail, cognitively healthy participants.. Moreover, concomitant cognitive impairment and frailty was associated with a decline in using a telephone (OR = 3.62) and with a decline in shopping (OR = 3.08). No cumulative effects were found regarding the occurrence of falls (Figure 3).

Figure 3. Forest plot indicating odds ratios for cumulative concomitant cognitive impairment and frailty as factor associated with listed outcomes over four-year follow-up adjusted for sex, age, education and BMI



In cognitively impaired individuals, the mean number of hospitalizations was 1.23 ± 0.50 and mean hospital stay was 3.58 ± 4.37 days. In frail individuals, the mean number of hospitalizations was 1.16 ± 0.43 and mean hospital stay was 3.42 ± 3.83 days. Among those with concomitant cognitive impairment and frailty, the mean number of hospitalizations was similar to that found for those with either cognitive impairment or frailty alone (1.21 ± 0.504), but mean hospital stay was longer (3.75 ± 4.63). In the reference group (non-frail individuals with intact cognition), the mean number of hospitalizations was 1.50 ± 1.24 and mean hospital stay was 3.58 ± 6.05 days.

Discussion

Studies involving the Brazilian population of older adults report that women account for the majority of the samples,^{6,24} which is likely due to the greater longevity of women compared to men, leading to a larger contingent of women aged 60 years or older.²⁵ This phenomenon is directly reflected in scientific studies involving samples recruited from the community. The similar number of men and women in the present study is due to the uniqueness of the recruitment of the sample, which was composed of older adults that reside in the same home, many of whom were conjugal partners. The mean age of the participants was close to 70 years, with the men slightly older than the women. This result is in agreement with data described in previous studies conducted in Brazil.^{2,13,26}

Approximately 30% of the participants exhibited cognitive impairment. The same rate is reported in a Chinese study involving 480 participants using the same instrument for cognitive screening (MMSE) with cutoff points adjusted for education, in which women had a greater probability of cognitive impairment.²⁷ This rate is high in comparison to previous Brazilian population-based studies, in which the prevalence ranges from 8 to 14%.^{28,29} The divergence may be due to the profile of older adults in different samples as well as the measures and cutoff points employed. In the present study, the majority of participants had less than five years of schooling and the full version of MMSE was used. Another point to consider is the differences in cutoff points used in different studies based on schooling and age.³⁰

Regarding the prevalence of frailty, studies conducted in low/middle-income countries report similar results, with rates of 12.2% in Colombia,³¹ 4.9% in Taiwan³² and 10% in a study involving data from different low/middle-income countries.³³ The divergence may be explained by the different manners of assessing frailty.

The concomitant cognitive impairment and frailty was present in 10.9% participants of this study. The association between both conditions were reported by other Brazilian studies.^{34,35}

In the present study, one-quarter of the participants were completely independent regarding the performance of IADLs in 2014 and this proportion dropped to half after four years. This was observed because the completely independent and completely dependent groups (the extremes categories) lose number of participants to the partially dependent group

(middle category). It is expected that independent participants starts needing support for some IADL over the time. Recovering abilities in performing IADL or the changes of aspect of the care can be reasons for completely dependent participants in 2014 being categorized as partially dependent in 2018.³⁶

Functional loss in terms of IADLs ranged from 12 to 40%, with the most evident declines related to travelling, managing finances and shopping. The data from 2014 are in agreement with results described by Nunes et al.,¹³ who found that nearly 30% of older adults required supervision or were unable to perform IADLs. A study involving octogenarians found overall functional decline in 20% of the participants during eight months of follow-up.³⁷

The occurrence of falls (assessed at follow-up) was reported by 19.5% of the men and 30.3% of the women. A study conducted in the United Kingdom involving 4301 men and women between 50 and 75 years of age reports similar data, with falls more prevalent among women (29.1%) than men (23.5%).

Hospitalizations were only investigated in 2018 and men were admitted more often than women (33.9% vs. 25.5%). Regarding hospital admissions, the study found 1.2 times of hospitalization and 3.5 days of hospital stay.

Cognitive impairment increased the chance of being admitted to hospital in the previous year. A previous study found that the main clinical conditions associated with hospitalizations were cardiovascular disease and diabetes.³⁸ A systematic review of the literature confirms these associations but also reports the possible mediation of depression, stress and the use of medications.³⁹ The study also highlighted the complexity of this relation, as cognitive decline may emerge or become aggravated following the occurrence of a hospitalization.

The association between cognitive impairment and the loss of functioning is well-documented in the literature. Each daily activity has a specific level of complexity and requires specific cognitive skills. In the present study, cognitive impairment was associated with functional decline in using the telephone. A previous longitudinal study confirms these results, stating that initiating a telephone call and maintaining an appropriate telephone connection becomes an increasingly difficult task with the progression of cognitive decline.⁴⁰

Frailty alone was associated with hospitalization, which is in agreement with both classic and recent studies.^{11,42} As mentioned above, a previous study reports that the main clinical reasons for hospitalization are cardiovascular disease and diabetes,³⁸ which are cited in the literature as conditions that result in physical frailty.^{43,44}

No decline in IADL was associated to frailty, however the classic publication by Fried and collaborators discussed the functional decline in frail individuals over time.¹¹ A study involving community-dwelling Mexican older adults found that frailty was associated with functional dependence in a 10-year period.⁴⁵ A Canadian study involving 1643 older adults found similar results to those of the present investigation, reporting that the frailty criteria (with the exception of unintentional weight loss) were individually associated with the inability to manage one's own finances and medications in the model adjusted for sociodemographic characteristics, but when other criteria were incorporated into the model, these associations lost their significance.⁴⁶ Managing finances and medications requires preserved cognition, which may demonstrate a possible overlapping of cognitive impairment and frailty. Functional loss in frail older adults is clear, but further studies are needed to gain a better understanding of the relation between physical status and specific activities of daily living.

Falls was not linked with frailty in this study, in the other hand the literature is clear regarding the prediction of frailty on this outcome. In cross-sectional analyses of the English Longitudinal Study of Ageing (ELSA) involving 4301 participants, frailty was significantly associated with falls in both women and men, but the effect was maintained only for women in the adjusted analysis.⁴⁷ The authors attribute this relation to the possible mediation of deficits in balance and muscle function.⁴⁸ Accordingly, the measurement of frailty in the present study included the investigation of walking speed and muscle strength however could not be enough to predict falls.

Separately, frailty and cognitive impairment were associated with hospitalizations and functional decline in using telephone and shopping. . Considering hospitalizations, studies report associations with frailty⁴⁹ and cognitive impairment⁵⁰ but found inconsistent statistics when the predictor was the concomitant cognitive impairment and frailty.. One study found that the combination of the Montreal Cognitive Assessment test and the Clinical Frailty Scale predicted hospitalizations in patients with liver problems.⁵¹

Considering the studies found in the literature, the discussion of functional decline regarding specific activities is limited. The smaller number of participants in comparison to large population-based studies, the way in which the older adults were selected and the restriction regarding the diagnosis of dementias are limitations that should be considered when interpreting the present results. The follow-up rate was relatively small, this happens because most of the participants changes address and do not update contact information with the health services, which difficult the following assessments. However, considering potential bias, the characteristic of the lost in follow-up participants were the same those were contacted again in 2018. Nonetheless, this is a pioneering study in Brazil aimed at understanding the effects of frailty and cognitive impairment on community-dwelling residents in a longitudinal follow-up investigation.

Conclusion

Frailty and cognitive impairment were associated with hospitalizations, functional decline but not falls among older adults. Both conditions exerted cumulative effects on the occurrence of hospitalizations and functional decline specific to the activity of managing medications. Moreover, the combination of the MMSE and CHS frailty criteria was capable of measuring cumulative effects. The physiological mechanisms behind the two conditions may clarify the effects found. However, further clinical investigations with specific samples and population-based surveys in Brazil and other developing countries are needed. This study has particular relevance, as it provides information that can assist in the establishment of prevention measures for adverse health outcomes, which currently account for considerable expenditures in the healthcare system and exert a negative impact on the wellbeing and quality of life of older adults.

References

1. Instituto Brasileiro de Geografia e Estatística. Tábua completa de mortalidade para o Brasil - 2017 : breve análise da evolução da mortalidade no Brasil [Internet]. 1st ed. Brasília: IBGE; 2018. 28 p. Available from: <https://biblioteca.ibge.gov.br/index.php/biblioteca-catalogo?view=detalhes&id=2101628>
2. Barbosa KTF, Costa KN de FM, Pontes M de L de F, Batista PS de S, Oliveira FMRL

- de, Fernandes M das GM. Aging and individual vulnerability: a panorama of older adults attended by the family health strategy. Vol. 26, Texto & Contexto - Enfermagem. scielo; 2017. p. e2700015.
3. Rodrigues NO, Neri AL. Vulnerabilidade social, individual e programática em idosos da comunidade: dados do estudo FIBRA, Campinas, SP, Brasil . Vol. 17, Ciência & Saúde Coletiva . scielo ; 2012. p. 2129–39.
 4. Schröder-Butterfill E, Marianti R. A framework for understanding old-age vulnerabilities. Ageing Soc [Internet]. 2006 Jan;26(1):9–35. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/23750062>
 5. Salmazo-Silva H, Lima-Silva TB, Barros TC, Oliveira EM, Ordonez TN, Carvalho G, et al. Vulnerability in old age: definition and interventions in the field of Gerontology. *Kairós Gerontol.* 2012;15(6):97–116.
 6. Jesus ITM, Orlando F de S, Zazzetta MS. Frailty and cognitive performance of elderly in the context of social vulnerability. *Dement Neuropsychol* [Internet]. 2018 Nov 13;12(2):173–80. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC6022987/>
 7. Woodford HJ, George J. Cognitive assessment in the elderly: a review of clinical methods. *QJM.* 2007 Aug;100(8):469–84.
 8. Eshkoor SA, Hamid TA, Mun CY, Ng CK. Mild cognitive impairment and its management in older people. *Clin Interv Aging* [Internet]. 2015 Apr 10;10:687–93. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/25914527>
 9. Brigola AG, Luchesi BM, Alexandre T da S, Inouye K, Mioshi E, Pavarini SCI. High burden and frailty: association with poor cognitive performance in older caregivers living in rural areas. *Trends psychiatry Psychother.* 2017;39(4):257–63.
 10. Morley JE, Vellas B, van Kan GA, Anker SD, Bauer JM, Bernabei R, et al. Frailty consensus: a call to action. *J Am Med Dir Assoc.* 2013 Jun;14(6):392–7.
 11. Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, Gottdiener J, et al. Frailty in older adults: evidence for a phenotype. *J Gerontol A Biol Sci Med Sci.* 2001 Mar;56(3):M146-56.
 12. Shimada H, Makizako H, Doi T, Tsutsumimoto K, Lee S, Suzuki T. Cognitive impairment and disability in older Japanese adults. *PLoS One.* 2016;
 13. Nunes JD, Saes M de O, Nunes BP, Siqueira FCV, Soares DC, Fassa MEG, et al. Functional disability indicators and associated factors in the elderly: a population-based study in Bagé, Rio Grande do Sul, Brazil. *Epidemiol e Serviços Saúde.* 2017;26(2):295–304.
 14. Brigola AG, Luchesi BM, Rossetti ES, Mioshi E, Inouye K, Pavarini SCI. Health profile of family caregivers of the elderly and its association with variables of care: a rural study. *Rev Bras Geriatr e Gerontol.* 2017;
 15. Tinetti ME. Preventing Falls in Elderly Persons. *N Engl J Med.* 2003;
 16. Maia BC, Viana PS, Arantes PMM, Alencar MA. Consequências das quedas em idosos vivendo na comunidade. *Rev Bras Geriatr e Gerontol.* 2012;
 17. Instituto Brasileiro de Geografia e Estatística. Censo demográfico 2010 [Internet]. 2010. Available from: <http://www.ibge.gov.br/home/estatistica/populacao/censo2010/default.shtm>
 18. Luchesi BM, Alexandre TDS, De Oliveira NA, Brigola AG, Kusumota L, Pavarini SCI, et al. Factors associated with attitudes toward the elderly in a sample of elderly caregivers. *Int Psychogeriatrics.* 2016;28(12).
 19. Pavarini SCI, Brigola AG, Ottaviani AC, Luchesi BM, Souza ÉN, Rossetti ES, et al. Factors associated with cognitive performance in elderly caregivers. *Arq Neuropsiquiatr.* 2018;76(10):685–691.

20. Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental activities of daily living. *Gerontologist*. 1969;9(3):179–86.
21. Santos RL dos, Virtuoso Júnior JS. Reliability of the Brazilian version of the Scale of Instrumental. *Rev Bras em Promoção Saúde*. 2008;21(4):290–6.
22. Folstein MF, Folstein SE, McHugh PR. “Mini-mental state”. A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res*. 1975 Nov;12(3):189–98.
23. Brucki SMD, Nitrini R, Caramelli P, Bertolucci PHF, Okamoto IH. Suggestions for utilization of the mini-mental state examination in Brazil. *Arq Neuro-Psiquiatr*. 2003 Sep;61(3B):777–81.
24. Sposito G, Neri AL, Yassuda MS. Advanced Activities of Daily Living (AADLs) and cognitive performance in community-dwelling elderly persons: Data from the FIBRA Study - UNICAMP [Internet]. *Revista Brasileira de Geriatria e Gerontologia*. 2016. p. 7–20. Available from: http://www.scielo.br/scielo.php?script=sci%7B_%7Darttext%7B&%7Dpid=S1809-98232016000100007%7B&%7Dlang=pt
25. Melo NCV de, Teixeira, Karla Maria Damiano Barbosa TL, Montoya ÁJA, Silveira MB. Household arrangements of elderly persons in Brazil: analyses based on the National Household Survey sample (2009). *Rev Bras Geriatr Geront*. 2016;19(1):139–51.
26. Pavarini SCI, Neri AL, Brigola AG, Ottaviani AC, Souza ÉN, Rossetti ES, et al. Elderly caregivers living in urban, rural and high social vulnerability contexts. *Rev da Esc Enferm*. 2017;
27. Ren L, Zheng Y, Wu L, Gu Y, He Y, Jiang B, et al. Investigation of the prevalence of Cognitive Impairment and its risk factors within the elderly population in Shanghai, China. *Sci Rep*. 2018;
28. Dias EG, Andrade FB de, Duarte YA de O, Santos JLF, Lebrao ML. Advanced activities of daily living and incidence of cognitive decline in the elderly: the SABE Study. *Cad Saude Publica*. 2015 Aug;31(8):1623–35.
29. Gondim AS, Coelho Filho JM, Cavalcanti A de A, Roriz Filho J de S, Nogueira CB, Peixoto Junior AA, et al. Prevalence of functional cognitive impairment and associated factors in Brazilian community-dwelling older adults. *Dement Neuropsychol*. 2017;11(1):32–9.
30. Brigola AG, Ottaviani AC, Souza ÉN, Rossetti ES, Terassi M, Oliveira NA, et al. Descriptive data in different paper-based cognitive assessments in elderly from the community: Stratification by age and education. *Dement e Neuropsychol*. 2018;12(2).
31. Curcio C-L, Henao G-M, Gomez F. Frailty among rural elderly adults. *BMC Geriatr*. 2014;14:2.
32. Wu Y-H, Liu L-K, Chen W-T, Lee W-J, Peng L-N, Wang P-N, et al. Cognitive Function in Individuals With Physical Frailty but Without Dementia or Cognitive Complaints: Results From the I-Lan Longitudinal Aging Study. *J Am Med Dir Assoc*. 2015 Oct;16(10):899.e9-16.
33. Brigola AG, Rossetti ES, Santos BR, Neri AL, Zazzetta MS, Inouye K, et al. Relationship between cognition and frailty in elderly A systematic review. *Dement Neuropsychol*. 2015;9(2):110–9.
34. Macuco CRM, Batistoni SST, Lopes A, Cachioni M, da Silva Falcao DV, Neri AL, et al. Mini-Mental State Examination performance in frail, pre-frail, and non-frail community dwelling older adults in Ermelino Matarazzo, Sao Paulo, Brazil. *Int Psychogeriatr*. 2012 Nov;24(11):1725–31.
35. Yassuda MS, Lopes A, Cachioni M, Falcao DVS, Batistoni SST, Guimaraes V V, et al.

- Frailty criteria and cognitive performance are related: data from the FIBRA study in Ermelino Matarazzo, Sao Paulo, Brazil. *J Nutr Health Aging*. 2012 Jan;16(1):55–61.
36. Hardy SE, Gill TM. Recovery from disability among community-dwelling older persons. *JAMA*. 2004 Apr;291(13):1596–602.
 37. Martín Lesende I, Mendibil Crespo LI, Castaño Manzanares S, Otter ASD, Garaizar Bilbao I, Pisón Rodríguez J, et al. Functional decline and associated factors in patients with multimorbidity at 8 months of follow-up in primary care: The functionality in pluripathological patients (FUNCIPLUR) longitudinal descriptive study. *BMJ Open*. 2018;
 38. Lee JM, Davis MM, Gebremariam A, Kim C. Age and Sex Differences in Hospitalizations Associated with Diabetes. *J Women's Heal*. 2010;
 39. Mathews SB, Arnold SE, Epperson CN. Hospitalization and cognitive decline: Can the nature of the relationship be deciphered? *Am J Geriatr Psychiatry*. 2014;
 40. Hajek A, König HH. Longitudinal Predictors of Functional Impairment in Older Adults in Europe ' Evidence from the Survey of Health, Ageing and Retirement in Europe. *PLoS One*. 2016;
 41. Howell EH, Senapati A, Hsich E, Gorodeski EZ. Medication self-management skills and cognitive impairment in older adults hospitalized for heart failure: A cross-sectional study. *SAGE open Med [Internet]*. 2017 Mar 23;5:2050312117700301–2050312117700301. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/28540048>
 42. Zhang Q, Guo H, Gu H, Zhao X. Gender-associated factors for frailty and their impact on hospitalization and mortality among community-dwelling older adults: a cross-sectional population-based study. *PeerJ [Internet]*. 2018 Feb 28;6:e4326–e4326. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/29507821>
 43. Hanlon P, Nicholl BI, Jani BD, Lee D, McQueenie R, Mair FS. Frailty and pre-frailty in middle-aged and older adults and its association with multimorbidity and mortality: a prospective analysis of 493 737 UK Biobank participants. *Lancet Public Heal [Internet]*. 2018 Jul 1;3(7):e323–32. Available from: [https://doi.org/10.1016/S2468-2667\(18\)30091-4](https://doi.org/10.1016/S2468-2667(18)30091-4)
 44. Vetrano DL, Palmer KM, Galluzzo L, Giampaoli S, Marengoni A, Bernabei R, et al. Hypertension and frailty: a systematic review and meta-analysis. *BMJ Open [Internet]*. 2018 Dec 1;8(12):e024406. Available from: <http://bmjopen.bmj.com/content/8/12/e024406.abstract>
 45. Al Snih S, Graham JE, Ray LA, Samper-Ternent R, Markides KS, Ottenbacher KJ. Frailty and incidence of activities of daily living disability among older Mexican Americans. *J Rehabil Med*. 2009;
 46. Provencher V, Béland F, Demers L, Desrosiers J, Bier N, Ávila-Funes JA, et al. Are frailty components associated with disability in specific activities of daily living in community-dwelling older adults? A multicenter Canadian study. *Arch Gerontol Geriatr*. 2017;
 47. Gale CR, Cooper C, Aihie Sayer A. Prevalence and risk factors for falls in older men and women: The English Longitudinal Study of Ageing. *Age Ageing*. 2016;
 48. Ambrose AF, Paul G, Hausdorff JM. Risk factors for falls among older adults: A review of the literature. *Maturitas*. 2013.
 49. Feng L, Nyunt MSZ, Gao Q, Feng L, Lee TS, Tsoi T, et al. Physical frailty, cognitive impairment, and the risk of neurocognitive disorder in the Singapore longitudinal ageing studies. *Journals Gerontol - Ser A Biol Sci Med Sci*. 2017;72(3):369–75.
 50. Feng L, Zin Nyunt MS, Gao Q, Feng L, Yap KB, Ng T-P. Cognitive Frailty and Adverse Health Outcomes: Findings From the Singapore Longitudinal Ageing Studies (SLAS). *J Am Med Dir Assoc*. 2017 Mar;18(3):252–8.

51. Ney M, Tangri N, Dobbs B, Bajaj J, Rolfson D, Ma M, et al. Predicting Hepatic Encephalopathy-Related Hospitalizations Using a Composite Assessment of Cognitive Impairment and Frailty in 355 Patients With Cirrhosis. *Am J Gastroenterol*. 2018;

3.3 Estudo 3: Hospitalization and mortality in older caregivers: an analysis of accumulated conditions of cognitive impairment, frailty, caregiver burden and perceived stress³

Abstract

The accumulation of cognitive impairment, frailty, perceived stress and excessive burden poses a risk to the health of older caregivers. This study aimed to investigate the influence of the combination of these conditions on the occurrence of hospitalizations and deaths among older caregivers in a four-year follow-up period. Three hundred fifty-one older caregivers participated in a survey and underwent gerontological-geriatric evaluations in 2014. After four years, 33 of the caregivers had died and 99 were not found. The 228 surviving caregivers were reevaluated and data was collected on hospitalizations; 24% reported using hospital services in the previous year. Mean hospital stay was three days (range: one to 22 days). The accumulation of cognitive impairment, frailty, a high level of perceived stress and burden as well as the accumulation of a high level of perceived stress and frailty were associated with the risk of hospitalization. Among the deaths, 15 occurred in the first two years after the baseline evaluation. Considering singular effects, the mortality rate was higher among frail caregivers (33.3%), followed by those with cognitive impairment (23.1%) and a high level of perceived stress (20.4%). Considering accumulative conditions, mortality was greater among frail older caregivers with cognitive impairment (43.8%), following by those with a high level of perceived stress and cognitive impairment (32.4%). The investigation of accumulated effects is important to the identification of potentially vulnerable older caregivers as well as the management and monitoring of the care, health and independence of those who provide care for other older adults.

Key words: Survival; Aged care; Longitudinal study; Risk factors.

Introduction

Due to the greater proneness to chronic diseases associated with both lifestyle and the aging process, the "aging" population is experiencing heterogeneous changes in levels of functioning. The need for support occurs when an older adult no longer has the resources or cognitive, functional and behavioral reserves necessary for the maintenance of independence

³ Versão submetida a periódico *peer-reviewed*.

and autonomy. The responsibility normally falls to the closest person in the affective-social circle.

The literature shows that the person most often responsible for providing care to a dependent older adult is a woman (generally the spouse of the care receiver), who spends more than ten hours per day providing such care and reports exhaustion, stress and excessive burden (Gratao et al., 2019; Inouye, Pedrazzani, Pavarini, & Toyoda, 2009; Luchesi, Souza et al., 2016). The daily routine of these women involves both care and household activities without any previous training in providing care and without receiving support from others (Gratão et al., 2013).

Studies with high levels of evidence show that caregivers are at greater risk of vulnerability, with a negative impact on wellbeing, compared to non-caregivers and the care burden impacts wives more than daughters who perform the role of caregiver (Pinquart & Sorensen, 2003, 2011). Moreover, a greater degree of dependence on the part of the care receiver increases the chances of the caregiver experiencing excessive burden and burnout (Gratão et al., 2013). Thus, caregivers may be exposed to situations that negatively affect their health and satisfaction with life. Indeed, living with continuous stress leads to a poorer quality of life and shorter life expectancy (Aldwin, Sutton, & Lachman, 1996; Carolyn M. Aldwin et al., 2011).

When providing care in old age, caregivers are exposed to syndromes related to their own aging, such as cognitive impairment and physical frailty (Brigola, Luchesi, Alexandre et al., 2017). In recent decades, such conditions have been determined to be risk factors for a poorer quality of life as well as a greater likelihood of hospitalization and death (Boyle, Buchman, Wilson, Leurgans, & Bennett, 2010; Solfrizzi et al., 2012). The combination of cognitive impairment and frailty, which is denominated a clinical syndrome involving the simultaneous occurrence of cognitive and physical decline (Kelaiditi et al., 2013), has been highlighted as the strongest factor associated with the future negative impact on the health of older adults due to the additive effect of the two conditions (John, Tyas, Griffith, & Menec, 2017; Panza et al., 2018).

In the literature, it is unclear whether levels of perceived stress and caregiver burden are the primary reasons for the need to seek a high-complexity healthcare service, such as a hospital or emergency/urgent care unit. Vascular and coronary disease, cardiopulmonary

disease, pneumonia and stroke are the leading reasons for the hospitalization of older adults (Kardas & Ratajczyk-Pakalska, 2003). Poor emotional wellbeing may be a secondary symptom of an adverse health condition and is part of the systematic health-illness process (Cummings et al., 2016; Duric, Clayton, Leong, & Yuan, 2016). This system, with the cited components, is not sufficiently discussed in a complex context of providing care.

The financial costs of hospitalization for patients aged 60 years or older are described as high and such individuals are major users of these healthcare institutions (Barros, Pereira, Weiller, & Anversa, 2015). One should also bear in mind that hospitalization *per se* is a considerable challenge in the lives of older caregivers and their families. The functioning of the caregiver may not be the same after being discharged from hospital (Gill, Allore, Gahbauer, & Murphy, 2010) and an older adult who was previously a provider of care ends up needing daily assistance. Moreover, hospitalization requires the family to allocate resources to fill in for the hospitalized caregiver as well as during the recovery period. While the hospitalization of a caregiver requires coping on the part of the family, the death of a caregiver requires a greater response from the family. One study found that the death of a caregiving spouse occurs less often in comparison to the death of the care receiver, but, when it occurs, it constitutes a major change in the care plans (Gaugler, Jutkowitz, Peterson, & Zmora, 2018).

Among longitudinal studies addressing the cumulative effects of cognitive impairment, frailty, caregiver burden and levels of perceived stress on adverse health outcomes, none has included older populations or caregivers residing in Brazilian communities. Thus, the present study can contribute to multidisciplinary health care, meeting the need to investigate frailty and cognition in specific populations – such as caregivers – and analyzing the effects on adverse outcomes, such as hospitalization and death.

The aim of the present study was to investigate the cumulative effects of the conditions of older caregivers (cognitive impairment and frailty) and those associated with care (burden and level of perceived stress) on adverse health outcomes among older caregivers, such as the need for hospitalization in the previous year and the occurrence of death in the follow-up period. Our initial hypothesis is that there are cumulative effects of cognitive impairment, frailty and depressed psychological wellbeing.

Methods

Design

Longitudinal study with a four-year follow-up

Participants

The participants comprised a population of 351 caregivers ≥ 60 years of age from a study entitled “Variables associated with cognition in older caregivers” conducted in 2014 (baseline) and a study entitled “Follow-up of older caregivers in primary care” conducted at 18 Family Health Units (FHU – public primary care modality) in the city of São Carlos, state of São Paulo, Brazil. The results of the cross-sectional analyses as well as the recruitment, selection and data collection methods at baseline were published previously (Brigola, Luchesi, Alexandre et al., 2017; Bruna Moretti Luchesi, Alexandre et al., 2016; Pavarini et al., 2017).

For the 2018 data collection (follow-up), all older caregivers evaluated in 2014 and/or their relatives were invited to participate. Data collection was performed either at the caregivers' homes or by telephone. Information on mortality was collected from the families and subsequently confirmed by the FHU teams.

Among the 351 caregivers evaluated in 2014, 22 had moved from the area of coverage of the FHUs during the follow-up period and 68 were not located after three home visits or by telephone. Thus, the baseline data in the present study refer to information from 261 participants, among whom there were 33 (12.6%) confirmations of death. The others ($n = 228$) were reevaluated for the collection of the follow-up data. Three participants were excluded from analysis due not completing the cognition, frailty and stress assessments.

This study received authorization from the São Carlos Municipal Secretary of Health (certificate number: 68/2014) and received approval from the Human Research Ethics Committee of Federal University of São Carlos (certificate number: 46431315.3.0000.5504).

The follow-up data collection procedures occurred between 45 and 48 months after the baseline collection.

Variables and evaluations

2014 evaluations (baseline)

- *Cognitive impairment*: The Mini Mental State Examination (total score: 0 to 30 point) (Folstein, Folstein, & McHugh, 1975) was used for the assessment of cognitive impairment using the following cutoff points adjusted for schooling: <26 points for participants with nine or more years of schooling; <24 points for participants with five to eight years of schooling; <22 points for participants with one to four years of schooling; and <17 points for participants with no schooling (illiterate) (Brucki, Nitrini, Caramelli, Bertolucci, & Okamoto, 2003). The revised version of Addenbrooke's Cognitive Examination (ACE-R) was also used.

- *Physical frailty* was defined using the five components of the frailty phenotype described by Linda Fried of the Cardiovascular Health Study Collaborative Research Group in 2001: 1) unintentional weight loss in the previous year; 2) fatigue or exhaustion during routine activities; 3) muscle weakness (determined by low grip strength measured using a dynamometer); 4) slowness, determined by slow gait speed during a timed 4.6-meter walk; and 5) low level of physical activity, based on reports of the interviewees. Three or more of the five components of the frailty phenotype were considered indicative of frailty; one or two components was considered indicative of pre-frailty and the absence of criteria indicated that the individual was nonfrail (Fried et al., 2001).

- *Caregiver burden* was assessed using the short 12-item version of the Zarit Burden Interview (ZBI) (Bedard et al., 2001; Scazufca, 2002; Zarit, Reever, & Bach-Peterson, 1980), which measures the perceived impact on the physical and emotional health, social aspects and financial situation of the family caregiver. Each item has five response options and the total ranges from 12 to 48 points. A cutoff point of ≥ 13 points was used for the identification of caregivers with higher level of burden (Gratao et al., 2019).

- *Perceived stress* was measured using the Perceived Stress Scale (PSS) developed to measure the level of stress experienced in the previous month. The PSS has 14 items with five response options ranging from "never" to "very often". The total ranges from 0 to 56 points, with higher scores denoting a higher level of stress. For the present study, the median of ≥ 17 points was used as the cutoff point to define caregivers with high and low levels of stress

(Cohen, Kamarck, & Mermelstein, 1983; Luchesi, Souza et al., 2016; Luft, Sanches, Mazo, & Andrade, 2007).

- *Demographic characteristics*: sex (female/male), age (continuous and by range), years of schooling (continuous), family income in Brazilian currency (R\$) (continuous) and retirement (yes/no).

- *Care context*: The following care-related data were collected: relationship to dependent care receiver (spouse/other), duration of care in years (continuous and per range of time), daily care hours (range of time), financial/material assistance (yes/no) and emotional/affective support (yes/no).

2018 evaluations (follow-up)

- *Cases of deaths*: For confirmed cases of deaths, information on the cause and date of death were collected from the family and confirmed with the FHU team offering coverage to the area of the participant's home.

- *Admissions to hospital among surviving participants*: The participant was asked the following questions: Did you need to be hospitalized or use high-complexity healthcare services, such as an emergency/urgent care unit, for at least 24 hours in the last 12 months? If so, how many times and what was the total number of days you were hospitalized?

Cumulative conditions (+) and additive effects

- *Cognitive impairment and frailty*: defined as the simultaneous occurrence of cognitive impairment and physical frailty (not pre-frailty) (reference: cognitively intact, non-frail caregivers).

- *Cognitive impairment and burden*: defined as the simultaneous occurrence of cognitive impairment and a high level of caregiver burden (reference: cognitively intact caregivers without excessive burden).

- *Cognitive impairment and stress*: defined as the simultaneous occurrence of cognitive impairment and a high level of perceived stress (reference: cognitively intact caregivers with a low level of perceived stress).

- *Frailty and burden*: defined as the simultaneous occurrence of physical frailty (not pre-frailty) and a high level of caregiver burden (reference: non-frail caregivers without excessive burden)

-*Frailty and stress*: defined as the simultaneous occurrence of physical frailty (not pre-frailty) and a high level of perceived stress (reference: non-frail caregivers with a low level of perceived stress).

Data analysis

The data collected in 2014 were entered twice in a databank on Excel 2016 (Microsoft Corp., Redmond, WA, USA) by two independent individuals. The information collected in 2018 was compiled in the baseline database and followed the same data entry procedure. Inconsistencies were checked and corrected. SPSS version 25.0 (IBM Inc., Chicago, IL, USA) was used for the treatment and analysis of the data.

In the presentation of the information (Table 1), the sample was divided into three groups: 1) surviving older caregivers with no report of hospitalization in the previous year; 2) surviving older caregivers with a report of hospitalization in the previous year; and 3) older caregivers who had died during the follow-up period. Means, proportions and dispersion data of the variables collected at baseline (e.g., demographic and care-related characteristics) were presented for each of these subgroups.

Binary logistic regression was performed to analyze factors associated with the hospitalization of the caregivers. Reports of hospitalization were incorporated into the model as the dependent variable. Cognitive impairment (reference: absence of cognitive impairment), frailty (reference: absence of frailty), excessive burden (reference: absence of excessive burden) and a high level of stress (reference: low level of stress) and the accumulated conditions were the independent variables. Odd ratios (OR), 95% confidence intervals (CI) and p-values were calculated (Table 2).

Survival analysis (Cox regression) was performed for the analysis of factors associated with the mortality of the caregivers. The event of death was incorporated into the model as the outcome and was controlled for time of death. The independent variables followed the same inclusion pattern as that in the analysis of factors associated with hospitalization. Hazard ratios (HR), 95% CIs and p-values were calculated (Table 2).

Both regression models were adjusted by sex and age. Figure 1 shows the risk factors associated with hospitalization controlled for these two variables. The level of significance was set to 5% ($p < 0.05$). The independent variables, including accumulated conditions, were transformed into sub-samples. The frequencies of mortality and respective CIs were calculated for each sub-sample and are presented in Figure 2. The calculation of frequency did not include the group of survivors that had been hospitalized.

Results

Among the 351 caregivers in 2014, 90 (25.6%) were lost to follow-up. Thirty-three (12.6%) of the remaining 261 had died and 228 surviving caregivers were reevaluated in 2018. The data from three caregivers were not included in the analyses due to incomplete evaluations at baseline.

Mean age in the overall sample was 70 years in 2014 and 73 years in 2018. The most prevalent age range was 60-69 years in 2014 and 70-79 years in 2018.

Among the surviving caregivers in 2018, 54 (20.9%) reported having been hospitalized in the previous year. This corresponds to 24% of the surviving caregivers not lost to follow-up ($n = 228$).

Table 1 displays the data for the three groups: surviving caregivers in 2018 with no occurrence of hospitalization, surviving caregivers in 2018 who reported hospitalization and caregivers who had died during the follow-up period. The data from 2014 are reported obeying the division of these groups.

Table 1 shows the predominance of women, the 60-to-69-year-old age group, one to four years of schooling and retired individuals in the three groups. Men accounted for 42.4% of the group of caregivers who had died and 18.1% of the survivors. The prevalence of an advanced age (>80 years) increased among the groups and was highest in the groups of

caregivers who had died. No effect was found for schooling or income. However, the largest percentage of retired participants was in the group of caregivers who had died. A greater effect was found for age ($F: 7.51; p = 0.001$); caregivers who had died were significantly older than the survivors who had not been hospitalized ($p < 0.001$) and were also older (although not significantly) than those who had been hospitalized ($p = 0.24$).

Table 1. Baseline characteristics of caregivers. Demographics, Care-related characteristics, and Health assessment. Sao Carlos, Brazil, 2014.

		Survivors not hospitalized between 2017-2018 (n = 171)	Survivors hospitalized between 2017-2018 (n = 54)	Deceased between 2014-2018 (n = 33)	All caregivers (n = 258)
Sex	Male	18.1	24.1	42.4	22.5
	Female	81.9	75.9	57.6	77.5
Age, years		68.9±6.3	69.9±6.7	73.9±9.0	69.7±6.9
	60-69	59.6	50	39.4	55.0
	70-79	32.2	38.9	36.4	34.1
	≥80	8.2	11.1	24.2	10.9
Schooling, years		3.5±3.0	3.4±3.5	4.2±4.4	3.61±3.33
	+9	8.2	9.3	9.1	8.5
	5-8	12.3	7.4	9.1	10.9
	1-4	60.8	57.4	60.6	60.1
	Illiterate	18.7	25.9	21.2	20.5
Monthly family income, R\$		2178±1349	2266±1655	1943.48±936	2167±1376
Retired	Yes	64.9	68.5	78.8	67.4
	No	35.1	31.5	21.2	32.6
Relationship to care recipient	Spouse	84.6	90.7	78.8	85.3
	Others	15.4	9.3	21.2	14.7
Duration of care, years		10.8±14.0	8.0±10.6	7.4±10.3	9.8±12.9
	<6	48.5	51.9	48.5	49.2
	≥	48.5	46.3	45.5	47.7
	missing	2.9	1.9	6.1	3.1
Hours dedicated to care per week		38.2±31.4	50.3±41.3	38.8±25.9	40.9±33.4
	<40	68.4	55.6	54.5	64.0
	>40	29.2	44.4	39.5	33.7
	missing	2.3	-	6.1	2.3
Financial support	Yes	13.5	7.4	15.2	12.4
	No	86.0	92.6	84.8	87.2
	Missing	0.6	-	-	0.4
Affective support	Yes	46.2	44.4	45.5	45.7
	No	53.2	55.6	54.5	53.9
	Missing	0.6	-	-	0.4

ACE-R		63.4±17.8	57.1±18.2	59.1±20.6	61.5±18.4
MMSE		22.8±4.0	21.56±4.8	22.1±5.3	22.5±4.3
	<cutoff	76.6	64.8	63.6	72.5
	>cutoff	23.4	35.2	36.4	27.5
Frailty	Non	18.1	22.2	12.1	18.2
	Pre	66.7	38.9	48.5	58.5
	Frail	15.2	38.9	39.4	23.3
Zarit-12		7.4±8.6	9.2±9.1	5.8±6.6	7.6±8.5
	<13	79.5	70.4	84.8	78.3
	>13	20.5	29.6	15.2	21.7
PSS		18.7±9.9	20.3±10.4	19.1±8.2	19.1±9.8
	<17	47.4	40.7	30.3	43.8
	>17	52.6	59.3	69.7	56.2

% or mean ± standard deviation. ACE-R=Addenbrooke's Cognitive Examination – Revised.

MMSE=Mini Mental State Examination. PSS=Perceived Stress Scale.

Caregivers were predominantly spouses providing care for more than six years and for less than 40 hours per week without receiving financial or emotional/motivational support. A total of 21% of caregivers were not spouses in the group that had died and 9% were not spouses in the group that had been hospitalized. In the group of surviving caregivers who had not been hospitalized, mean care duration was three years, with a mean of 0.6 hours per week less in comparison to the caregivers who had died in 2018 and 12 hours per week less compared to surviving caregivers who had been hospitalized. However, no significant effects on the groups were found for duration of care ($F: 1.51; p = 0.223$) and weekly care hours ($F: 2.75; p = 0.066$).

Also, Table 1 shows greater frequencies of cognitive impairment, frailty and a high level of stress in the group of caregivers that had died. Excessive burden was more frequent in the group that had been hospitalized. In comparison to the other groups, the hospitalized caregivers had lower cognitive scores on the ACE-R ($F: 2.77; p = 0.064$) and Mini Mental State Examination ($F: 2.05; p = 0.130$), but these differences did not achieve statistical significance. An increase was found in the prevalence of frailty among the groups. The same occurred regarding a high level of stress, which was more prevalent in the group of caregivers who had died.

The risk of hospitalization was found only when conditions accumulated (+). Accumulating cognitive impairment, frailty, a high level of perceived stress and burden and

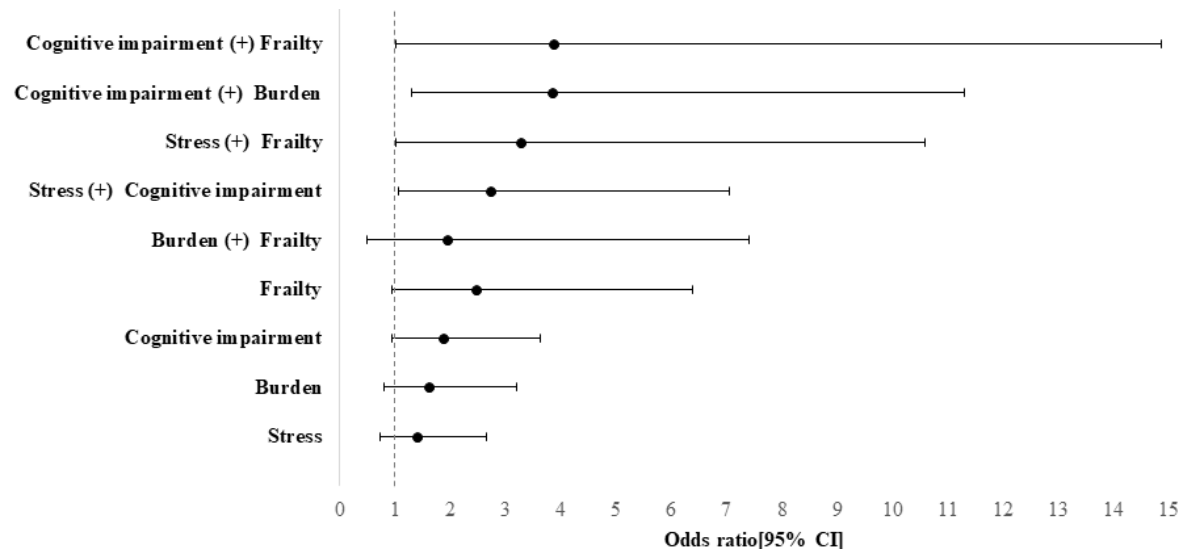
accumulating a high level of perceived stress and frailty were associated with a greater risk of hospitalization (Table 2; Figure 1). Among the participants who had been hospitalized, mean hospital stay was 3.0 ± 4.0 days (range: one to 22 days). Approximately half ($n = 29$) were hospitalized for one day.

Table 2. Binary regression for hospitalization and Cox regression for mortality of caregivers. Sao Carlos, Brazil, 2014-2018.

	Hospitalization			HR	Death	
	OR	95%CI	p		95%CI	p
Cognitive impairment, unadjusted	1.77	0.91-3.44	.088	0.80	0.33-1.93	.624
<i>Adjusted¹</i>	1.82	0.93-3.55	.076	0.85	0.37-2.03	.679
<i>Adjusted²</i>	1.82	0.94-3.56	.075	0.49	0.71-1.43	.196
<i>Adjusted³</i>	1.86	0.95-3.63	.069	0.51	0.17-1.49	.218
Frailty, unadjusted	2.08	0.86-5.03	.101	1.03	0.24-4.47	.960
<i>Adjusted¹</i>	1.98	0.81-4.84	.132	0.54	0.09-3.27	.503
<i>Adjusted²</i>	2.50	0.98-6.35	.054	1.03	0.24-4.47	.960
<i>Adjusted³</i>	2.46	0.94-6.39	.064	0.54	0.08-3.27	.503
Stress, unadjusted	1.31	0.70-2.43	.395	0.81	0.34-1.93	.639
<i>Adjusted¹</i>	1.31	0.70-2.44	.392	0.81	0.34-1.93	.637
<i>Adjusted²</i>	1.41	0.74-2.68	.287	0.79	0.33-1.90	.607
<i>Adjusted³</i>	1.40	0.73-2.65	.303	0.79	0.33-1.92	.617
Care burden, unadjusted	1.63	0.81-3.26	.163	7.06	1.18-42.28	.032
<i>Adjusted¹</i>	1.63	0.81-3.26	.163	6.97	1.16-41.78	.033
<i>Adjusted²</i>	1.59	0.79-3.19	.190	6.47	1.06-39.42	.043
<i>Adjusted³</i>	1.60	0.79-3.21	.186	6.30	1.03-38.46	.046
Cumulative effects of cognitive impairment with:						
Frailty, unadjusted	2.89	0.87-9.54	.082	1.21	0.62-5.66	.801
<i>Adjusted¹</i>	3.83	1.04-14.07	.043	1.33	0.22-8.18	.756
<i>Adjusted²</i>	3.08	0.88-10.80	.078	0.81	0.17-3.81	.801
<i>Adjusted³</i>	3.86	1.00-14.87	.050	1.33	0.21-8.18	.756
Stress, unadjusted	2.22	0.90-5.45	.080	0.72	0.24-2.11	.551
<i>Adjusted¹</i>	2.73	1.06-7.07	.038	0.74	0.24-2.23	.597
<i>Adjusted²</i>	2.24	0.91-5.50	.078	0.52	0.15-1.84	.317
<i>Adjusted³</i>	2.72	1.05-7.04	.039	0.56	0.15-2.02	.379
Care burden, unadjusted	3.85	1.32-11.20	.013	14.00	0.87-223	.062
<i>Adjusted¹</i>	3.92	1.34-11.46	.012	13.02	0.78-217	.074
<i>Adjusted²</i>	3.78	1.28-11.10	.015	9.68	0.59-157	.111
<i>Adjusted³</i>	3.83	1.30-11.30	.015	8.55	0.50-144	.137
Cumulative effects of frailty with:						
Stress, unadjusted	2.14	0.80-5.75	.129	§	§	§
<i>Adjusted¹</i>	3.42	1.08-10.84	.036	§	§	§
<i>Adjusted²</i>	2.02	0.74-5.48	.167	§	§	§
<i>Adjusted³</i>	3.27	1.01-10.58	.048	§	§	§
Care Burden, unadjusted	2.48	0.75-8.22	.135	§	§	§
<i>Adjusted¹</i>	2.79	0.80-9.66	.104	§	§	§
<i>Adjusted²</i>	1.72	0.47-6.46	.400	§	§	§
<i>Adjusted³</i>	1.93	0.50-7.41	.336	§	§	§

1= model adjusted by sex; 2= model adjusted by age (median 69y); 3= model adjusted by sex and age (median: 69 y). § analysis not conducted due to small number of cases

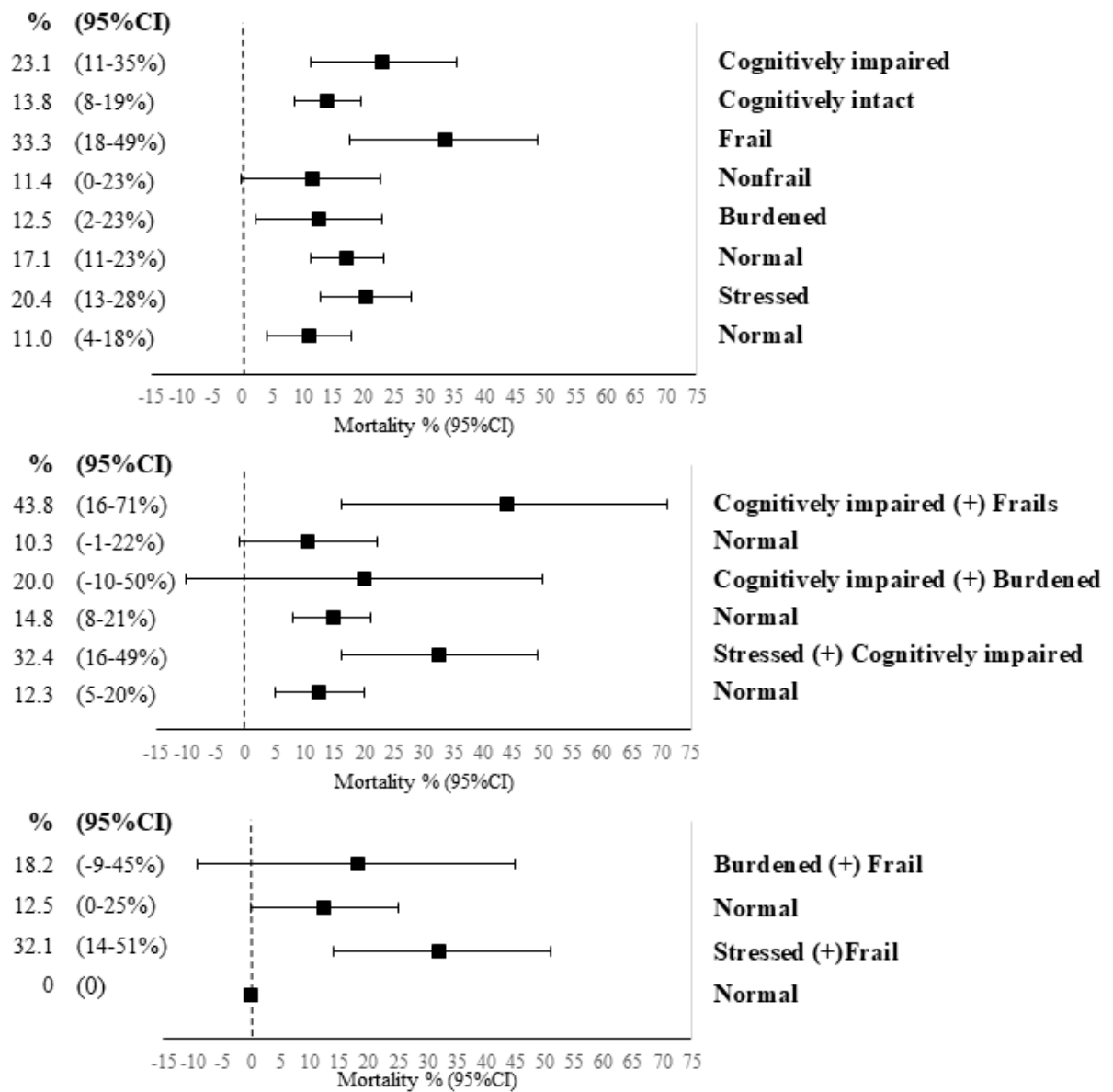
Figure 1. Accumulation effects on hospitalization in older caregivers.



The deaths of the 33 caregivers occurred between the first semester after the data collection in 2014 and the last semester of the follow-up in 2018. Mean time until death was 2.1 ± 1.0 years after the collection in 2014. The date of death was recorded in 24 cases, 15 (62.5%) of which occurred in the first two years.

In a subsample of comparing those who had not been hospitalized and those who had died, the mortality rate was highest among frail caregivers (33.3%), followed by those with cognitive impairment (23.1%) and higher levels of perceived stress (20.4%).

Figure 2. Mortality rate (%) considering accumulated conditions in older caregivers.



In the analysis of accumulated conditions, mortality was highest among frail caregivers with cognitive impairment (43.8%), followed by caregivers with a high level of perceived stress and cognitive impairment (32.4%), frail caregivers with a high level of perceived stress (32.1%) and caregivers with both cognitive impairment and excessive burden (20%) (Figure 2).

Discussion

In the present study, a transition in age groups occurred between 2014 and 2018, with a greater proportion of individuals aged 70 to 79 during the second data collection. Among the participants who were reevaluated, about one-quarter reported being hospitalized in the previous year and the percentage of deaths was 12/100 caregivers. The caregivers who had died during the follow-up period were approximately four years older at baseline than those that had survived. The prevalence of the male sex was high among the caregivers who had died. The concomitant occurrences of cognitive impairment and frailty, cognitive impairment and a high level of perceived stress, cognitive impairment and burden as well as frailty and a high level of perceived stress were associated with hospitalization in the previous year. Excessive caregiver burden was associated with mortality. The highest mortality rates were among caregivers with cognitive impairment, frailty and a high level of perceived stress. Among the participants with accumulated conditions, the prevalence of death was higher among those with cognitive impairment and frailty as well as those with cognitive impairment a high level of stress.

This study confirms the findings of other investigations conducted in Brazil. Caregivers are generally women, the spouses of the care receiver, in a similar age range as the care receiver and provide care for many years and many hours per day without receiving any support (Brigola, Luchesi, Rossetti et al., 2017; Vieira, Fialho, Freitas, & Jorge, 2011). The lack of support and degree of dependence of the care receiver can considerably increase the level of stress of caregivers, compromising their psychological wellbeing, cognitive status and social involvement (Gratão et al., 2013; Luchesi, Degani, Brígola, Pavarini, & Marques, 2015).

Regarding the occurrence of hospitalization, the prevalence in the multicenter *Brazilian Longitudinal Study of Aging* (ELSI-Brazil) was lower than that found in the present investigation (10.2% versus 24%) in a general population of older adults. A study conducted in the southern region of Brazil with 1593 older adults found that hospitalization for non-surgical reasons was more frequent than hospitalization for surgical reasons (17% versus 10%) (Nunes et al., 2017). Neither of the studies cited offered data on the frequency of hospitalizations among older caregivers, but particularities are known to exist in the different regions of the country.

Women were the majority in the group of caregivers who had been hospitalized, which differs from data reported in a previous study conducted with older adults who lived in nursing homes (Hoffmann & Schmiemann, 2017). In the present investigation, hospitalized caregivers had a higher family income, took care of spouses more and had been providing care for a shorter period of time. However, they provided care for more hours per week and had no financial or emotional support. These characteristics compose the care context and exert an influence on the occurrence of higher levels of stress and caregiver burden.

The results show that a high level of perceived stress combined with cognitive impairment was associated with the risk of hospitalization. Stress alone is considered a predominant symptom in hospitalized individuals. Indeed, a previous study found that three-quarters of the hospitalized participants had symptoms of stress and more than 10% were in the pre-exhaustion and exhaustion phases caused by psychological symptoms (Macena & Lange, 2008).

We found no studies analyzing the characteristics of being a caregiver and the possible association with admission to hospital, which limits the interpretation on this topic. However, cognitive impairment and frailty are clearly described as factors associated with the risk of hospitalization. Analyzed alone, cognitive impairment was associated with hospitalization in a multi-center study conducted in France (Avila-Funes et al., 2009). A meta-analysis with eight studies, many of which used the criteria of the Cardiovascular Health Study, found a clear association between pre-frailty/frailty and the risk of hospitalization in older adults (Chang, Lin, & Cheng, 2018).

We also found no studies on the accumulation of conditions. However, some investigations have performed a similar analysis with other variables that are potentially related to this issue. The association between functioning and annual admission to hospitals was only found among older adults with multimorbidity in one study (Wang et al., 2018). Functional limitation and morbidity are closely associated with cognitive impairment and physical frailty and have been discussed in other studies (Melo-Silva, Mambrini, Souza Junior, Andrade, & Lima-Costa, 2018; Nunes et al., 2017).

With regard to mortality, 9% of the caregivers had died (16.7% when calculated without the group of survivors that had been hospitalized). Among the deaths, 42.4% were men, whereas only 18.1% of the survivors were men. In the group of caregivers who had died,

there was a larger number of participants aged 80 years or older. The highest mortality rates were found for caregivers with cognitive impairment, frailty and a high level of perceived stress as well as the accumulation of these conditions.

The mortality rate was similar to that reported in a previous four-year longitudinal study with caregivers (12%) (Schulz & Beach, 1999). In the investigation cited, caregiver strain increased the risk of mortality by 63%. This is in agreement with the present findings, in which the mortality rate was lower among caregivers with low levels of stress and burden.

Feelings of stress in life are reported to be a predictor of mortality in caregivers. In the literature, the risk of mortality in caregivers is lower compared to non-caregivers but increases in the occurrence of reports of psychological stress. In a previous study involving 1143 older men, feelings of stress experienced throughout the course of one's life increased the risk of death, with an odds ratio of 1.42 for moderate stress and 1.37 for high stress; moreover, participants with any feelings of stress had a 50% greater chance of dying in the follow-up period (Aldwin et al., 2011). In another follow-up study with 375 caregivers of older relatives or friends compared to 694 non-caregivers, the adjusted ratio for the risk of dying in the first three years was 0.74 but increased to 1.81 among caregivers with high levels of stress, equaling the risk of mortality found among the non-caregivers (Fredman, Cauley, Hochberg, Ensrud, & Doros, 2010).

Excessive caregiver burden alone was associated with the risk of mortality in the Cox regression, but this effect was not found for the other conditions. This finding is likely due to the time component of the event used for the calculation of the hazard ratio, which was better suited for this variable, but the interpretation is limited due to the small number of participants. The broad range of the confidence interval suggests a small number of events (deaths) analyzed in the participants.

Cognitive impairment and frailty increased the percentage of deaths among the caregivers. In the literature, cognitive impairment and frailty have been confirmed as independent factors for mortality in old age (Cano, Samper-Ternent, Al Snih, Markides, & Ottenbacher, 2012). In a study conducted with an initial sample of 1815 older residents of Latin American heritage in the United States, 690 deaths (38%) occurred after ten years and the frequencies of cognitive decline and frailty were relatively higher in these cases compared to the frequencies found among the survivors (Cano et al., 2012). In an epidemiological survey involving 2375 Singaporean Chinese individuals aged 55 years or older and without

dementia or neurodegenerative diseases, the participants with concomitant pre-frailty and cognitive impairment had a 1.8-fold greater risk of mortality in the three-year follow-up period; in cases of the concomitant occurrence of cognitive decline and frailty, the risk of mortality was increased fivefold (Feng et al., 2017). This effect was also found in another study, in which the odds of death in older adults with concomitant cognitive decline and frailty was 1.55-fold higher compared to the analyses in which only frailty was used as the predictor (John et al., 2017).

A limitation of the present study was the impossibility of performing a clinical diagnosis of dementia, which would have enabled the further data interpretation.

The investigation of the effects on health of cognitive impairment, frailty and the psychological aspects of providing care for a dependent older adult is particularly relevant to the identification of risk factors and the planning of interventions directed at caregivers. Such care is commonly provided for a spouse or loved one in their own home for many years and even decades (Gratão et al., 2013; Luchesi et al., 2016). Over time, the functional dependence of the care receiver can increase, with a consequent reduction in autonomy, leading to greater feelings of burden and poorer psychological wellbeing for the caregiver (Gratão et al., 2013). Thus, in addition to the conditions of their own aging (decline in cognitive function and physical frailty), caregivers have a greater chance of becoming vulnerable. Indeed, caregivers with accumulated conditions are at greater risk of adverse outcomes compared to healthier caregivers with less psychological burden.

In conclusion, the occurrence of hospitalization was high in the present study and the frequency of deaths among the caregivers was similar to rates described in the literature. Hospitalization and death during the follow-up period were more frequent among the caregivers with cognitive impairment, frailty, a high level of stress and excessive burden in this specific population. The present findings can contribute to health promotion programs for caregivers to ensure that they remain active and independent in their activities.

References

- Aldwin, C M, Sutton, K. J., & Lachman, M. (1996). The development of coping resources in adulthood. *Journal of Personality*, 64(4), 837–871.
- Aldwin, Carolyn M., Molitor, N.-T., Spiro, A., Levenson, M. R., Molitor, J., & Igarashi, H. (2011). Do Stress Trajectories Predict Mortality in Older Men? Longitudinal Findings from the VA Normative Aging Study. *Journal of Aging Research*, 2011, 1–10.

- <https://doi.org/10.4061/2011/896109>
- Avila-Funes, J. A., Amieva, H., Barberger-Gateau, P., Le Goff, M., Raoux, N., Ritchie, K., ... Dartigues, J.-F. (2009). Cognitive impairment improves the predictive validity of the phenotype of frailty for adverse health outcomes: the three-city study. *Journal of the American Geriatrics Society*, 57(3), 453–461. <https://doi.org/10.1111/j.1532-5415.2008.02136.x>
- Barros, I. F. O., Pereira, M. B., Weiller, T. H., & Anversa, E. T. R. (2015). Internações hospitalares por quedas em idosos brasileiros e os custos correspondentes no âmbito do Sistema Único de Saúde. *Rev Kairós Gerontol.*
- Bedard, M., Molloy, D. W., Squire, L., Dubois, S., Lever, J. A., & O'Donnell, M. (2001). The Zarit Burden Interview: a new short version and screening version. *The Gerontologist*, 41(5), 652–657.
- Boyle, P. A., Buchman, A. S., Wilson, R. S., Leurgans, S. E., & Bennett, D. A. (2010). Physical frailty is associated with incident mild cognitive impairment in community-based older persons. *Journal of the American Geriatrics Society*, 58(2), 248–255. <https://doi.org/10.1111/j.1532-5415.2009.02671.x>
- Brigola, A. G., Luchesi, B. M., Alexandre, T. da S., Inouye, K., Mioshi, E., & Pavarini, S. C. I. (2017). High burden and frailty: association with poor cognitive performance in older caregivers living in rural areas. *Trends in Psychiatry and Psychotherapy*, 39(4), 257–263. <https://doi.org/10.1590/2237-6089-2016-0085>
- Brigola, A. G., Luchesi, B. M., Rossetti, E. S., Mioshi, E., Inouye, K., Pavarini, S. C. I., ... Pavarini, S. C. I. (2017). Health profile of family caregivers of the elderly and its association with variables of care: a rural study. *Revista Brasileira de Geriatria e Gerontologia*, 20(3), 409–420. <https://doi.org/10.1590/1981-22562017020.160202>
- Brucki, S. M. D., Nitrini, R., Caramelli, P., Bertolucci, P. H. F., & Okamoto, I. H. (2003). Suggestions for utilization of the mini-mental state examination in Brazil. *Arq Neuro-Psiquiatr*, 61(3B), 777–781.
- Cano, C., Samper-Ternent, R., Al Snih, S., Markides, K., & Ottenbacher, K. J. (2012). Frailty and cognitive impairment as predictors of mortality in older Mexican Americans. *The Journal of Nutrition, Health & Aging*, 16(2), 142–147.
- Chang, S.-F., Lin, H.-C., & Cheng, C.-L. (2018). The Relationship of Frailty and Hospitalization Among Older People: Evidence From a Meta-Analysis. *Journal of Nursing Scholarship : An Official Publication of Sigma Theta Tau International Honor Society of Nursing*, 50(4), 383–391. <https://doi.org/10.1111/jnu.12397>
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 24(4), 385–396.
- Cummings, D. M., Kirian, K., Howard, G., Howard, V., Yuan, Y., Muntner, P., ... Safford, M. M. (2016). Consequences of Comorbidity of Elevated Stress and/or Depressive Symptoms and Incident Cardiovascular Outcomes in Diabetes: Results From the REasons for Geographic And Racial Differences in Stroke (REGARDS) Study. *Diabetes Care*, 39(1), 101–109. <https://doi.org/10.2337/dc15-1174>
- Duric, V., Clayton, S., Leong, M. L., & Yuan, L.-L. (2016). Comorbidity Factors and Brain Mechanisms Linking Chronic Stress and Systemic Illness. *Neural Plasticity*, 2016, 5460732. <https://doi.org/10.1155/2016/5460732>
- Feng, L., Zin Nyunt, M. S., Gao, Q., Feng, L., Yap, K. B., & Ng, T.-P. (2017). Cognitive Frailty and Adverse Health Outcomes: Findings From the Singapore Longitudinal Ageing Studies (SLAS). *Journal of the American Medical Directors Association*, 18(3), 252–258. <https://doi.org/10.1016/j.jamda.2016.09.015>
- Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). “Mini-mental state”. A practical method for grading the cognitive state of patients for the clinician. *J Psychiatr Res*,

- 12(3), 189–198.
- Fredman, L., Cauley, J. A., Hochberg, M., Ensrud, K. E., & Doros, G. (2010). Mortality associated with caregiving, general stress, and caregiving-related stress in elderly women: Results of caregiver-study of osteoporotic fractures. *Journal of the American Geriatrics Society*, 58(5), 937–943. <https://doi.org/10.1111/j.1532-5415.2010.02808.x>
- Fried, L. P., Tangen, C. M., Walston, J., Newman, A. B., Hirsch, C., Gottdiener, J., ... McBurnie, M. A. (2001). Frailty in older adults: evidence for a phenotype. *The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences*, 56(3), M146-56.
- Gaugler, J. E., Jutkowitz, E., Peterson, C. M., & Zmora, R. (2018). Caregivers dying before care recipients with dementia. *Alzheimer's & Dementia (New York, N. Y.)*, 4, 688–693. <https://doi.org/10.1016/j.trci.2018.08.010>
- Gill, T. M., Allore, H. G., Gahbauer, E. A., & Murphy, T. E. (2010). Change in disability after hospitalization or restricted activity in older persons. *JAMA*, 304(17), 1919–1928. <https://doi.org/10.1001/jama.2010.1568>
- Gratao, A. C. M., Brigola, A. G., Ottaviani, A. C., Luchesi, B. M., Souza, E. N., Rossetti, E. S., ... Pavarini, S. C. I. (2019). Brief version of Zarit Burden Interview (ZBI) for burden assessment in older caregivers. *Dementia & Neuropsychologia*, 13(1), 122–129. <https://doi.org/10.1590/1980-57642018dn13-010015>
- Gratão, A. C. M., Talmelli, L. F. da S., Figueiredo, L. C., Rosset, I., Freitas, C. P., & Rodrigues, R. A. P. (2013). Dependência funcional de idosos e a sobrecarga do cuidador. *Rev Esc Enferm USP*, 47(1), 137–144. <https://doi.org/10.1590/S0080-62342013000100017>
- Hoffmann, F., & Schmiemann, G. (2017). Influence of age and sex on hospitalization of nursing home residents: A cross-sectional study from Germany. *BMC Health Services Research*, 17(1), 55. <https://doi.org/10.1186/s12913-017-2008-7>
- Inouye, K., Pedrazzani, E. S., Pavarini, S. C. I., & Toyoda, C. Y. (2009). Perceived quality of life of elderly patients with dementia and family caregivers: evaluation and correlation. *Rev Latin-Am Enferm*, 17(2), 187–193. <https://doi.org/10.1590/S0104-11692009000200008>
- John, P. D., Tyas, S. L., Griffith, L. E., & Menec, V. (2017). The cumulative effect of frailty and cognition on mortality – results of a prospective cohort study. *International Psychogeriatrics*, 29(04), 535–543. <https://doi.org/10.1017/S1041610216002088>
- Kardas, P., & Ratajczyk-Pakalska, E. (2003). Reasons for elderly patient hospitalization in departments of internal medicine in Lodz. *Aging Clinical and Experimental Research*, 15(1), 25–31.
- Kelaiditi, E., Cesari, M., Canevelli, M., van Kan, G. A., Ousset, P.-J., Gillette-Guyonnet, S., ... Vellas, B. (2013). Cognitive frailty: rational and definition from an (I.A.N.A./I.A.G.G.) international consensus group. *The Journal of Nutrition, Health & Aging*, 17(9), 726–734. <https://doi.org/10.1007/s12603-013-0367-2>
- Luchesi, B.M., Alexandre, T. D. S., De Oliveira, N. A., Brigola, A. G., Kusumota, L., Pavarini, S. C. I., & Marques, S. (2016). Factors associated with attitudes toward the elderly in a sample of elderly caregivers. *International Psychogeriatrics*, 28(12). <https://doi.org/10.1017/S1041610216001538>
- Luchesi, Bruna Moretti, Alexandre, T. da S., Oliveira, N. A., Brigola, A. G., Kusumota, L., Pavarini, S. C. I., & Marques, S. (2016). Factors associated with attitudes toward the elderly in a sample of elderly caregivers. *International Psychogeriatrics*, 1–11. <https://doi.org/10.1017/S1041610216001538>
- Luchesi, Bruna Moretti, Degani, G. C., Brígola, A. G., Pavarini, S. C. I., & Marques, S. (2015). Evaluation of depressive symptoms in older caregivers. *Revista de Psiquiatria Clinica*. Lemos Editorial e Graficos Ltda. <https://doi.org/10.1590/0101-60830000000047>

- Luchesi, Bruna Moretti, Souza, É. N., Gratão, A. C. M., Gomes, G. A. de O., Inouye, K., Alexandre, T. da S., ... Pavarini, S. C. I. (2016). The evaluation of perceived stress and associated factors in elderly caregivers. *Archives of Gerontology and Geriatrics*, *67*, 7–13. <https://doi.org/10.1016/j.archger.2016.06.017>
- Luft, C. D. B., Sanches, S. de O., Mazo, G. Z., & Andrade, A. (2007). Versão brasileira da Escala de Estresse Percebido: tradução e validação para idosos. *Revista de Saúde Pública*, *41*(4), 606–615. <https://doi.org/10.1590/S0034-89102007000400015>
- Macena, C. S. de, & Lange, E. S. N. (2008). A incidência de estresse em pacientes hospitalizados. *Psicologia Hospitalar*. scielopepsic .
- Melo-Silva, A. M. de, Mambrini, J. V. de M., Souza Junior, P. R. B. de, Andrade, F. B. de, & Lima-Costa, M. F. (2018). Hospitalizations among older adults: results from ELSI-Brazil. *Revista de Saude Publica*, *52Suppl 2*(Suppl 2), 3s-3s. <https://doi.org/10.11606/S1518-8787.2018052000639>
- Nunes, B. P., Soares, M. U., Wachs, L. S., Volz, P. M., Saes, M. de O., Duro, S. M. S., ... Facchini, L. A. (2017). Hospitalization in older adults: association with multimorbidity, primary health care and private health plan. *Revista de Saude Publica*, *51*, 43. <https://doi.org/10.1590/S1518-8787.2017051006646>
- Panza, F., Lozupone, M., Solfrizzi, V., Sardone, R., Dibello, V., Di Lena, L., ... Logroscino, G. (2018). Different Cognitive Frailty Models and Health- and Cognitive-related Outcomes in Older Age: From Epidemiology to Prevention. *Journal of Alzheimer's Disease*, *62*(3), 993–1012. <https://doi.org/10.3233/JAD-170963>
- Pavarini, S. C. I., Neri, A. L., Brigola, A. G., Ottaviani, A. C., Souza, E. N., Rossetti, E. S., ... Luchesi, B. M. (2017). Elderly caregivers living in urban, rural and high social vulnerability contexts. *Revista Da Escola de Enfermagem Da USP*, *51*. <https://doi.org/10.1590/S1980-220X2016040103254>
- Pinquart, M., & Sorensen, S. (2003). Differences between caregivers and noncaregivers in psychological health and physical health: a meta-analysis. *Psychology and Aging*, *18*(2), 250–267.
- Pinquart, M., & Sorensen, S. (2011). Spouses, adult children, and children-in-law as caregivers of older adults: a meta-analytic comparison. *Psychol Aging*, *26*(1), 1–14. <https://doi.org/10.1037/a0021863>
- Scazufca, M. (2002). Brazilian version of the Burden Interview scale for the assessment of burden of care in carers of people with mental illnesses. *Rev Bras Psiquiatr*, *24*(1), 12–17. <https://doi.org/10.1590/S1516-44462002000100006>
- Schulz, R., & Beach, S. R. (1999). Caregiving as a risk factor for mortality: the Caregiver Health Effects Study. *JAMA*, *282*(23), 2215–2219.
- Solfrizzi, V., Scafato, E., Frisardi, V., Sancarolo, D., Seripa, D., Logroscino, G., ... Panza, F. (2012). Frailty syndrome and all-cause mortality in demented patients: the Italian Longitudinal Study on Aging. *Age (Dordrecht, Netherlands)*, *34*(2), 507–517. <https://doi.org/10.1007/s11357-011-9247-z>
- Vieira, C. P. de B., Fialho, A. V. de M., Freitas, C. H. A. de, & Jorge, M. S. B. (2011). Practices of elderly's informal caregiver at home. *Rev Bras Enferm*, *64*(3), 570–579. <https://doi.org/10.1590/S0034-71672011000300023>
- Wang, X.-X., Chen, Z.-B., Chen, X.-J., Huang, L.-L., Song, X.-Y., Wu, X., ... Wang, P.-X. (2018). Functional status and annual hospitalization in multimorbid and non-multimorbid older adults: a cross-sectional study in Southern China. *Health and Quality of Life Outcomes*, *16*(1), 33. <https://doi.org/10.1186/s12955-018-0864-4>
- Zarit, S. H., Reever, K. E., & Bach-Peterson, J. (1980). Relatives of the impaired elderly: correlates of feelings of burden. *Gerontologist*, *20*(6), 649–655.

3.4 Estudo 4: Deaths among older caregivers and non-caregivers: exploring the effects of age, sex and schooling as risk factors⁴

Abstract

Objectives: to analyze the mortality rates of community-dwelling older caregivers and non-caregivers in a four-year period considering the effects of age, sex and schooling. **Methods:** two hundred sixty older caregivers and 279 older non-caregivers participated in the study between 2014 and 2018. **Results:** In the group of caregivers, 77% were women, mean age was 69 years and mean schooling was three years. In the group of non-caregivers, 68% were men, mean age was 74 years and mean schooling was three years. The mortality rate was 12.6% in the group of caregivers and 31.2% in the group of non-caregivers. No effects of the demographic variables were found in the group of caregivers. The female sex was associated with the risk of mortality among the non-caregivers. **Conclusion:** The outcomes studied underscore the importance of designing care strategies and the follow-up of families with older people considering demographic and care-related characteristics.

Key words: Survival. Older adults. Caregivers. Mortality. Longitudinal studies.

Introduction

The chronic stress, depression and anxiety that stem from the daily task of providing care for a dependent loved one can compromise the mental health and psychological wellbeing of the caregiver.¹ Caregivers of older adults tend to have more depressive symptoms and care-related stress, less self-efficacy, lower subjective wellbeing and different levels of physical health compared to non-caregivers.² Considering specific characteristics, such as sex, a meta-analysis found that female caregivers have higher levels of depression and burden as well as lower levels of subjective wellbeing and self-rated health. Women report more problems related to the behavior of the care recipient, provide care for more hours per week, assist in more activities and provide more intimate care to older dependent individuals, but no differences between sexes are found in terms of the use of formal or informal support.³

⁴ Versão submetida a periódico *peer-reviewed*.

According to Schultz and Eden,⁴ caregivers of a dependent older adult must fulfill multiple roles that exert a direct impact on their health and wellbeing. Over time, the complexity of care increases, which is accompanied by an increase in responsibilities. This occurs with greater intensity in the context of family care. Therefore, caregivers subjected to long work weeks are at high risk of becoming ill.

Elder care in Brazil is mainly performed within the home environment, often by relatives and friends in a similar age range as the care recipient.^{5,6} Many caregivers exercise functions for which they have no preparation, which can generate feelings of insecurity, fear and concern, intensifying the degree of burden and leading to frailty. Moreover, older caregivers face the challenges of their own aging, which when added to the demands of providing care, lead to greater vulnerability in comparison to older adults who do not provide care for anyone.⁷ These conditions exert a considerable impact on the quality of life and life expectancy of caregivers.

Despite this greater vulnerability, the literature reports that the mortality rate of caregivers is considerably lower than that of non-caregivers. One study found that the mortality of caregivers and non-caregivers in a six-year period was 7.5% and 9%, respectively.⁸ Another study found that caregivers had a 16.5% lower mortality rate in a seven-year period compared to non-caregivers, refuting the hypothesis that poorer psychological conditions would affect caregivers more, as the effects of these conditions were only found in non-caregiving older adults.⁹

There seems to be a consensus that the mortality rates of caregivers are lower compared to their older non-caregiving peers.⁹ However, the component factors of this theoretical model are not yet clear. The investigation of differences between the two populations may contribute to improving healthcare for both older caregivers and care recipients considering family rearrangements and the increased burden to the family following the death of caregivers and non-caregivers. In an attempt to fill this gap in knowledge, the aim of the present study was to analyze the mortality rates of community-dwelling older caregivers and non-caregivers in a four-year period. A further aim was to analyze the effects of age, sex and schooling in both groups. The hypothesis is that older caregivers have a lower mortality rate than non-caregivers and there are differences among subgroups divided according to age, sex and schooling.

Methods

Design

A longitudinal study with a four-year follow-up was conducted by the Health and Aging Group of the Federal University of São Carlos, Brazil.

Participants

We evaluated community-dwelling older adults registered with primary care centers in the city of São Carlos, state of São Paulo, Brazil. São Carlos is located in the southeastern region of the country and has an estimated population of 221,950 residents, among whom 13% were aged 60 years or older according to the 2010 census.¹⁰

The baseline study was conducted in 2014 and was entitled "Variables Associated to Cognition in Older Caregivers". The participant selection process is described elsewhere¹¹⁻¹³ but a brief description is given here. Community-dwelling older adults (age ≥ 60 years, as defined by the World Health Organization for developing countries) registered with 18 primary care centers (n = 1188) in rural and urban areas of São Carlos were contacted in person and invited to participate in the survey. Individuals with hearing, visual or language limitations that would constitute barriers to the data collection process were excluded. During the home visits, trained researchers identified older persons who were providing care and those who were receiving care. The response rate was 59.1% (total: 702 individuals). The baseline sample comprised 351 older caregivers and 351 non-caregivers.

The follow-up data collection began in April 2018. Among the 351 older caregivers in the baseline study, 22 participants had changed address (including those who went to nursing homes) and could not be contacted for the 2018 wave. Sixty-eight caregivers were lost to follow-up (not located at home after three attempts). Thus, the longitudinal study involved data on 261 caregivers (74.3% of the baseline sample). Among these individuals, 33 deaths were confirmed by primary care services and family members. Among the 351 older non-caregivers in the baseline study, 15 participants had changed address (including those who went to nursing homes) and could not be contacted for the 2018 wave. Fifty-seven participants were lost to follow-up (not located at home after three attempts). Thus, the longitudinal study involved data on 279 non-caregivers (79.5% of the baseline sample).

Among these individuals, 87 deaths were confirmed by primary care services and family members.

This study received approval from the Human Research Ethics Committee of the Federal University of São Carlos (certificate number: 1.123.813/2015). All participants signed a statement of informed consent at baseline and gave consent to participate in future studies. At-home interviews were conducted by trained professionals in the fields of gerontology and nursing.

Variables of interest and assessments

- *Demographic characteristics*: sex (male, female), age (continuous variable and by range [60-69 y; 70-79 y; ≥ 80 y]), schooling (continuous variable and by category [illiterate; 1-4 y; ≥ 5 y]).

- *Basic activities of daily living*: BADL index proposed by Katz et al. composed of six activities: feeding, sphincter control, transferring, hygiene, dressing and bathing. Individuals with one or more limitations regarding these activities were recorded as having "BADL limitation".¹⁴

- *Instrumental activities of daily living*: IADL scale proposed by Lawton and Brody for the determination of the degree of dependence on activities such as performing housework, managing finances, using a telephone, administering medications, traveling, shopping and preparing meals. A perfect score is 21 (complete independence). Individuals with a score ≤ 20 points were recorded as having "IADL limitation".^{15,16}

- *Mortality*: for confirmed cases of death, the date of death was obtained from the primary care services and family members.

Statistical analysis

The Statistical Package for Social Sciences (SPSS software, version 21.0) was used for the data analysis. Descriptive statistics were performed to characterize the sample. Frequency (n), percentage (%), mean and standard deviation (\pm) values were calculated for the

description of the participants at baseline (Table 1) and the prevalence of mortality assessed at follow-up (Table 2).

Two groups were considered: caregivers and non-caregivers. Mean age and schooling were compared using the t-test. Categorical variables (age group [reference: 60-69y], sex [reference: men], schooling [reference: ≥ 5 y], BADL limitation and IADL limitation [reference: independence]) were compared using Pearson's chi-squared (X^2) test. We tested the association between mortality and age (≥ 80 y; 70-79y; 60-69y) sex (female; male) and schooling (illiterate; 1-4y; ≥ 5 y) in each group (caregivers and non-caregivers). Single Cox regression models were run to analyze the effects (hazard ratio [HR] and respective confidence intervals [95%CI]) of factors associated with the event of death among caregivers and non-caregivers (unadjusted column; Table 2). ADL and IADL limitation (reference: independence) were the controlling variables (adjusted column, Table 2).

Figures 1 and 2 were constructed using Prism GraphPad to illustrate the cumulative survival curve in caregivers and non-caregivers (Figure 1) and in each group considering sex (Figure 2). The component "time of event" was described in the overall mean and compared using the t-test. We adopted the 5% significance level ($p \geq 0.05$).

Results

The characteristics of the 261 caregivers and 279 non-caregivers included in the sample are displayed in Table 1.

Table 1. Baseline characteristics of 540 caregivers and non-caregivers from "Variables Associated to Cognition in Older Caregivers" study. São Carlos, Brazil, 2014.

<i>Characteristics</i>	<i>Caregivers</i> <i>n = 261</i> <i>n (%) or mean ± SD</i>	<i>Non-caregivers</i> <i>n = 279</i> <i>n (%) or mean ± SD</i>	<i>Statistics;</i> <i>p-value</i>
Age, y	69.71 ± 6.93	74.27 ± 8.6	T: -6.7; <.001
60-69	144 (55.2)	98 (35.1)	ref
70-79	89 (34.1)	112 (40.1)	X ² : 10.2; .001
80+	28 (10.7)	69 (24.7)	X ² : 26.0; <.001
Men	60 (23.0)	190 (68.1)	X ² : 110.3; <.001
Women	201 (77.0)	89 (31.9)	
Schooling, y	3.59 ± 3.31	3.47 ± 3.80	T: 0.393; .696
Illiterate	54 (20.7)	79 (38.3)	X ² : 1.8; .181
1-4	157 (60.2)	148 (53.0)	X ² : 0; 1
5+	50 (19.2)	48 (17.2)	ref
Missing	-	4 (1.4)	
BADL limitation	34 (13.0)	95 (34.1)	X ² : 32.7; <.001
IADL limitation	153 (58.6)	279 (100)	X ² : 144.1; <.001

BADL = activities of daily living. IADL = instrumental activities of daily living. SD = standard deviation.

Differences in the variables were found between the caregivers and non-caregivers, with the exception of schooling. On average, the non-caregivers were four years older than the caregivers. The "80 years or older" age group was also more prevalent in the group of non-caregivers. Moreover, the group of non-caregivers was composed predominantly of men and had more individuals with limitations regarding both BADL and IADL.

The mortality rate between baseline and follow-up was 12.6% (33 individuals) among the caregivers and 31.2% (87 individuals) among the non-caregivers. Among the confirmed deaths in the group of caregivers, 31 individuals (93.9%) had no limitations regarding BADL, but 23 (69.7%) had some limitation regarding IADL. Nineteen caregivers who died (57.6%)

were women and 20 (60.6%) were 70 years of age or older. Mean age at baseline of the caregivers who died during the follow-up period was 73.8 ± 9 years. Seven of the caregivers who died (21.2%) were illiterate and 20 (60.6%) had between one and four years of schooling. Mean schooling in the group was 4.21 ± 4.41 years. It was possible to determine when death occurred in 24 of the 33 cases. On average, death occurred 2.1 years after the baseline evaluation, occurring within the first two years after baseline in 15 cases (62.5%).

Among the deaths in the group of non-caregivers, all individuals were dependent with regard to IADL and 51 (58.6%) were independent regarding BADL. Thirty-eight non-caregivers (56.3%) were men and 71 (81.6%) were 70 years of age or older. Mean age at baseline of the caregivers who died during the follow-up period was 78.7 ± 9.15 years. Thirty-two (36.8%) were illiterate and 43 (49.4%) had between one and four years of schooling. Mean schooling in the group was 3.34 years. It was possible to determine when death occurred in 57 of the 87 cases. On average, death occurred 2.1 years after the baseline evaluation, occurring within the first two years after baseline in 28 cases (49.1%).

In general, non-caregivers died at a twofold greater proportion compared to the caregivers (Figure 1). The mean time to death after baseline was the same in both groups. Table 2 displays the results of the regression analyses for deaths in the groups of caregivers and non-caregivers. No effects were found for age, sex or schooling. In the group of non-caregivers, the female sex was associated with death when the model was adjusted for BADL and IADL limitations.

Table 2. Association between mortality in four-year period among caregivers and non-caregivers in relation to age, sex and schooling in unadjusted analysis and analysis adjusted for measures of functional independence. São Carlos, 2014-2018.

	<i>n (%) Died</i>		<i>Unadjusted</i>			<i>BADL/IADL-Adjusted</i>		
	<i>n/N</i>	<i>%</i>	<i>HR</i>	<i>95%CI</i>	<i>p</i>	<i>HR</i>	<i>95%CI</i>	<i>p</i>
Age factor (70-79 y)								
Non-caregivers	32/87	36.8	1.5	0.7-3.1	.289	1.5	0.7-3.1	.287
Caregivers	12/33	36.4	1.7	0.6-4.4	.275	1.5	0.5-4.2	.383
Age factor (+80 y)								
Non-caregivers	39/87	44.8	1.6	0.8-3.3	.137	1.7	0.8-3.5	0.121
Caregivers	8/33	24.2	1.2	0.3-3.8	.746	1.3	0.3-4.4	.688
Sex factor (women)								
Non-caregivers	49/87	56.3	1.6	0.9-2.9	.060	1.7	1.0-3.1	.042
Caregivers	14/33	42.4	1.2	0.5-2.7	.654	1.3	0.5-3.2	.537
Schooling factor (Illiterate)								
Non-caregivers	32/86	36.8	1.2	0.5-2.7	.538	1.2	0.6-2.7	.551
Caregivers	7/33	21.2	1.3	0.3-4.6	.696	1.2	0.3-4.7	.749
Schooling factor (1-4 y)								
Non-caregivers	43/86	49.4	1.0	0.5-2.1	.964	0.9	0.4-2.0	.951
Caregivers	20/33	60.6	1.0	0.3-3.2	.946	0.9	0.3-3.1	.961

BADL = basic activities of daily living. IADL = instrumental activities of daily living. HR = hazard ratio.

Figure 1. Cumulative survival for caregivers (n = 24) and non-caregivers (n = 57). São Carlos, 2014-2018.

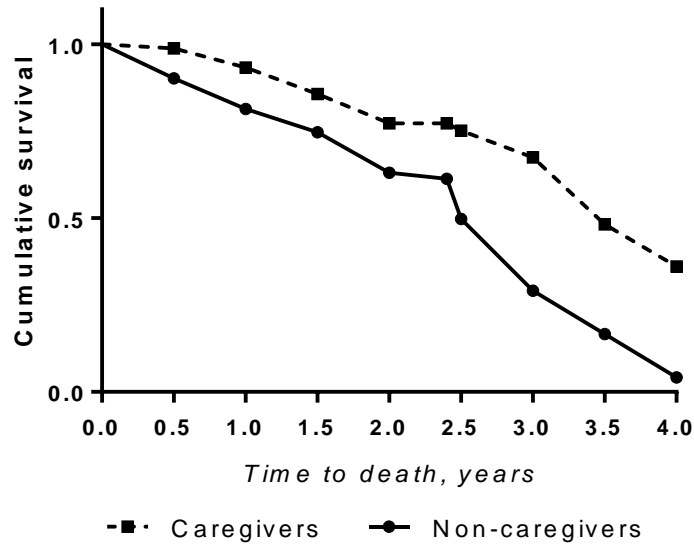
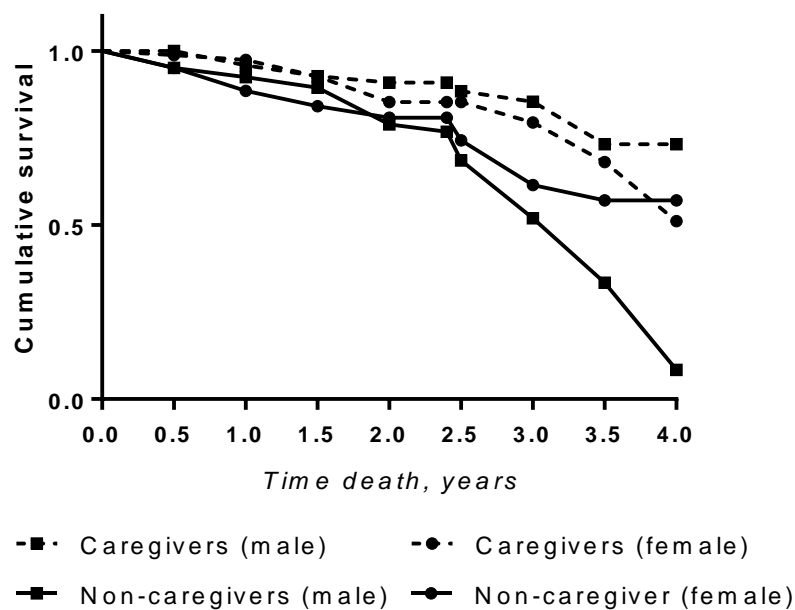


Figure 2. Cumulative survival for caregivers (n = 24) and non-caregivers (n = 57) stratified by sex. São Carlos, 2014-2018.



The female sex was associated with mortality in the group of non-caregivers. Eighty-nine women were in this group, 39 of whom (42.7%) died in the four-year follow-up period.

Among the 190 men in the group of non-caregivers, 49 (25.8%) died in the four-year follow-up period, which is a significantly smaller proportion in comparison to the women. However, time to death was significantly longer among the women (2.4 *versus* 1.8; $p = 0.035$). Thus, male non-caregivers died in a shorter period of time after baseline, as shown by the survival curve in Figure 2.

Discussion

Among the 540 older caregivers and non-caregivers in the 2014 sample, 120 (22.2%) died during the four-year follow-up period. Among these individuals, 33 were caregivers and 87 were care recipients (non-caregivers), demonstrating a higher mortality rate among the non-caregivers. At baseline, the non-caregivers were predominantly men, were older and had more limitations regarding activities of daily living compared to the caregivers. In the group of caregivers, none of the variables evaluated was associated with the occurrence of death. In the group of non-caregivers, however, the female sex was associated with the occurrence of death.

The literature reports that caregivers of older adults are generally in the same age group as the care recipient, although the care recipients are slightly older.^{11,17} Most often, the caregiver is the wife, daughter or daughter-in-law of the care recipient and is at risk in terms of health due to the long hours dedicated to care as well as the occurrence of stress and excessive burden.^{6,18} Nonetheless, providing care for an older adult is a form of social engagement that may prevent feelings of loneliness. Indeed, a lack of social engagement and feelings of isolation are considered risk factors for depression and disability in old age.^{19,20}

In the cross-sectional analysis at baseline, the majority of care recipients were more dependent than the caregivers. This finding is likely due to the recruitment method employed in the study, as the sample was composed of older adults cohabitating with other older adults in a situation in which one provided assistance to the other. The literature also shows that a low degree of functioning often occurs among older adults who live alone. Living alone and not receiving assistance from others has been associated with poor functioning among non-caregivers, as demonstrated in surveys conducted with older adults in Brazil.^{21,22}

The mortality rate was lower in the group of caregivers compared to non-caregivers. The literature emphasizes the need for more specialized care for caregivers. Since the beginning of the century, mortality has been studied as an adverse outcome in caregivers, especially those with excessive burden, and the effect of stress during the course of one's life is an important aspect of the risk of death in old age. The risk of death is lower among caregivers compared to non-caregivers but increases in the occurrence of reports of psychological stress. A previous study reports that feelings of stress during the course of one's life increases the risk of death, with an odds ratio of 1.42 for moderate stress and 1.37 for high stress, independently of the relation to providing care to a dependent older person.²³ In the study, data from 1143 older men showed that the participants with any feelings of stress also had a 50% greater chance of dying after controlling for marital status, schooling, self-rated health, the use of alcoholic beverages and smoking. Being married and a good self-assessment of health had a protective effect, whereas being a smoker and not using alcohol were associated with the risk of mortality.²³

A follow-up study with 375 caregivers of older family members or friends compared to 694 non-caregivers found that the adjusted ratio for the risk of death was 0.74, but caregivers with high levels of stress had an adjusted ratio of 1.81 for mortality in the first three years compared to those with low stress, equaling the risk of mortality found for older non-caregivers. Among caregivers who were spouses with a high level of stress, the ratio of mortality was 1.70 in the first three years, which was the same as the ratio for non-caregivers with a conjugal life.²⁴ Similar results are reported in a five-year study involving 3710 older adults who provided some type of care to a dependent family member, in which more burdened caregivers had a higher risk of mortality compared to those with some care-related burden (HR = 1.55) or no burden (HR = 1.83).¹⁸

A study involving 3075 participants also found a greater risk for death and functional dependence among non-caregivers compared to caregivers. However, caregivers who provided care 24 or more hours per week tended to have higher rates of functional decline after eight years. In the same study, self-declared white caregivers had a 1.5-fold higher mortality rate compared to self-declared black caregivers.²⁵ Another investigation with 3503 caregivers matched with 3503 non-caregivers found different results for subgroups of caregivers. As in other studies, the mortality rate was 18% lower among the caregivers compared to the non-caregivers, but the analyses did not reveal an increase in rates in

subgroups based on ethnicity, sex or time per week dedicated to care. The relationship to the care recipient had an effect; caregivers who were sons/daughters of the care recipient had lower mortality rates.⁸

No longer providing care for a loved one or becoming a caregiver during a follow-up period can alter the odds ratios for death. A 10-year investigation with 1068 older women, 35% of whom were caregivers, found a 38.8% mortality rate for caregivers and 48.7% for non-caregivers. Among the women who were caregivers at baseline, the HR for death was 0.77 (95% CI: 0.62-0.95) and the ratio diminished in the first three years after no longer being in the role of caregiver, but increased to similar levels as those found for non-caregivers in a five-year period (Fredman, Lyons, Cauley, Hochberg, & Applebaum, 2015). There seems to be a consensus in the literature that caregivers have lower mortality rates compared to non-caregiving peers.⁹

Age has been found to be the main factor associated with mortality and older males appear to be more affected by the outcome.^{27,28} These two characteristics were more prevalent in the group of non-caregivers, which may explain the earlier deaths in this group. However, the Cox regression analysis in which time was incorporated showed that older female non-caregivers died at a larger proportion than male non-caregivers. Few studies were found in the literature for the discussion of this outcome. Studies discussing the mortality of women show that they are more susceptible to the outcome due to the occurrence of diseases, such as cardiovascular disease and cancer, as well as functional limitations and lifestyle factors, such as physical inactivity.²⁹⁻³²

The present study has limitations that should be considered. The investigation included all causes of mortality among the participants. Specific causes and previous conditions potentially related to death, such as hospitalization, loss of functioning and institutionalization, were not recorded. Such information would furnish greater detail regarding the profile of mortality among the caregivers and non-caregivers in the present sample. The small number of participants limited the data analysis in terms of considering other aspects of the care context as adjustment variables. However, the study was specific in recruiting caregivers and non-caregivers and had a similar number of participants as those in previous studies that also investigated the mortality of caregivers. The fact that the non-caregivers were older adults who received some type of care may limit the interpretation of

the results. However, the control variables in the regression analysis (basic and instrumental activities of daily living) minimized the effects of this limitation.

The present findings have clinical implications considering the offer of care by older adults to other older adults. Caregivers may be somewhat younger and have greater functional capacity compared to the care recipients, but special attention should be given to those who feel burdened by the care. This situation can compromise mental, cognitive and physical health, making the caregiver as vulnerable as the care recipient. Non-caregivers may be more functionally limited and many, such as female non-caregivers, may be at greater risk of adverse health outcomes, which can exert a negative impact on their wellbeing and the wellbeing of their families.

Conclusion

The mortality rate of older non-caregivers in the four-year follow-up period was twice the rate of older caregivers. At baseline, the caregivers were predominantly women, were younger and had better functional compacity than the non-caregivers. Male non-caregivers had a lower mortality rate, but the time of the occurrence of death in the four-year period was shorter compared to female non-caregivers. The outcomes studied underscore the importance of designing strategies for the management and follow-up of families with older adults considering demographic and care-related characteristics.

References

1. Pinquart M, Sorensen S. Associations of stressors and uplifts of caregiving with caregiver burden and depressive mood: a meta-analysis. *J Gerontol B Psychol Sci Soc Sci.* 2003 Mar;58(2):P112-28.
2. Pinquart M, Sorensen S. Differences between caregivers and noncaregivers in psychological health and physical health: a meta-analysis. *Psychol Aging.* 2003 Jun;18(2):250–67.
3. Pinquart M, Sorensen S. Gender differences in caregiver stressors, social resources, and health: an updated meta-analysis. *J Gerontol B Psychol Sci Soc Sci.* 2006 Jan;61(1):33–45.
4. Schulz R, Eden J. Family Caregiving Roles and Impacts. In: Schulz R, Eden J, editors. *Families Caring for an Aging America* [Internet]. Washington DC: National Academies Press (US); 2016. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK396398/>
5. Santos-Orlandi AA dos, Brito TRP de, Ottaviani AC, Rossetti ES, Zazzetta MS, Grat?o

- ACM, et al. Profile of older adults caring for other older adults in contexts of high social vulnerability. *Esc Anna Nery - Rev Enferm* [Internet]. 2017 [cited 2017 Jun 15];21(1). Available from: <http://www.gnresearch.org/doi/10.5935/1414-8145.20170013>
6. Pavarini SCI, Neri AL, Brigola AG, Ottaviani AC, Souza ÉN, Rossetti ES, et al. Elderly caregivers living in urban, rural and high social vulnerability contexts. *Rev da Esc Enferm*. 2017;
 7. Brigola AG, Barbieri MC, Luchesi BM, Grazziano E da S, Machado RC, Dupas G, et al. Association between depressive syndrome and visual complaints among elderly caregivers. *J Bras Psiquiatr*. 2018;
 8. Roth DL, Haley WE, Hovater M, Perkins M, Wadley VG, Judd S. Family caregiving and all-cause mortality: Findings from a population-based propensity-matched analysis. *Am J Epidemiol*. 2013;178(10):1571–8.
 9. Roth DL, Brown SL, Rhodes JD, Haley WE. Reduced mortality rates among caregivers: Does family caregiving provide a stress-buffering effect? *Psychol Aging*. 2018 Jun;33(4):619–29.
 10. Instituto Brasileiro de Geografia e Estatística. Censo demográfico 2010 [Internet]. 2010. Available from: <http://www.ibge.gov.br/home/estatistica/populacao/censo2010/default.shtm>
 11. Brigola AG, Luchesi BM, Alexandre T da S, Inouye K, Mioshi E, Pavarini SCI. High burden and frailty: association with poor cognitive performance in older caregivers living in rural areas. *Trends psychiatry Psychother*. 2017;39(4):257–63.
 12. Luchesi BM, Alexandre TDS, De Oliveira NA, Brigola AG, Kusumota L, Pavarini SCI, et al. Factors associated with attitudes toward the elderly in a sample of elderly caregivers. *Int Psychogeriatrics*. 2016;28(12).
 13. Pavarini SCI, Brigola AG, Ottaviani AC, Luchesi BM, Souza ÉN, Rossetti ES, et al. Factors associated with cognitive performance in elderly caregivers. *Arq Neuropsiquiatr*. 2018;76(10):685--691.
 14. Katz S, Ford AB, Moskowitz RW, Jackson BA, Jaffe MW. Studies of illness in the aged. The index of ADL: a standardized measure of biological and psychosocial function. *JAMA*. 1963 Sep;185:914–9.
 15. Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental activities of daily living. *Gerontologist*. 1969;9(3):179–86.
 16. Santos RL dos, Virtuoso Júnior JS. Reliability of the Brazilian version of the Scale of Instrumental. *Rev Bras em Promoção Saúde*. 2008;21(4):290–6.
 17. Bierhals CCBK, Santos NO Dos, Fengler FL, Raubustt KD, Forbes DA, Paskulin LMG. Needs of family caregivers in home care for older adults. *Rev Lat Am Enfermagem* [Internet]. 2017 Apr 6;25:e2870–e2870. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/28403338>
 18. Perkins M, Howard VJ, Wadley VG, Crowe M, Safford MM, Haley WE, et al. Caregiving strain and all-cause mortality: Evidence from the REGARDS study. *Journals Gerontol - Ser B Psychol Sci Soc Sci*. 2013;68(4):504–12.
 19. Bandari R, Khankeh HR, Shahboulaghi FM, Ebadi A, Keshtkar AA, Montazeri A. Defining loneliness in older adults: protocol for a systematic review. *Syst Rev* [Internet]. 2019 Jan 17;8(1):26. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/30654846>
 20. Landeiro F, Barrows P, Nuttall Musson E, Gray AM, Leal J. Reducing social isolation and loneliness in older people: a systematic review protocol. *BMJ Open* [Internet]. 2017 May 17;7(5):e013778–e013778. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/28515187>

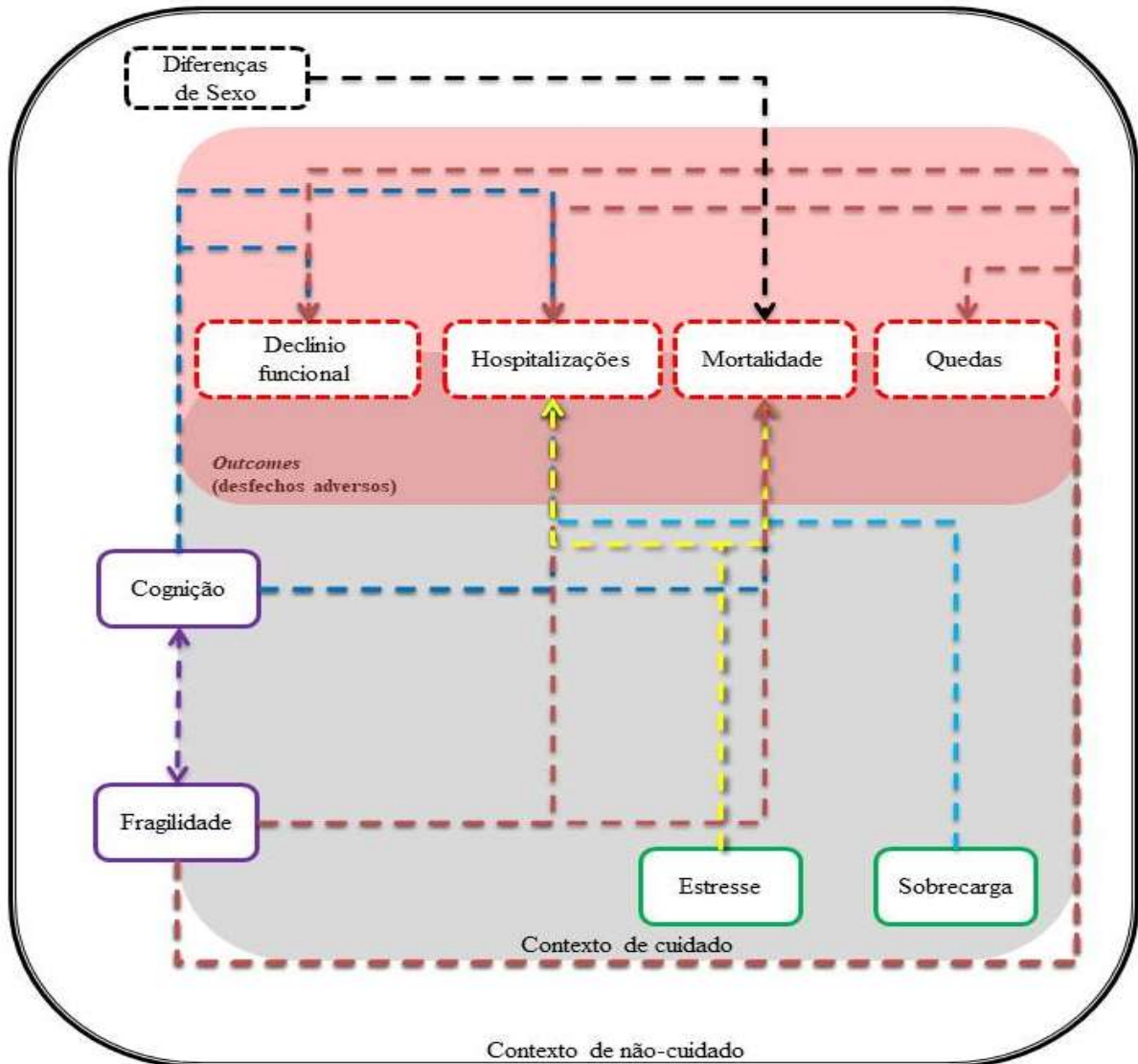
21. Negrini ELD, Nascimento CF do, Silva A da, Antunes JLF. Elderly persons who live alone in Brazil and their lifestyle . Vol. 21, *Revista Brasileira de Geriatria e Gerontologia* . scielo ; 2018. p. 523–31.
22. Elias HC, Marzola TS, Molina NPFM, Assunção LM de, Rodrigues LR, Tavares DM dos S. Relation between family functionality and the household arrangements of the elderly . Vol. 21, *Revista Brasileira de Geriatria e Gerontologia* . scielo ; 2018. p. 562–9.
23. Aldwin CM, Molitor N-T, Spiro A, Levenson MR, Molitor J, Igarashi H. Do Stress Trajectories Predict Mortality in Older Men? Longitudinal Findings from the VA Normative Aging Study. *J Aging Res* [Internet]. 2011;2011:1–10. Available from: <http://www.hindawi.com/journals/jar/2011/896109/>
24. Fredman L, Cauley JA, Hochberg M, Ensrud KE, Doros G. Mortality associated with caregiving, general stress, and caregiving-related stress in elderly women: Results of caregiver-study of osteoporotic fractures. *J Am Geriatr Soc*. 2010;58(5):937–43.
25. Fredman L, Cauley JA, Satterfield S, Simonsick E, Spencer SM, Ayonayon HN, et al. Caregiving, mortality, and mobility decline: the Health, Aging, and Body Composition (Health ABC) Study. *Arch Intern Med*. 2008 Oct;168(19):2154–62.
26. Fredman L, Lyons JG, Cauley JA, Hochberg M, Applebaum KM. The relationship between caregiving and mortality after accounting for time-varying caregiver status and addressing the healthy caregiver hypothesis. *Journals Gerontol - Ser A Biol Sci Med Sci*. 2015;70(9):1163–8.
27. Kara O, Canbaz B, Kizilarslanoglu MC, Arik G, Sumer F, Aycicek GS, et al. Which parameters affect long-term mortality in older adults: is comprehensive geriatric assessment a predictor of mortality? *Aging Clin Exp Res*. 2017 Jun;29(3):509–15.
28. Llamas-Velasco S, Villarejo-Galende A, Contador I, Lora Pablos D, Hernández-Gallego J, Bermejo-Pareja F. Physical activity and long-term mortality risk in older adults: A prospective population based study (NEDICES). *Prev Med reports* [Internet]. 2016 Oct 8;4:546–50. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/27785416>
29. Brown WJ, McLaughlin D, Leung J, McCaul KA, Flicker L, Almeida OP, et al. Physical activity and all-cause mortality in older women and men. *Br J Sports Med*. 2012 Jul;46(9):664–8.
30. Seguin R, Buchner DM, Liu J, Allison M, Manini T, Wang C-Y, et al. Sedentary behavior and mortality in older women: the Women’s Health Initiative. *Am J Prev Med* [Internet]. 2014 Feb;46(2):122–35. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/24439345>
31. Stevens GA, Mathers CD, Beard JR. Global mortality trends and patterns in older women. *Bull World Health Organ* [Internet]. 2013 Sep 1;91(9):630–9. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/24101779>
32. Izano M, Satariano WA, Hiatt RA, Braithwaite D. The impact of functional limitations on long-term outcomes among African-American and white women with breast cancer: a cohort study. *BMJ Open* [Internet]. 2013 Oct 1;3(10):e003232. Available from: <http://bmjopen.bmj.com/content/3/10/e003232.abstract>

4 CONSIDERAÇÕES FINAIS

O primeiro artigo traz evidências sobre a existência da relação do comprometimento cognitivo e da fragilidade em idosos, independente de ofertarem cuidados ou não a um idoso dependente. Da mesma forma, o segundo artigo investiga a relação entre a fragilidade e o comprometimento cognitivo sobre a ocorrência de quedas, hospitalizações e declínio funcional em idosos, entendendo como o acúmulo dessas condições pode modificar os efeitos das associações. O terceiro artigo estudou, apenas em cuidadores, os efeitos da fragilidade, do comprometimento cognitivo, e adicionalmente da sobrecarga do cuidado e dos níveis de estresse em eventos adversos à saúde como hospitalizações e óbito nesses idosos com determinado perfil. O quarto artigo, e último estudo dessa tese, buscou entender o evento de óbito nos grupos distintos de cuidadores e não-cuidadores, analisando as possíveis associações do perfil demográfico, como a idade, sexo e escolaridade.

A figura a seguir sintetiza os achados dos quatro estudos. Trata-se de um diagrama composto por elementos geométricos menores que representam os fatores de risco (roxo e verde) e os eventos adversos à saúde (em vermelho). O plano de fundo cinza compreende as variáveis coletadas entre idosos cuidadores e o plano de fundo branco representa as informações coletadas entre não cuidadores. Dessa forma, o estresse e a sobrecarga foram variáveis coletadas entre idosos cuidadores e a fragilidade e a cognição, e seus domínios avaliados em ambos os contextos. O plano de fundo vermelho transparente remete a área dos fatores de riscos e as linhas tracejadas indicam a direção da associação entre os fatores que indicam riscos aos desfechos adversos à saúde observados entre os quatro estudos.

Figura 2. Síntese dos achados nos quatro estudos conduzidos para a tese de doutorado. São Carlos, 2020.



Nota: Plano de fundo cinza compreende o âmbito dos cuidadores e em branco os não-cuidadores. Em verde e roxo são destacados como os fatores de risco e as caixas em vermelho como os desfechos adversos à saúde. Fonte: elaboração própria.

Os resultados dessa tese, em uma perspectiva geral, corroboram com os achados da literatura quanto à estreita relação entre a cognição e a fragilidade física, e evidencia que essas condições, independentemente ou acumuladamente, podem estar associadas à piora no estado de saúde em geral e a outros desfechos como o declínio funcional, a hospitalização e o óbito em uma população idosa geral. Os resultados com idosos cuidadores, também confirmam as sínteses da revisão de literatura (BRIGOLA *et al.*, 2015; ROBERTSON, SAVVA E KENNY, 2013). O *framework* da síndrome da fragilidade se conecta ao *framework* da cognição por

meio de componentes que podem ser vistos como elementos fisiológicos compartilhados nas duas condições clínicas e, adicionalmente a saúde mental e o bem-estar psicológico, podem contribuir para o mecanismos, minimizando ou maximizando os efeitos da relação entre as duas condições (ROBERTSON; SAVVA; KENNY, 2013). Dessa forma, sugere-se que quanto mais evidentes são os sinais e sintomas dessas condições clínicas na pessoa idosa, maior seria o risco de apresentar desfechos adversos à saúde, entre eles o óbito (BRIGOLA *et al.*, 2015).

O estudo inova ao trazer que essas condições também podem ser tratadas como indicadores de risco à saúde da população idosa que cuida de outros idosos. Além disso, essas condições clínicas inerentes ao envelhecimento podem interagir com o ônus do cuidado, como a sobrecarga e o estresse, e tornarem o idoso cuidador mais vulnerável quando comparado ao idoso não cuidador. Em geral os idosos cuidadores apresentaram em menor frequência os desfechos adversos à saúde comparados aos não cuidadores, entretanto, a taxa de mortalidade dos idosos cuidadores frágeis foi similar aos não cuidadores. Os idosos cuidadores, concomitantemente comprometidos cognitivamente, frágeis e estressados, apresentaram maiores taxas de mortalidade que os idosos não cuidadores.

Em cada estudo realizado nessa tese de doutorado foram destacados os seus limites. Os dados e resultados presentes aqui não podem ser generalizados para outros perfis de cuidadores, como cuidadores não idosos, cuidadores de pessoas com demência, cuidadores de pessoas hospitalizadas ou institucionalizadas e cuidadores formais.

Os estudos que compõem essa tese de doutorado podem contribuir para a atualização de guias e estratégias no que tange a avaliação da saúde da população idosa, com o intuito da identificação dos indivíduos mais frágeis e vulneráveis. O delineamento de políticas públicas e ações, sendo elas de prevenção ou intervenção, podem considerar o perfil da população idosa, buscando entender se ela desempenha o papel de cuidado a um membro familiar. Essas ações podem ter origem na atenção primária à saúde e permear todo o sistema de cuidado à saúde da população idosa no Brasil. Destaca-se que o mapeamento da rede de suporte social da pessoa idosa possui singular importância, pois esta, se sólida e eficaz, proporcionaria aderência e adesão às intervenções.

As profissões atuantes na saúde pública são os elementos-chave para o desenvolvimento dessas ações. Dessa forma, a proteção do Sistema Único de Saúde e a

valorização da gerontologia e geriatria, da enfermagem e das áreas relacionadas ao cuidado em saúde e envelhecimento são critérios indiscutíveis para garantir a saúde de uma das maiores populações mundiais, que envelhece a passos largos e carece de atenção econômica, social, cultural e ética.

Cuidar do cuidador pode mostrar benefícios não somente a um indivíduo, mas a múltiplos indivíduos que compõem a mesma rede social, que incluem a família, a comunidade e os serviços públicos de saúde. Ao cuidar do cuidador, direta e indiretamente, se cuida dos seus receptores de cuidado e de outros membros da família, e potencialmente se reduz a vulnerabilidade da rede de suporte informal de cuidado.

Como conclusão, o comprometimento cognitivo e a fragilidade são determinantes de saúde e fatores de risco para inúmeros eventos adversos à saúde, listados na literatura, e confirmados nos presentes achados em declínio funcional, quedas, hospitalização e óbito em idosos que cuidam e que não cuidam. Existe um consenso de que ofertar cuidado pode ser um fator protetor aos eventos adversos à saúde, todavia quando o cuidado é desgastante psicologicamente, o cuidador se tornaria tão vulnerável quanto aos seus pares não cuidadores. Esse estudo corrobora com a literatura e acrescenta que as condições frequentemente presentes no envelhecimento, como a fragilidade e o comprometimento cognitivo, de forma acumulada, podem tornar o idoso cuidador mais vulnerável em relação aos não cuidadores.

5 REFERÊNCIAS

BEDARD, M. *et al.* The Zarit Burden Interview: a new short version and screening version. **The Gerontologist**, v. 41, n. 5, p. 652–657, out. 2001.

BRIGOLA, A. G. *et al.* Relationship between cognition and frailty in elderly: A systematic review | Relação entre cognição e fragilidade em idosos: Uma revisão sistemática. **Dementia e Neuropsychologia**, v. 9, n. 2, p. 110–119, 2015.

BRIGOLA, A. G. **Perfil cognitivo, fragilidade, sintomas depressivos e sobrecarga de idosos cuidadores em comunidades rurais.** [s.l.] Universidade Federal de São Carlos, 2016.

_____. High burden and frailty: association with poor cognitive performance in older caregivers living in rural areas. **Trends in psychiatry and psychotherapy**, v. 39, n. 4, p. 257–263, 2017.

BRUCKI, S. M. D. *et al.* Sugestões para o uso do mini-exame do estado mental no Brasil. **Arquivos de Neuro-Psiquiatria**, v. 61, n. 3B, p. 777–781, set. 2003.

LOPES, L. O.; CACHIONI, M. Cuidadores familiares de idosos com doença de Alzheimer em uma intervenção psicoeducacional. **Revista Brasileira de Geriatria e Gerontologia**, v. 16, n. 3, p. 443-460, 2013.

CARVALHO, V. A.; CARAMELLI, P. Brazilian adaptation of the Addenbrooke's Cognitive Examination-Revised (ACE-R). **Dementia & Neuropsychologia**, v. 2, p. 212–216, 2007.

COHEN, S.; KAMARCK, T.; MERMELSTEIN, R. A global measure of perceived stress. **Journal of health and social behavior**, v. 24, n. 4, p. 385–396, dez. 1983.

CUNNINGHAM, N. A.; CUNNINGHAM, T. R.; ROBERTSON, J. M. Understanding and measuring the wellbeing of carers of people with dementia. **The Gerontologist**, v. 59, n.5, p. e552-564, 2019.

DODGE, R.; DALY, A.; HUYTON, J.; SANDERS, L. The challenge of defining wellbeing. **International Journal of Wellbeing**, n. 2, p. 222–235, 2012.

FENG, LIANG *et al.* Cognitive Frailty and Adverse Health Outcomes: Findings From the Singapore Longitudinal Ageing Studies (SLAS). **Journal of the American Medical**

Directors Association, v. 18, n. 3, p. 252–258, mar. 2017.

FOLSTEIN, M. F.; FOLSTEIN, S. E.; MCHUGH, P. R. “Mini-mental state”. A practical method for grading the cognitive state of patients for the clinician. **J Psychiatr Res**, v. 12, n. 3, p. 189–198, nov. 1975.

FREDMAN, L. *et al.* Caregiving, mortality, and mobility decline: the Health, Aging, and Body Composition (Health ABC) Study. **Archives of internal medicine**, v. 168, n. 19, p. 2154–2162, out. 2008.

____. Mortality associated with caregiving, general stress, and caregiving-related stress in elderly women: Results of caregiver-study of osteoporotic fractures. **Journal of the American Geriatrics Society**, v. 58, n. 5, p. 937–943, 2010.

____. The relationship between caregiving and mortality after accounting for time-varying caregiver status and addressing the healthy caregiver hypothesis. **Journals of Gerontology - Series A Biological Sciences and Medical Sciences**, v. 70, n. 9, p. 1163–1168, 2015.

FRIED, L. P. *et al.* Frailty in older adults: evidence for a phenotype. **The journals of gerontology. Series A, Biological sciences and medical sciences**, v. 56, n. 3, p. M146-56, mar. 2001.

GRATAO, A. C. M. *et al.* Brief version of Zarit Burden Interview (ZBI) for burden assessment in older caregivers. **Dementia & neuropsychologia**, v. 13, n. 1, p. 122–129, 2019.

JOHN, P. D. *et al.* The cumulative effect of frailty and cognition on mortality – results of a prospective cohort study. **International Psychogeriatrics**, v. 29, n. 04, p. 535–543, 2017.

KATZ, S. *et al.* Studies of illness in the aged. The index of ADL: a standardized measure of biological and psychosocial function. **JAMA**, v. 185, p. 914–919, set. 1963.

LAWTON, M. P.; BRODY, E. M. Assessment of older people: self-maintaining and instrumental activities of daily living. **The Gerontologist**, v. 9, n. 3, p. 179–186, 1969.

LEE, Y., KIM, J., CHON, D. *et al.* The effects of frailty and cognitive impairment on 3-year mortality in older adults. **Maturitas**, v.107, p. 50-55, 2018.

LINO, V. T. S. *et al.* Adaptação transcultural da Escala de Independência em Atividades da

Vida Diária (Escala de Katz). **Cadernos de Saúde Pública**, v. 24, n. 1, p. 103–112, jan. 2008.

LUCHESE, B. M. *et al.* The evaluation of perceived stress and associated factors in elderly caregivers. **Archives of Gerontology and Geriatrics**, v. 67, p. 7–13, 2016.

LUFT, C. D. B. *et al.* Versão brasileira da Escala de Estresse Percebido: tradução e validação para idosos. **Revista de Saúde Pública**, v. 41, n. 4, p. 606–615, ago. 2007.

MIOSHI, E. *et al.* The Addenbrooke's Cognitive Examination Revised (ACE-R): a brief cognitive test battery for dementia screening. **International journal of geriatric psychiatry**, v. 21, n. 11, p. 1078–1085, nov. 2006.

MORLEY, J. E. *et al.* Frailty consensus: a call to action. **Journal of the American Medical Directors Association**, v. 14, n. 6, p. 392–397, jun. 2013.

PAVARINI, S. C. I. , NERI, A. L., BRIGOLA, A. G. *et al.* Elderly caregivers living in urban, rural and high social vulnerability contexts. **Revista da Escola de Enfermagem da USP**, n. 51, e03254, 2017.

PAVARINI, S. C. I. , BRIGOLA, A. G., OTTAVIANI, A. C. *et al.* Factors associated with cognitive performance in elderly caregivers. **Arquivos de Neuro-Psiquiatria**, v.76, n.10, p. 685-691, 2018.

PERKINS, M. *et al.* Caregiving strain and all-cause mortality: Evidence from the REGARDS study. **Journals of Gerontology - Series B Psychological Sciences and Social Sciences**, v. 68, n. 4, p. 504–512, 2013.

RADLOFF, L. S. The CES-D Scale: a self report depression scale for research in the general population. **Applied Psychological Measurement**, v. 1, n. 3, p. 385–401, 1977.

ROBERTSON, D. A.; SAVVA, G. M.; KENNY, R. A. Frailty and cognitive impairment--a review of the evidence and causal mechanisms. **Ageing research reviews**, v. 12, n. 4, p. 840–851, set. 2013.

SANTOS, R. L. DOS; VIRTUOSO JÚNIOR, J. S. Reliability of the Brazilian version of the Scale of Instrumental. **Revista Brasileira em Promoção de Saúde**, v. 21, n. 4, p. 290–296, 2008.

THOMPSON, C. A.; SPILSBURY, K.; HALL, J.; BIRKS, Y.; BARNES, C.; ADAMSON,

J. Systematic review of information and support interventions for caregivers of people with dementia. **BMC Geriatrics**, n.7, 2007.

ZARIT, S. H.; REEVER, K. E.; BACH-PETERSON, J. Relatives of the impaired elderly: correlates of feelings of burden. **Gerontologist**, v. 20, n. 6, p. 649–655, dez. 1980.

GLOSSÁRIO

Acompanhamento (*follow-up*): segunda e última coleta de dados e avaliação das informações, ocorrida em 2018 no âmbito do estudo “Acompanhamento de idosos cuidadores da atenção básica”.

Baseline: primeira coleta de dados e avaliação das informações, ocorrida em 2014 no âmbito do estudo “Variáveis associadas à cognição de idosos cuidadores”.

Condições acumuladas: presença concomitante ou apresentar ao mesmo tempo as condições clínicas e do cuidado (comprometimento cognitivo, fragilidade, sobrecarga do cuidado e níveis de estresse percebido)

Desfechos adversos à saúde: nessa tese de doutorado deve ser entendido como eventos de quedas no último ano à data da entrevista do *follow-up*, admissão hospitalar no último ano à data da entrevista do *follow-up*, declínio funcional mensurado na *baseline* e no *follow-up*, e casos confirmados de óbito.

Efeitos aditivos/adicionados (efeitos cumulados/acumulados): associações observadas quando as condições clínicas e do cuidado (comprometimento cognitivo, fragilidade, sobrecarga do cuidado e níveis de estresse percebido) estavam presentes concomitantemente do participante.

Efeitos cumulados/acumulados (efeitos aditivos/adicionados): associações observadas quando as condições clínicas e do cuidado (comprometimento cognitivo, fragilidade, sobrecarga do cuidado e níveis de estresse percebido) estavam presentes concomitantemente do participante.

Eventos adversos à saúde: nessa tese de doutorado devem ser entendidos como eventos de quedas no último ano à data da entrevista do *follow-up*, admissão hospitalar no último ano à data da entrevista do *follow-up*, declínio funcional mensurado na *baseline* e no *follow-up*, e casos confirmados de óbito durante o acompanhamento.

Follow-up (acompanhamento): segunda e última coleta de dados e avaliação das informações, ocorrida em 2018 no âmbito do estudo “Acompanhamento de idosos cuidadores da atenção básica”.

Idosos cuidadores: pessoas idosas identificadas na *baseline* enquanto responsáveis pelo

cuidado de não-cuidadores.

Idosos não-cuidadores: pessoas idosas identificadas na *baseline* enquanto receptoras de cuidado prestado pelos idosos cuidadores.

Idosos receptores de cuidado: pessoas idosas identificadas na *baseline* enquanto receptoras de cuidado prestado pelos idosos cuidadores.

Outcomes: nessa tese de doutorado devem ser entendidos como eventos de quedas no último ano à data da entrevista do *follow-up*, admissão hospitalar no último ano à data da entrevista do *follow-up*, declínio funcional mensurado na *baseline* e no *follow-up*, e casos confirmados de óbito durante o acompanhamento.

APÊNDICE A. QUESTIONÁRIO SOCIODEMOGRÁFICO-2014

<p>Sexo: (1) Masculino (2) Feminino</p>
<p>Data de Nascimento: ____/____/____ (____ anos)</p>
<p>Estado Civil: (1) Casado (a) ou vive com companheiro(a) (2) Solteiro (a) (3) Divorciado/ separado/ desquitado (4) Viúvo (99) NR</p>
<p>Trabalha atualmente: (1) Sim O que faz? _____ (0) Não (99) NR</p>
<p>Aposentado ou pensionista: (1) Sim (2) Não (99) NR</p>
<p>Escolaridade: Número de anos de estudo: _____ anos (1) Nunca foi à escola (nunca chegou a concluir a 1ª série primária ou o curso de alfabetização de adultos) (2) Curso de alfabetização de adultos (3) Primário (atual nível fundamental, 1ª a 4ª série) (4) Ginásio (atual nível fundamental, 5ª a 8ª série) (5) Científico, clássico (atuais curso colegial ou normal, curso de magistério, curso técnico) (6) Curso superior (7) Pós-graduação, com obtenção do título de Mestre ou Doutor (99) NR</p>
<p>Raça/ Cor: (1) Branca (2) Preta (3) Mulata/ cabocla/ parda (4) Indígena (5) Amarela/ oriental (99) NR</p>
<p>Renda do cuidador (em reais): _____ (99) NR</p> <p>Renda familiar mensal (em reais): _____ (99) NR</p> <p>Considera a renda suficiente? (1) Sim (0) Não (99) NR</p>
<p>Possui plano particular de saúde? (1) Sim (0) Não (99) NR</p>
<p>Número de pessoas que moram na casa: _____ (99) NR</p> <p>Número de filhos: _____ (99) NR</p>

Com quem mora?	Sim	Não	NR
Marido/ mulher/ companheiro	(1)	(0)	(99)
Filhos/ enteados	(1)	(0)	(99)
Netos	(1)	(0)	(99)
Bisnetos	(1)	(0)	(99)
Outros parentes	(1)	(0)	(99)
Outros (amigos, empregado)	(1)	(0)	(99)

É proprietário de sua residência?	(1) Sim
	(0) Não
	(99) NR

APÊNDICE B. CARACTERIZAÇÃO DO CUIDADO

<p>O Sr(a) está cuidando do seu(a): (1) Cônjuge (2) Pai/mãe (3) Sogro/sogra (4) Irmão/irmã (5) Outro (especificar): _____</p>
<p>Há quanto tempo (meses) o Sr(a) é o cuidador do idoso(a)? _____</p> <p>Quantas horas por dia o Sr(a) se dedica ao cuidado do idoso(a)? _____ horas</p> <p>Quantos dias na semana o Sr(a) se dedica ao cuidado do idoso(a)? _____ dias</p> <p>Quantos dias no final de semana o Sr(a) se dedica ao cuidado do idoso(a)? _____ dias</p>

<p>O Sr(a) recebe ajuda:</p> <p>Material/ financeira (1) Sim (0) Não (99) NR Afetiva/emocional (1) Sim (0) Não (99) NR</p>
<p>O Sr(a) recebe ajuda de entidades para o cuidado do idoso(a)?</p> <p>Grupos religiosos/ Igreja/ Voluntariado (1) Sim (0) Não (99) NR Instituições de saúde. (1) Sim (0) Não (99) NR Serviço de assistência social. (1) Sim (0) Não (99) NR</p>

APÊNDICE C. CARACTERIZAÇÃO SÓCIODEMOGRÁFICA DO IDOSO

Sexo: (1) Masculino (2) Feminino
Data de Nascimento: ____/____/____ (____ anos)
Estado Civil: (1) Casado (a) ou vive com companheiro (a) (2) Solteiro (a) (3) Divorciado/ separado/ desquitado (4) Viúvo (99) NR
Trabalha atualmente: (1) Sim O que faz? _____ (1) Não (99) NR
É aposentado ou pensionista: (1) Sim (0) Não (99) NR
Escolaridade: Número de anos de estudo: _____ anos (1) Nunca foi à escola (nunca chegou a concluir a 1ª série primária ou o curso de alfabetização de adultos) (2) Curso de alfabetização de adultos (3) Primário (atual nível fundamental, 1ª a 4ª série) (4) Ginásio (atual nível fundamental, 5ª a 8ª série) (5) Científico, clássico (atuais curso colegial ou normal, curso de magistério, curso técnico) (6) Curso superior (7) Pós-graduação, com obtenção do título de Mestre ou Doutor (99) NR
Raça/ Cor: (1) Branca (2) Preta (3) Mulata/ cabocla/ parda (4) Indígena (5) Amarela/ oriental (99) NR

APÊNDICE D. QUESTIONÁRIO AVALIAÇÃO DOS *OUTCOMES*-2018

Código/Número: _____ (0)Cuidador (1)Idoso

Nome: _____ Idade: _____

Quedas

Caiu nos últimos doze meses? (0)Não (1)Sim Quantas vezes: _____

Hospitalizações/internações

Hospitalizou nos últimos doze meses? (0)Não (1)Sim Quantas vezes: _____

Total de dias: _____

Hábitos de vida

Fuma? (0)Não (1)Sim

Uso de bebidas alcoólicas? (0)Não (1)Sim

Prática de atividades físicas? (1)Não (0)Sim

ANEXO A. AUTORIZAÇÃO DA SECRETARIA MUNICIPAL

**Prefeitura Municipal de São Carlos**
Secretaria Municipal de SaúdeRua São Joaquim, 1233 - Centro
CEP: 13560-300 – Fone (16) 3362-1350**PARECER Nº 21/2015**

Trata-se de solicitação de autorização para o desenvolvimento de projeto de pesquisa intitulado: *“Acompanhamento de idosos cuidadores na Atenção Básica”*, a ser desenvolvido pelo Grupo de Pesquisa Saúde e Envelhecimento, sob orientação e coordenação da Profª Drª Sofia Cristina Iost Pavarini, docente do Departamento de Gerontologia da UFSCar, tendo como objetivo geral analisar a relação da cognição e variáveis associadas de idosos que cuidam de outros idosos e que estão cadastrados nas unidades de Saúde da Família do Município de São Carlos.

Considerando que a metodologia proposta apresenta mínimo risco aos participantes, visto que serão utilizados instrumentos de avaliação (entrevista e testes cognitivos); vale ressaltar o risco de desconforto pela participação, desta forma deverá ser dada liberdade de escolha aos sujeitos da pesquisa, em não participarem do estudo ou desistirem de participar a qualquer momento; bem como as atividades serem imediatamente suspensas, caso se perceba riscos ou danos à sua pessoa, não previstos nos TCLE.

Os pesquisadores devem garantir confidencialidade e privacidade dos dados, preservação absoluta do anonimato dos participantes e do ambiente de pesquisa, explicitando os objetivos e finalidade deste estudo.

Considerando que os resultados da respectiva pesquisa certamente contribuirão para o fortalecimento das ações que objetivam a construção da Rede Saúde Escola em nosso município, esta Secretaria nada tem a opor e faz as seguintes considerações:

- Considerando que o Projeto apresentado aponta que a coleta dos dados será realizada junto aos cuidadores em domicílio e eventualmente nas USF durante um período de 2 anos a partir de março de 2016; caso haja necessidade de utilização dos espaços das Unidades de Saúde para o desenvolvimento de alguma das etapas do trabalho, as atividades deverão ser pactuadas junto às equipes, de forma a não causar prejuízos ao cotidiano do serviço;
- O contato e formalização do convite aos sujeitos da pesquisa, assim como a aplicação dos instrumentos para a coleta de dados, deverão ser realizados pelos pesquisadores, sem qualquer ônus para este serviço;
- Os pesquisadores deverão fazer contato prévio com as Unidades para acompanhamento dos ACS nas visitas, e se apresentarem a um dos membros da gestão da equipe portando cópia deste parecer;
- O trabalho de campo deste Projeto somente poderá ser iniciado após Parecer favorável do Comitê de Ética em Pesquisa e com a assinatura do Termo de Consentimento Livre e Esclarecido pelos participantes e,
- Após a conclusão do projeto os resultados deverão ser enviados para que possamos socializar com os demais profissionais da Secretaria Municipal de Saúde.

São Carlos, 22 de Maio de 2015.


Marcus Alexandre Petrilli
Secretário Municipal de Saúde

ANEXO B. PARECER DO COMITÊ DE ÉTICA EM PESQUISAS

UNIVERSIDADE FEDERAL DE
SÃO CARLOS/UFSCAR



PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Acompanhamento de idosos cuidadores na Atenção Básica

Pesquisador: Sofia Cristina Iost Pavarini

Área Temática:

Versão: 1

CAAE: 46431315.3.0000.5504

Instituição Proponente: Universidade Federal de São Carlos/UFSCar

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 1.123.813

Data da Relatoria: 14/07/2015

Apresentação do Projeto:

Trata-se de um estudo longitudinal de caráter correlacional. A amostra será composta por um grupo controle, composto por idosos não cuidadores e por três grupos de idosos cuidadores, os quais terão a avaliação do processamento cognitivo diferentes, sendo um por processamento auditivo, um processamento visual figuras simples e um processamento visual reconhecimento de faces. Serão utilizados instrumentos para a coleta

de dados sobre: cognição, fragilidade, desempenho nas atividades de vida diária, sobrecarga, sintomas depressivos, dor e funcionalidade familiar.

Objetivo da Pesquisa:

Objetivo Primário:

Analisar as variáveis associadas a cognição de idosos que cuidam de outros idosos e que estão cadastrados nas unidades de Saúde da Família do Município de São Carlos.

Objetivo Secundário:

Caracterizar o perfil dos idosos cuidadores segundo suas características sociodemográficas, de cuidado e avaliação da saúde; Comparar o

processamento cognitivo de idosos cuidadores ao longo de dois anos; Avaliar o desempenho cognitivo, funcionalidade, sobrecarga e sintomas depressivos dos cuidadores ao longo de dois anos; Analisar a associação entre o processamento cognitivo e perfil cognitivo, com sobrecarga,

Endereço: WASHINGTON LUIZ KM 235

Bairro: JARDIM GUANABARA

CEP: 13.565-905

UF: SP

Município: SAO CARLOS

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E-mail: cephumanos@ufscar.br

UNIVERSIDADE FEDERAL DE
SÃO CARLOS/UFSCAR



Continuação do Parecer: 1.123.813

depressão, funcionalidade dos cuidadores, e com as variáveis relacionadas ao contexto do cuidado.

Avaliação dos Riscos e Benefícios:

Riscos:

Ao responder as perguntas os participantes poderão sentir cansaço ou desconforto pelo tempo gasto com os instrumentos de avaliação ou relembrar algumas sensações diante das perguntas. Se isto ocorrer, o entrevistado poderá interromper a entrevista e retirar seu consentimento ou retomar em outro momento se assim o desejar.

Benefícios:

Os benefícios para os integrantes da pesquisas são indiretos pois ajudarão a entender a situação do cuidado ao idoso pelo familiar cuidador que também é idosos. Também podemos identificar alguns sintomas como alteração de memória ou sinais de depressão que, caso isso ocorra, o entrevista será imediatamente encaminhado a equipe de Saúde da Família para avaliação mais aprofundada de sua saúde.

Os riscos e benefícios foram adequadamente descritos.

Comentários e Considerações sobre a Pesquisa:

A pesquisa é relevante, riscos e benefícios foram adequadamente descritos.

Considerações sobre os Termos de apresentação obrigatória:

- O TCLE contém todas as informações necessárias aos participantes da pesquisa.

- O Termo de Autorização da instituição em que serão selecionados os participantes da pesquisa está adequado.

Recomendações:

Não há recomendações.

Conclusões ou Pendências e Lista de Inadequações:

Não há pendências ou inadequações.

Situação do Parecer:

Aprovado

Necessita Apreciação da CONEP:

Não

Endereço: WASHINGTON LUIZ KM 235

Bairro: JARDIM GUANABARA

CEP: 13.565-905

UF: SP

Município: SAO CARLOS

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E-mail: cephumanos@ufscar.br

UNIVERSIDADE FEDERAL DE
SÃO CARLOS/UFSCAR



Continuação do Parecer: 1.123.813

Considerações Finais a critério do CEP:

SAO CARLOS, 25 de Junho de 2015

Assinado por:
Ricardo Carneiro Borra
(Coordenador)

Endereço: WASHINGTON LUIZ KM 235

Bairro: JARDIM GUANABARA

CEP: 13.565-905

UF: SP **Município:** SAO CARLOS

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**ANEXO C. ESCALA DE INDEPENDENCIA EM ATIVIDADES DA VIDA DIÁRIA –
KATZ**

ATIVIDADES Pontos (1 ou 0)	INDEPENDÊNCIA (1 ponto) SEM supervisão, orientação ou assistência pessoal	DEPENDÊNCIA (0 pontos) COM supervisão, orientação ou assistência pessoal ou cuidado integral
Banhar-se Pontos: ____	(1 ponto) Banha-se completamente ou necessita de auxílio somente para lavar uma parte do corpo como as costas, genitais ou uma extremidade incapacitada	(0 pontos) Necessita de ajuda para banhar-se em mais de uma parte do corpo, entrar e sair do chuveiro ou banheira ou requer assistência total no banho
Vestir-se Pontos: ____	(1 ponto) Pega as roupas do armário e veste as roupas íntimas, externas e cintos. Pode receber ajuda para amarrar os sapatos	(0 pontos) Necessita de ajuda para vestir-se ou necessita ser completamente vestido
Ir ao banheiro Pontos: ____	(1 ponto) Dirigi-se ao banheiro, entra e sai do mesmo, arruma suas próprias roupas, limpa a área genital sem ajuda	(0 pontos) Necessita de ajuda para ir ao banheiro, limpar-se ou usa urinol ou comadre
Transferência Pontos: ____	(1 ponto) Senta-se/deita-se e levanta-se da cama ou cadeira sem ajuda. Equipamentos mecânicos de ajuda são aceitáveis	(0 pontos) Necessita de ajuda para sentar-se/deitar-se e levantar-se da cama ou cadeira
Continência Pontos: ____	(1 ponto) Tem completo controle sobre suas eliminações (urinar e evacuar)	(0 pontos) É parcial ou totalmente incontinente do intestino ou bexiga
Alimentação Pontos: ____	(1 ponto) Leva a comida do prato à boca sem ajuda. Preparação da comida pode ser feita por outra pessoa	(0 pontos) Necessita de ajuda parcial ou total com a alimentação ou requer alimentação parenteral

**ANEXO D. ESCALA DE ATIVIDADES INSTRUMENTAIS DA VIDA DIÁRIA DE
LAWTON&BRODY**

Resultado: _____/21		
	(1)	Dependência total (7 ou menos pontos)
	(2)	Dependência parcial (entre 7 e 21 pontos)
	(3)	Independência (21 pontos)

<p>Em relação ao uso do telefone 3 Recebe e faz ligações sem assistência 2 Necessita de assistência para realizar ligações telefônicas 1 Não tem o hábito ou é incapaz de usar o telefone</p>
<p>Em relação às viagens 3 Realiza viagens sozinho 2 Somente viaja quando tem companhia 1 Não tem o hábito ou é incapaz de viajar</p>
<p>Em relação à realização de compras 3 Realiza compras, quando é fornecido o transporte 2 Somente faz compra quando tem companhia 1 Não tem hábito ou é incapaz de realizar compras</p>
<p>Em relação ao preparo de refeições 3 Planeja e cozinha as refeições completas 2 Prepara somente refeições pequenas ou quando recebe ajuda 1 Não tem o hábito ou é incapaz de preparar refeições</p>
<p>Em relação ao trabalho doméstico 3 Realiza tarefas pesadas 2 Realiza tarefas leves, necessitando de ajuda nas pesadas 1 Não tem o hábito ou é incapaz de realizar trabalho doméstico</p>
<p>Em relação ao uso de medicamentos 3 Faz uso de medicamento sem assistência 2 Necessita de lembretes ou de assistência 1 É incapaz de controlar sozinho o uso de medicamentos</p>
<p>Em relação ao manejo do dinheiro 3 Preenche cheque e a as contas sem auxílio 2 Necessita de assistência para o uso de cheque e contas 1 Não tem o hábito de lidar com o dinheiro ou é incapaz de manusear dinheiro e contas</p>

ANEXO E. EXAME COGNITIVO DE ADDENBROOKE – REVISADO (ACE-R)

ORIENTAÇÃO							[Escore 0-5] <input type="text"/>	O R I E N T A Ç Ã O
➤ Perguntar: Qual é	Dia da semana	O dia do mês	O mês	O ano	A hora aproximada			
➤ Perguntar: Qual é	Local específico	Local genérico	Bairro ou rua próxima	Cidade	Estado	[Escore 0-5] <input type="text"/>		
REGISTRO							[Escore 0-3] <input type="text"/>	
➤ Diga: "Eu vou dizer três palavras e você irá repeti-las a seguir: carro, vaso, tijolo" (Dar um ponto para cada palavra repetida acertadamente na 1ª vez, embora possa repeti-las até três vezes para o aprendizado, se houver erros). Use palavras não relacionadas. Registre o número de tentativas:								
ATENÇÃO & CONCENTRAÇÃO							[Escore 0-5] <input type="text"/>	
➤ Subtração de setes seriadamente (100-7, 93-7, 86-7, 79-7, 72-7, 65). Considere um ponto para cada resultado correto. Se houver erro, corrija-o e prossiga. Considere correto se o examinando espontaneamente se corrigir. Pare após 5 subtrações (93, 86, 79, 72, 65):								
MEMÓRIA - Recordação							[Escore 0-3] <input type="text"/>	
➤ Pergunte quais as palavras que o indivíduo acabara de repetir. Dar um ponto para cada.								
MEMÓRIA - Memória anterógrada							[Escore 0-7] <input type="text"/>	
➤ Diga: " Eu vou lhe dar um nome e um endereço e eu gostaria que você repetisse depois de mim. Nós vamos fazer isso três vezes, assim você terá a possibilidade de aprendê-los. Eu vou lhe perguntar mais tarde." Pontuar apenas a terceira tentativa:								
	1ª Tentativa	2ª Tentativa	3ª Tentativa					
Renato Moreira	.....	.....	.....		
Rua Bela Vista 73	.....	.....	.....		
Santarém	.....	.....	.....		
Pará	.....	.....	.....		
MEMÓRIA - Memória Retrógrada							[Escore 0-4] <input type="text"/>	
➤ Nome do atual presidente da República..... ➤ Nome do presidente que construiu Brasília..... ➤ Nome do presidente dos EUA..... ➤ Nome do presidente dos EUA que foi assassinado nos anos 60.....								

FLUÊNCIA VERBAL – Letra “P” e Animais**➤ Letras**

Diga: " Eu vou lhe dizer uma letra do alfabeto e eu gostaria que você dissesse o maior número de palavras que puder começando com a letra, mas não diga nomes de pessoas ou lugares. Você está pronto(a) ? Você tem um minuto e a letra é "P".

[Escore 0-7]

0-15 seg	16-30 seg	31-45 seg	46-60 seg
----------	-----------	-----------	-----------

>17	7
14-17	6
11-13	5
8-10	4
6-7	3
4-5	2
2-3	1
<2	0
total	acertos

➤ Animais

Diga: "Agora você poderia dizer o maior número de animais que conseguir, começando com qualquer letra?"

[Escore 0-7]

0-15 seg	16-30 seg	31-45 seg	46-60 seg
----------	-----------	-----------	-----------

>21	7
17-21	6
14-16	5
11-13	4
9-10	3
7-8	2
5-6	1
<5	0
total	acertos

LINGUAGEM - Compreensão

- Mostrar a instrução escrita e pedir ao indivíduo para fazer o que está sendo mandado (não auxilie se ele pedir ajuda ou se só ler a frase sem realizar o comando):

[Escore 0-1]

Feche os olhos

➤ Comando :

" Pegue este papel com a mão direita, dobre-o ao meio e coloque -o no chão."

Dar um ponto para cada acerto. Se o indivíduo pedir ajuda no meio da tarefa não dê dicas.






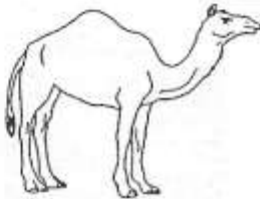

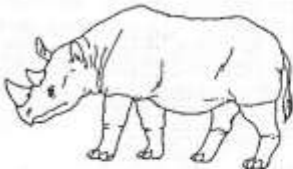



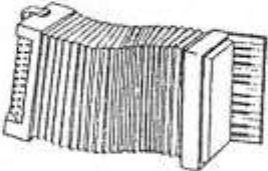
[Escore 0-3]

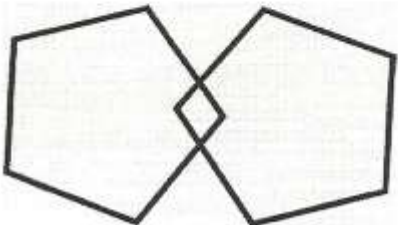
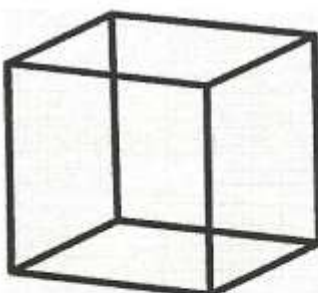
LINGUAGEM - Escrita

- Peça ao indivíduo para escrever uma frase: Se não compreender o significado, ajude com: *alguma frase que tenha começo, meio e fim; alguma coisa que aconteceu hoje; alguma coisa que queira dizer.* Para a correção não são considerados erros gramaticais ou ortográficos. Dar um ponto.

[Escore 0-1]

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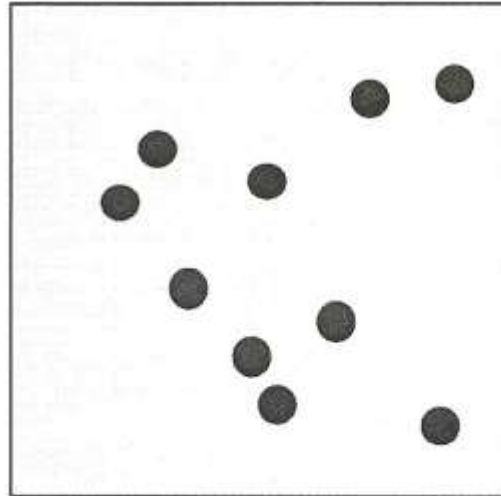
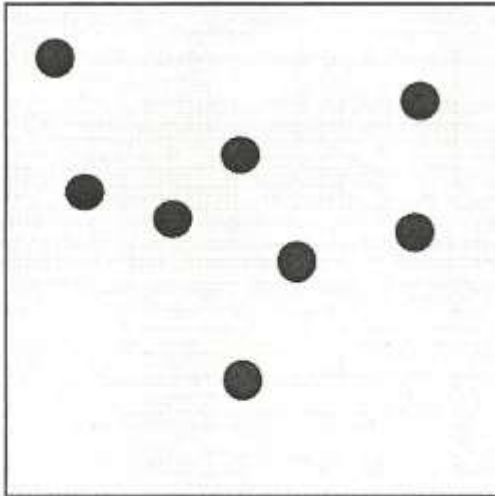
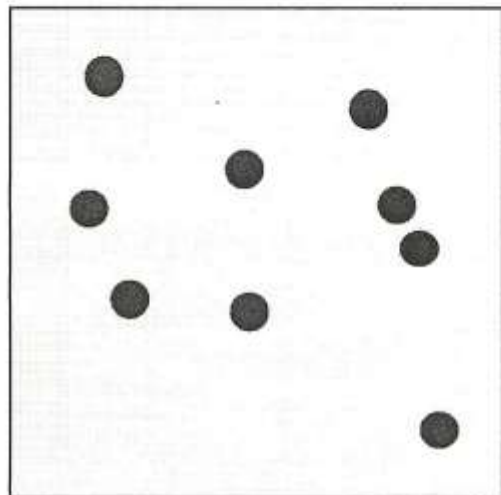
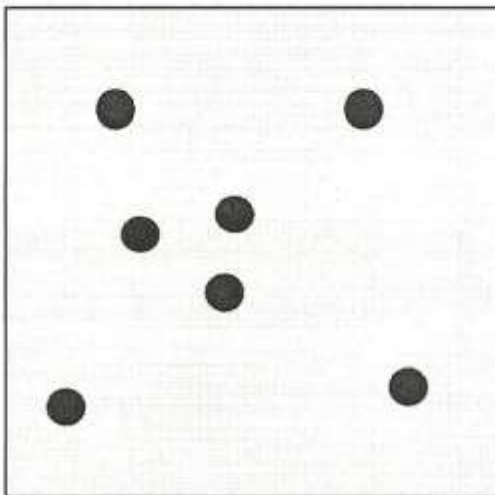
L I N G U A G E M - Repetição			
<p>➤ Peça ao indivíduo para repetir: "hipopótamo"; "excentricidade"; "ininteligível"; "estatístico". Diga uma palavra por vez e peça ao indivíduo para repetir imediatamente depois de você. Pontue 2, se todas forem corretas; 1, se 3 forem corretas; 0, se 2 ou menos forem corretas.</p>	[Escore 0-2] <input type="text"/>		
<p>➤ Peça ao indivíduo que repita: "Acima, além e abaixo"</p>	[Escore 0-1] <input type="text"/>		
<p>➤ Peça ao indivíduo que repita: "Nem aqui, nem ali, nem lá"</p>	[Escore 0-1] <input type="text"/>		
L I N G U A G E M - Nomeação			
<p>➤ Peça ao indivíduo para nomear as figuras a seguir:</p>	[Escore 0-2] caneta + relógio <input type="text"/>	L I N G U A G E M	
 <input type="text"/>  <input type="text"/>  <input type="text"/>	[Escore 0-10] <input type="text"/>		
 <input type="text"/>  <input type="text"/>  <input type="text"/>			
 <input type="text"/>  <input type="text"/>  <input type="text"/>			
 <input type="text"/>  <input type="text"/>  <input type="text"/>			
L I N G U A G E M - Compreensão			
<p>➤ Utilizando as figuras acima, peça ao indivíduo para:</p> <ul style="list-style-type: none"> • Apontar para aquela que está associada com a monarquia _____ • Apontar para aquela que é encontrada no Pantanal _____ • Apontar para aquela que é encontrada na Antártica _____ • Apontar para aquela que tem uma relação náutica _____ 	[Escore 0-4] <input type="text"/>		

LINGUAGEM - Leitura			L I N G U A G E M	
<p>➤ Peça ao indivíduo para ler as seguintes palavras: [Pontuar com 1, se todas estiverem corretas]</p> <p style="text-align: center;">táxi testa saxofone fixar ballet</p>	[Escore 0-1] <input type="text"/>			
HABILIDADES VISUAIS-ESPACIAIS				V I S U A L - E S P A C I A L
<p>➤ Pentágonos sobrepostos: Peça ao indivíduo para copiar o desenho e para fazer o melhor possível.</p>	[Escore 0-1] <input type="text"/> <input type="text"/>			
				
<p>➤ Cubo: Peça ao indivíduo para copiar este desenho (para pontuar, veja guia de instruções)</p>	[Escore 0-2] <input type="text"/>			
				
<p>➤ Relógio: Peça ao indivíduo para desenhar o mostrador de um relógio com os números dentro e os ponteiros marcando 5:10 h. (para pontuar veja o manual de instruções: círculo = 1; números = 2; ponteiros = 2, se todos corretos)</p>	[Escore 0-5] <input type="text"/>			




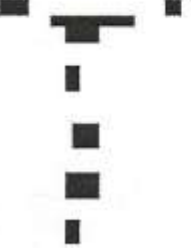
HABILIDADES PERCEPTIVAS

➤ Peça ao indivíduo para contar os pontos sem apontá-los.

[Escore 0-4]

V I S U A L - E S P A C I A L

HABILIDADES PERCEPTIVAS			
<p>➤ Peça ao indivíduo para identificar as letras:</p>			[Escore 0-4] <input type="text"/>
<input type="text"/>	<input type="text"/>		
<input type="text"/>	<input type="text"/>		
V I S U A L - E S P A C I A L			
RECORDAÇÃO & RECONHECIMENTO			
<p>➤ Peça "Agora você vai me dizer o que você se lembra daquele nome e endereço que nós repetimos no começo".</p>			
<p>Renato Moreira Rua Bela Vista 73 Santarém Pará</p>	<p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p>		[Escore 0-7] <input type="text"/>
<p>➤ Este teste deve ser realizado caso o indivíduo não consiga se recordar de um ou mais itens. Se todos os itens forem recordados, salte este teste e pontue 5. Se apenas parte for recordada, assinale os itens lembrados na coluna sombreada do lado direito. A seguir, teste os itens que não foram recordados dizendo "Bom, eu vou lhe dar algumas dicas: O nome / endereço era X, Y ou Z?" e assim por diante. Cada item reconhecido vale um ponto que é adicionado aos pontos obtidos pela recordação.</p>			[Escore 0-5] <input type="text"/>
Ricardo Moreira	Renato Moreira	Renato Nogueira	Recordação
Bela Vida	Boa Vista	Bela Vista	Recordação
37	73	76	Recordação
Santana	Santarém	Belém	Recordação
Pará	Ceará	Paraíba	Recordação
Escores Gerais			
	MEEM	/30	
	ACE-R	/100	
Subtotais			
	Atenção e Orientação	/18	
	Memória	/26	
	Fluência	/14	
	Linguagem	/26	
	Visual-espacial	/16	
M E M Ó R I A			
E S C O R E S			

ANEXO F. AVALIAÇÃO DA FRAGILIDADE PELOS CRITÉRIOS DO CHS

Peso (em Kg): _____ **Altura (em m):** _____ **IMC (Kg/m²):** _____

PERDA DE PESO											
Nos últimos doze meses o(a) senhor(a) acha que perdeu peso sem fazer nenhuma dieta? <input type="checkbox"/> Não <input type="checkbox"/> Sim. Quantos quilos?..... Avaliação do resultado: Perda de 4,5kg ou 5% do peso corporal.	Preenche o critério? <input type="checkbox"/> Sim = 1 <input type="checkbox"/> Não = 0										
FADIGA											
a) Com que frequência na ultima semana sentiu que tudo que fez exigiu um grande esforço? (0) Nunca/Raramente (- 1 dia) (1) Poucas vezes (1 a 2 dias) (2) Na maioria das vezes (3 a 4 dias) (3) Sempre (5 a 7 dias) b) Com que frequência, na ultima semana, sentiu que não conseguiria levar adiante suas coisas? (0) Nunca/Raramente (-1 dia) (1) Poucas vezes (1 a 2 dias) (2) Na maioria das vezes (3 a 4 dias) (3) Sempre (5 a 7 dias) Atende o critério quem assinalar alternativa 2 ou 3 em qualquer uma das respostas	Preenche o critério? <input type="checkbox"/> Sim = 1 <input type="checkbox"/> Não = 0										
BAIXA FORÇA DE PREENSÃO PALMAR											
1ª medida de força de preensão:.....Kgf. 2ª medida de força de preensão:.....Kgf. 3ª medida de força de preensão:.....Kgf. Média: $1^a+2^a+3^a/3=$Kgf.	Preenche o critério? <input type="checkbox"/> Sim = 1 <input type="checkbox"/> Não = 0										
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; padding: 2px;">HOMEM</th> <th style="text-align: left; padding: 2px;">MULHER</th> </tr> </thead> <tbody> <tr> <td style="padding: 2px;">IMC ≤ 24 Força de preensão ≤ 29</td> <td style="padding: 2px;">IMC ≤ 23 Força de preensão ≤ 17</td> </tr> <tr> <td style="padding: 2px;">IMC 24.1 – 26 Força de preensão ≤ 30</td> <td style="padding: 2px;">IMC 23.1- 26 Força de preensão ≤ 17.3</td> </tr> <tr> <td style="padding: 2px;">IMC 26.1 – 28 Força de preensão ≤ 30</td> <td style="padding: 2px;">IMC 26.1 - 29 Força de preensão ≤ 18</td> </tr> <tr> <td style="padding: 2px;">IMC > 28 Força de preensão ≤ 32</td> <td style="padding: 2px;">IMC > 29 Força de preensão ≤ 21</td> </tr> </tbody> </table>	HOMEM	MULHER	IMC ≤ 24 Força de preensão ≤ 29	IMC ≤ 23 Força de preensão ≤ 17	IMC 24.1 – 26 Força de preensão ≤ 30	IMC 23.1- 26 Força de preensão ≤ 17.3	IMC 26.1 – 28 Força de preensão ≤ 30	IMC 26.1 - 29 Força de preensão ≤ 18	IMC > 28 Força de preensão ≤ 32	IMC > 29 Força de preensão ≤ 21	
HOMEM	MULHER										
IMC ≤ 24 Força de preensão ≤ 29	IMC ≤ 23 Força de preensão ≤ 17										
IMC 24.1 – 26 Força de preensão ≤ 30	IMC 23.1- 26 Força de preensão ≤ 17.3										
IMC 26.1 – 28 Força de preensão ≤ 30	IMC 26.1 - 29 Força de preensão ≤ 18										
IMC > 28 Força de preensão ≤ 32	IMC > 29 Força de preensão ≤ 21										
DIMINUIÇÃO NA VELOCIDADE DA MARCHA											
Três medidas consecutivas do tempo para caminhar 4,6m no plano. 1ª medida de velocidade da marcha:.....centésimos de segundo. 2ª medida de velocidade da marcha:..... centésimos de segundo. 3ª medida de velocidade da marcha:..... centésimos de segundo. Média: $1^a.+2^a.+3^a /3=$ centésimos de segundo.	Preenche o critério? <input type="checkbox"/> Sim = 1 <input type="checkbox"/> Não = 0										
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; padding: 2px;">HOMEM</th> <th style="text-align: left; padding: 2px;">MULHER</th> </tr> </thead> <tbody> <tr> <td style="padding: 2px;">Altura ≤ 173 cm Tempo ≥ 7 segundos</td> <td style="padding: 2px;">Altura ≤ 159 cm Tempo ≥ 7 segundos</td> </tr> <tr> <td style="padding: 2px;">Altura > 173 cm Tempo ≥ 6 segundos</td> <td style="padding: 2px;">Altura > 159 cm Tempo ≥ 6 segundos</td> </tr> </tbody> </table>	HOMEM	MULHER	Altura ≤ 173 cm Tempo ≥ 7 segundos	Altura ≤ 159 cm Tempo ≥ 7 segundos	Altura > 173 cm Tempo ≥ 6 segundos	Altura > 159 cm Tempo ≥ 6 segundos					
HOMEM	MULHER										
Altura ≤ 173 cm Tempo ≥ 7 segundos	Altura ≤ 159 cm Tempo ≥ 7 segundos										
Altura > 173 cm Tempo ≥ 6 segundos	Altura > 159 cm Tempo ≥ 6 segundos										
BAIXA PRÁTICA DE ATIVIDADES FÍSICAS											
O(a) senhor(a) acha que faz menos atividades físicas do que há doze meses atrás? <input type="checkbox"/> Não <input type="checkbox"/> Sim	Preenche o critério? <input type="checkbox"/> Sim = 1 <input type="checkbox"/> Não = 0										
TOTAL: _____/5 Frágil (3, 4 ou 5) Pré frágil (1 ou 2) Não frágil (0)											

ANEXO G. ESCALA DE ESTRESSE PERCEBIDO

As questões nesta escala perguntam sobre seus sentimentos e pensamentos durante o último mês. Em cada caso, será pedido para você indicar o quão frequentemente você tem se sentido de uma determinada maneira. Embora algumas das perguntas sejam similares, há diferenças entre elas e você deve analisar cada uma como uma pergunta separada. A melhor abordagem é responder a cada pergunta razoavelmente rápido. Isto é, não tente contar o número de vezes que você se sentiu de uma maneira particular, mas indique a alternativa que lhe pareça como uma estimativa razoável.

Neste último mês, com que frequência...

		Nunca	Quase Nunca	Às vezes	Quase Sempre	Sempre
Pontuação		0	1	2	3	4
1	Você tem ficado triste por causa de algo que aconteceu inesperadamente?					
2	Você tem se sentido incapaz de controlar as coisas importantes em sua vida?					
3	Você tem se sentido nervoso e “estressado”?					
4	Você tem tratado com sucesso dos problemas difíceis da vida?					
5	Você tem sentido que está lidando bem as mudanças importantes que estão ocorrendo em sua vida?					
6	Você tem se sentido confiante na sua habilidade de resolver problemas pessoais?					
7	Você tem sentido que as coisas estão acontecendo de acordo com a sua vontade?					
8	Você tem achado que não conseguiria lidar com todas as coisas que você tem que fazer?					
9	Você tem conseguido controlar as irritações em sua vida?					
10	Você tem sentido que as coisas estão sob o seu controle?					
11	Você tem ficado irritado porque as coisas que acontecem estão fora do seu controle?					
12	Você tem se encontrado pensando sobre as coisas que deve fazer?					
13	Você tem conseguido controlar a maneira como gasta seu tempo?					
14	Você tem sentido que as dificuldades se acumulam a ponto de você acreditar que não pode superá-las?					

ANEXO H. ESCALA DE SOBRECARGA DE ZARIT

Resultado: _____/48	
(1)	Pequena ou nenhuma sobrecarga (0 a 12)
(2)	Sobrecarga evidente (13 a 48)

Nunca	Raramente	Algumas vezes	Frequentemente	Sempre	Resultado
0	1	2	3	4	o
O Sr/Sra sente que por causa do tempo o Sr/Sra, gasta com S*, o Sr/Sra não tem tempo suficiente para si mesmo?					
O Sr/Sra se sente estressado (a) entre cuidar de S* e suas outras responsabilidades com a família e o trabalho?					
O Sr/Sra se sente irritado (a) com quando S* está por perto?					
O Sr/Sra sente que S* afeta negativamente seus relacionamentos com outros membros da família ou amigos?					
O Sr/Sra se sente tenso (a) quando S* esta por perto?					
O Sr/Sra sente que a sua saúde foi afetada por causa do seu envolvimento com S*?					
O Sr/Sra sente que o Sr/Sra não tem tanta privacidade como gostaria, por causa de S*?					
O Sr/Sra. Sente que o Sr/Sra que a sua vida social tem sido prejudicada porque o Sr/Sra está cuidando de S*?					
O Sr/Sra sente que perdeu o controle da sua vida desde a doença de S*?					
O Sr/Sra sente que tem dúvida sobre o que fazer por S*?					
O Sr/Sra se sente que deveria estar fazendo mais por S*?					
De uma maneira geral, quanto o Sr/Sra se sente sobrecarregado (a) por cuidar de S**?					
TOTAL					
* No contexto S refere-se a quem é cuidado pelo entrevistado. Durante a entrevista, o entrevistador usa o nome desta pessoa.					
** Neste item as respostas são: nem um pouco=0, um pouco=1, moderadamente=2, muito=3, extremamente=4.					