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# Cognition, functionality, and life space in older adults: the mediating role of perceived control and autonomy

Cognição, funcionalidade e espaço de vida nas pessoas idosas: o papel mediador da percepção de controle e autonomia

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## Abstract

**Objectives:** To examine a model of associations between cognition, functionality, and life-space mobility, and the mediating role of perceived control and autonomy.

**Methods:** This is a cross-sectional study with a sample of older adults aged over 72 years, which used data from the FIBRA study. We used the structural equation modeling technique. Variables in this model were cognition, functionality, perceived control and autonomy, and life-space mobility, with sociodemographic and health covariables. Data imputation was done through the expected maximization method aiming at more effective data utilization. This study was funded by Coordenação de Aperfeiçoamento de Pessoal de Nível Superior.

**Results:** The mediation model reached good fit indices. Cognition, functionality, and perceived control and autonomy demonstrated a predictive capacity for life space. Functionality and perceived control and autonomy mediated the relationship between cognition and life space; therefore, cognition influences life space, given its associations with the mediating variables. There was a mediating effect of perceived control and autonomy on the relationship between functionality and life space.

**Conclusions:** Perceived control and autonomy have an adaptive role when considering changes in personal competencies. This adaptation is reflected on life spaces, indicating an adjustment between competence and environment. Studies aimed at promoting a good relationship between an individual and his or her context maintaining life space should consider perceived control and autonomy as important mechanisms in this relationship.

**Keywords:** aging; mobility limitation; cognition; activities of daily living; internal-external control; personal autonomy.

## Resumo

**Objetivos:** Examinar um modelo de associações entre cognição, funcionalidade e mobilidade em espaço de vida, e o papel mediador da percepção de controle e autonomia.

**Metodologia:** Estudo transversal, com amostra composta por idosos acima de 72 anos, utilizando dados do estudo FIBRA. Utilizou-se a técnica de Modelagem por Equações Estruturais. As variáveis do modelo foram a cognição, a funcionalidade, a percepção de controle e autonomia e a mobilidade em espaço de vida, com covariáveis sociodemográficas e de saúde. Realizou-se imputação de dados através da técnica *Expected Maximization*, visando o melhor aproveitamento dos dados. Estudo financiado pela Coordenação de Aperfeiçoamento de Pessoal de Nível Superior.

**Resultados:** O modelo de mediação obteve bons índices de ajuste. A cognição, a funcionalidade e a percepção de controle e autonomia demonstraram capacidade preditiva do espaço de vida. A funcionalidade e a percepção de controle e autonomia mediarão a relação entre a cognição e o espaço de vida, portanto, a cognição influencia o espaço de vida, dada suas associações com as variáveis mediadoras. Houve efeito de mediação da percepção de controle e autonomia na relação entre a funcionalidade e o espaço de vida.

**Conclusões:** A percepção de controle e autonomia exerce função adaptativa frente às alterações nas competências pessoais. Essa adaptação é refletida nos espaços de vida, indicando ajuste entre competência e meio. Estudos que visem promover uma boa relação entre o indivíduo e seu contexto, mantendo o espaço de vida, devem considerar a percepção de controle e autonomia como mecanismo importante nesta relação.

**Palavras-chave:** envelhecimento; limitação da mobilidade; cognição; atividades cotidianas; controle interno-externo; autonomia pessoal.



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## INTRODUCTION

The range of spatial mobility of older adults — or life-space mobility (LSM) — is an important indicator of functional capacities and physical and mental health conditions,<sup>1</sup> as well as relationships between individuals and demands of the physical and social environment.<sup>2</sup> Measures frequently used in clinical and research literature aim to identify the frequency and degree of mobility independence in spaces organized into proximal or distal mobility areas in relation to the person.<sup>3</sup> Self-reports of individuals, reports by reliable informants, or even records obtained with digital technologies have been shown to be useful and valid for this purpose.<sup>4</sup>

Even though increased chronological age is associated with reduced LSM,<sup>3</sup> there are large variations in these indicators due to the influence of preexisting conditions — sociodemographic, contextual, health, and lifestyle — and also of the environmental conditions in which an individual lives.<sup>5</sup> In particular, LSM requires cognitive and instrumental functionality for everyday functioning; these aspects are classically named in Gerontology as “personal competencies.”<sup>6</sup> Maintaining these functions allows individuals to deal with environmental demands, manage their everyday life, adapt to the changes of aging, and participate in different life spaces.<sup>7,8</sup> This adaptive aspect stems from the fact that individuals are not completely passive in the person-environment relationship, as they can intentionally and proactively act on their surroundings.<sup>2</sup>

Restrictions to LSM can occur deliberately as a way of adapting one's capabilities to environmental demands.<sup>2</sup> Therefore, LSM measurements potentially reflect the level of environmental complexity in which individuals are able to properly function. Subjective assessments such as perceived control and autonomy, which precede behavior adoption, influence proactivity.<sup>9,10</sup> Changes perceived in personal competencies may thus reflect on LSM, depending on these assessments.<sup>11</sup> According to the LSM model proposed by Webber et al.,<sup>5</sup> individual differences can contribute, delay, or avoid this restriction, since LSM is influenced by different types of determinants.

Sociodemographic, cognitive, functional, and psychological characteristics identified in the international literature about LSM ranges deserve to be examined in the light of the particularities of Brazilian samples of older adults. It is also vital to consider variables that could be subjacent to the relationship between personal competencies and LSM. This work aims to examine a model of associations between cognitive and functional indicators and LSM, as well as to estimate the potential of perceived control and autonomy to mediate these associations.

## METHODS

This is a descriptive analytical study with a cross-sectional design, performed with data from the follow-up sample of the Frailty Profile of Elderly Brazilians (Fragilidade em Idosos Brasileiros [FIBRA]) study, developed by the Universidade Estadual de Campinas (UNICAMP) center.

The FIBRA study aimed to investigate frailty in Brazilian older adults and its associations with sociodemographic, economic, psychological, social, and health variables. Four Brazilian universities were responsible for data collection, which took place in 17 Brazilian municipalities. Data collection at baseline was performed in 2008 and 2009. The study included older adults aged 65 years or older who could understand instructions and agreed to participate, with permanent residency in the city and household. Those with severe cognitive deficit, wheelchair users, those who were bedridden, had severe sequelae of stroke and/or aphasia, advanced or unstable Parkinson's disease, severe vision or hearing impairment, or who were terminally ill were excluded from the study. In 2016 and 2017, a follow-up study was performed with the cohort of older adults living in Campinas (SP) and in the Ermelino Matarazzo subdistrict (SP). At baseline, the sample from these areas comprised 1284 older adults. Of these, only 549 were in the follow-up study. In the follow-up study, older adults were assessed as to their cognitive status; those whose scores were higher than the Mini-Mental State Examination (MMSE) cutoff score<sup>12</sup> continued to answer to the study protocol, whereas those with lower scores had their data collected through a protocol directed at their family members. More information on the FIBRA follow-up study is available at Neri et al.<sup>13</sup>

The range of LSM was measured through the University of Alabama at Birmingham Study of Aging Life-Space Assessment (LSA). This questionnaire considers 5 mobility areas: areas of the house other than the room where the person sleeps; areas immediately outside the person's home, areas in the neighborhood, areas outside of the person's immediate neighborhood — but within town limits — and areas outside of the person's town or community. Individuals are inquired as to, in the previous 4 weeks, which areas they have reached, with which frequency, and whether they required assistance by equipment and/or other people. The questionnaire generates a composite score ranging from 0 to 120 by multiplying the code for the reached area, the frequency, and the assistance. The higher the score, the higher the life-space level.<sup>14</sup>

Global cognitive functioning considered the total MMSE score. This is a cognitive screening measure that assesses temporal and spatial orientation, immediate memory, attention

and calculation, recall, and language. It includes 30 dichotomously scored items (fully correct or incorrect), where each correct answer is attributed 1 point. The overall score ranges from 0 to 30, where higher scores represent better cognitive functioning.<sup>15</sup>

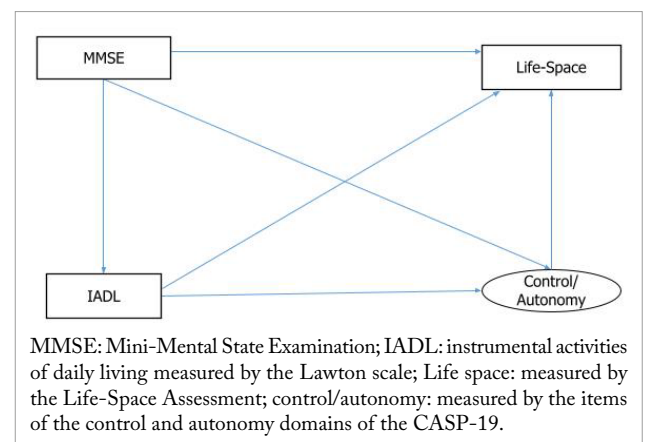
The Lawton and Brody<sup>16</sup> scale was used as an indicator of degrees of dependency in instrumental activities of daily living (IADL). This scale includes 7 activities: handling money, controlling medications, preparing food, using the telephone, housekeeping, mobility, and shopping. For each activity, individuals must answer if they are able to perform it independently, require some help, or are unable to perform it. The total number of activities that people were unable to perform was used in this study; the maximum number of activities that individuals could be dependent in was 7.

Perceived control and autonomy were derived from items comprising domains of the Brazilian version of the Control, Autonomy, Pleasure and Self-Realization (CASP-19) quality of life scale.<sup>17</sup> This is a 4-point Likert scale ranging from 0 (not at all) to 3 (very much). The control domain comprises 4 items and the autonomy domain includes 5 items. The items on control are: “My age prevents me from doing the things I would like to”; “I feel that what happens to me is out of my control”; “I feel free to plan for the future”; and “I feel left out of things.” The items on autonomy are: “I can do the things I want to do”; “Family responsibilities prevent me from doing what I want to do”; “I feel that I can please myself with what I do”; “My health stops me from doing things I want to”; and “Shortage of money stops me from doing the things I want to do.” Items with negative scores were inverted so that higher scores would represent more positive perceived control and autonomy. The literature indicates that the control and autonomy domains are frequently united as a single factor,<sup>19</sup> which also happened in Brazilian studies.<sup>18</sup> Therefore, these domains will be unified into a single latent variable and investigated as to their suitability in this study.

Covariables were selected based on the effects they have on variables of interest, more specifically on LSM. These are: chronological age (derived from the birth date informed by the interviewee); self-reported biological sex (1 = male; 2 = female); schooling (estimated by the self-reported number of years of formal education); living arrangement (number of people living in the household); and total number of self-reported diseases diagnosed by a physician or other health professional in the previous year (cardiac diseases, hypertension, stroke, diabetes mellitus, cancer, lung diseases [bronchitis or emphysema], depression, and osteoporosis), inquired in a dichotomous model.

Data analysis was done in 4 stages, as follows:

- 1) Assessing the suitability of measurements as to missing data with Little’s Missing Completely at Random (MCAR) test ( $p < 0.05$ ), data imputation using the expected maximization method, and examining the unifactorial structure of the CASP-19’s control and autonomy domains via confirmatory factor analysis based on fit and modification indices. The unifactorial structure of the control and autonomy domains of the CASP-19 scale had to be tested before being included in the model. Assessing the suitability of the latent variable’s factorial structure was important to assess its fit in our sample, allowing for the necessary adjustments in order to avoid interpretation biases resulting from poor fit in subsequent analyses;
- 2) Describing the sample with measures of position and dispersion and verifying the normality of data using the Kolmogorov-Smirnov test;
- 3) Establishing correlations between the study variables with Spearman’s Rho ( $p < 0.05$ ) according to a non-normal sample distribution;
- 4) Testing a model of direct and indirect associations via structural equation modeling (SEM) — because it allows us to consider the same variable as dependent and independent, as is the case when testing for mediating variables<sup>20</sup> — and using latent variables (perceived control and autonomy), which consider measurement errors and generate more robust results. Initially, we tested the mediating model (Figure 1)



**FIGURE 1.** Graphical representation of the mediation model to be tested by the Mini-Mental State Examination technique. The items referring to the control/autonomy latent variable, measurement errors, and the age, sex, schooling, number of self-reported diseases, and number of cohabitants covariables are not present in the Figure for conciseness.

without controlling for covariables, and then we tested the model with the inclusion of covariables.

SPSS version 20 was used for the procedures described in stages 1, 2, and 3, except for the confirmatory factor analysis and SEM, which were done using the lavaan package version 0.6-12 in R software version 4.2.1. The estimator employed in this study was the Weighted Least Square Mean and Variance Adjusted (WLSMV). For verifying model fit, the Root Mean Square Error of Approximation (RMSEA), Comparative fit index (CFI), and Tucker-Lewis Index (TLI) fit indices were considered, with the following criteria: RMSEA < 0.08 (90%CI < 0.10), CFI > 0.90, TLI > 0.90. The level of statistical significance was set at  $p < 0.05$ .<sup>21</sup>

## RESULTS

Out of 549 older adults comprising the FIBRA follow-up study, 130 scored below the MMSE cutoff and, according to the protocol,<sup>13</sup> did not answer items on perceived control and autonomy and LSM. This way, we used information on the 419 individuals whose scores were higher than the MMSE cutoff in the follow-up.

### Stage 1

There were missing data for the control and autonomy items of CASP-19, the total LSA score, and the living arrangement variable. Little's MCAR test revealed that missing data were completely random only for the control and autonomy items of CASP-19 ( $p = 0.078$  and  $p = 0.630$  for control and autonomy, respectively), thus data imputation was done only for this measure.

Uniting the control and autonomy items in a single factor did not result in a good fit (CFI = 0.66, TLI = 0.54, RMSEA = 0.110 [0.094–0.126]). Modification indices indicated residual correlations between items: 5 and 7, 3 and 5, 1 and 8 (MI = 26.524; MI = 25.321; MI = 23.575, respectively). For subsequent analyses, we excluded items based on factor loadings and considering the possibility of redundancy between items.<sup>19</sup> Items 7, 3, and 1 (with factor loadings of 0.39, 0.51, and 0.43, respectively) were excluded in relation to items 5 and 8 (with factor loadings of 0.53 and 0.59, respectively). A new confirmatory factor analysis was executed with items 2, 4, 5, 6, and 8, resulting in a good fit to data (CFI = 0.98, TLI = 0.97, RMSEA = 0.026 [0.001–0.057]). This would be the latent variable to be used in the SEM.

### Stage 2

The sample comprised mostly women (69.93%), aged between 72 and 98 years ( $M = 80.25$ ,  $SD = 4.58$ ), with an average

of 4.49 years of schooling ( $SD = 3.78$ ). Table 1 summarizes the other characteristics of the sample. The sample did not present a normal distribution according to a Kolmogorov-Smirnov test ( $p < 0.001$ ).

### Stage 3

Significant correlations were seen between cognition, dependency in IADL, perceived control and autonomy, and life-space levels. Covariables presented different correlations with the variables of interest: perceived control and autonomy were associated with a higher number of covariables (schooling, number of cohabitants, and self-reported diseases); Table 2 highlights the other correlations between the variables considered in this study.

### Stage 4

SEM was performed aiming to investigate the relationship between variables of interest, more specifically the mediating role of perceived control and autonomy in the relationship between personal competencies and life-space levels. Initially, the model was tested without controlling for covariables (Model 1), and then it was tested controlling for covariables (Model 2).

Model 1 had a good fit to the data (CFI = 0.96, TLI = 0.94, RMSEA = 0.04 [0.01–0.06]). Cognition had a direct effect on dependency in IADL and perceived control and autonomy, and an indirect effect on perceived control and autonomy and of life-space levels. The indirect effect of cognition on perceived control and autonomy was mediated by dependency in IADL, and its indirect effect on life-space levels was mediated by dependency in IADL and perceived control and autonomy. Dependency in IADL had a direct effect on perceived control and autonomy and life-space levels, and an indirect effect on life-space levels with a mediating role of perceived control and autonomy. Perceived control and autonomy had a direct effect on life-space levels. The model explained 26% of LSM. Figure 2 illustrates the strength of associations and how much each variable was explained by the model.

Model 2 also had a good fit to the data (CFI = 0.95, TLI = 0.91, RMSEA = 0.03 [0.01–0.05]). After including covariables, cognition retained the effects of the previous model, with the addition of a direct effect on life-space levels. Dependency in IADL and perceived control and autonomy retained the effects of the previous model. Covariables differed regarding their association with the model variables. Schooling presented associations with cognition, the number of diseases had associations with perceived control and

**TABLE 1.** Distribution of the sample according to sociodemographic, health, cognitive, functional, psychological, and life-space mobility (LSM) criteria (n = 419).

|                                  | Mean (SD)     | 95%CI         | n (%)       |
|----------------------------------|---------------|---------------|-------------|
| Age, years                       | 80.25 (4.58)  | 80.00 – 80.94 |             |
| Sex                              |               |               |             |
| Female                           |               |               | 293 (69.93) |
| Male                             |               |               | 126 (30.07) |
| Schooling, years                 | 4.49 (3.78)   | 4.04 – 4.78   |             |
| Number of cohabitants (n = 411)  | 2.58 (1.54)   | 2.42 – 2.72   |             |
| 1 (lives alone)                  |               |               | 77 (18.73)  |
| 2                                |               |               | 171 (41.61) |
| 3 or more                        |               |               | 163 (39.66) |
| Number of self-reported diseases | 2.17 (1.35)   | 2.08 – 2.35   |             |
| 0                                |               |               | 41 (9.78)   |
| 1                                |               |               | 100 (23.87) |
| 2 or more                        |               |               | 278 (66.35) |
| Dependency in IADL               | 0.31 (0.85)   | 0.21 – 0.37   |             |
| 0                                |               |               | 350 (83.53) |
| 1                                |               |               | 36 (8.59)   |
| 2 or more                        |               |               | 33 (7.88)   |
| MMSE                             | 25.04 (2.84)  | 24.68 – 25.25 |             |
| Control/autonomy                 | 19.58 (4.36)  | 19.27 – 20.13 |             |
| Control/autonomy*                | 13.66 (3.16)  | 13.45 – 14.07 |             |
| LSA (n = 391)                    | 53.65 (21.82) | 51.60 – 55.97 |             |

Cohabitants: number of people living in the household; diseases: number of self-reported chronic diseases; IADL: instrumental activities of daily living measured by the Lawton scale; MMSE: Mini-Mental State Examination; control/autonomy: sum of 9 control and autonomy items of the CASP-19; control/autonomy\*: sum of items remaining after the exclusion suggested by modification indices; LSA: life-space assessment.

**TABLE 2.** Correlations between the independent variables, dependent variables, and covariables. FIBRA study, Brazil. Older adults, 2016– 2017 (n = 384).

|                      | 1     | 2      | 3     | 4      | 5      | 6      | 7      | 8     | 9     | 10 |
|----------------------|-------|--------|-------|--------|--------|--------|--------|-------|-------|----|
| 1. Age               | -     |        |       |        |        |        |        |       |       |    |
| 2. Sex               | -0.08 | -      |       |        |        |        |        |       |       |    |
| 3. Schooling         | -0.05 | 0.05   | -     |        |        |        |        |       |       |    |
| 4. Cohabitants       | -0.02 | -0.03  | -0.09 | -      |        |        |        |       |       |    |
| 5. Diseases          | -0.04 | 0.24*  | -0.09 | -0.01  | -      |        |        |       |       |    |
| 6. MMSE              | -0.04 | -0.10† | 0.58* | -0.05  | -0.08  | -      |        |       |       |    |
| 7. IADL              | 0.09  | 0.08   | -0.04 | 0.21*  | 0.14*  | -0.13* | -      |       |       |    |
| 8. Control/autonomy  | 0.08  | 0.05   | 0.12† | -0.18* | -0.24* | 0.17*  | -0.26* | -     |       |    |
| 9. Control/autonomy† | 0.09  | 0.01   | 0.15* | -0.17* | -0.27* | 0.20*  | -0.26* | 0.93* | -     |    |
| 10. LSA              | -0.06 | -0.07  | 0.09  | -0.13† | -0.18† | 0.22*  | -0.37* | 0.38* | 0.37* | -  |

\*p < 0.01; †p < 0.05. Cohabitants: number of people living in the household; diseases: number of self-reported chronic diseases; IADL: instrumental activities of daily living measured by the Lawton scale; MMSE: Mini-Mental State Examination; control/autonomy: sum of 9 control and autonomy items of the CASP-19; control/autonomy\*: sum of items remaining after the exclusion suggested by modification indices; LSA: life-space assessment.

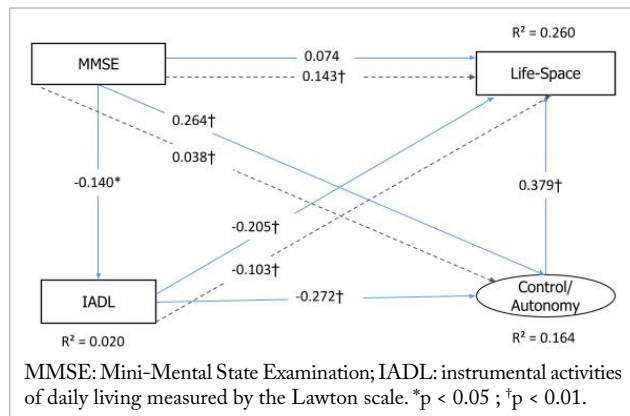
autonomy, and the number of cohabitants had associations with dependency in IADL and perceived control and autonomy. No effect was seen for covariables on life-space levels. Figure 3 illustrates the strength of associations after including the covariables.

## DISCUSSION

According to the model by Miller and Lachman,<sup>22</sup> age-related changes (such as cognitive alterations) affect the experiences of everyday life. Changes to everyday functioning provide information when individuals assess their capabilities

in relation to environmental demands. This study used the MMSE as a cognitive indicator, dependency in IADL as an indicator of everyday functioning, perceived control and autonomy as an assessment of capabilities in relation to environmental demands, and life-space mobility as the outcome of this complex relationship.

As seen in other literature findings, cognition was shown to be a predictor of life-space levels.<sup>8,11</sup> Functionality, indicated

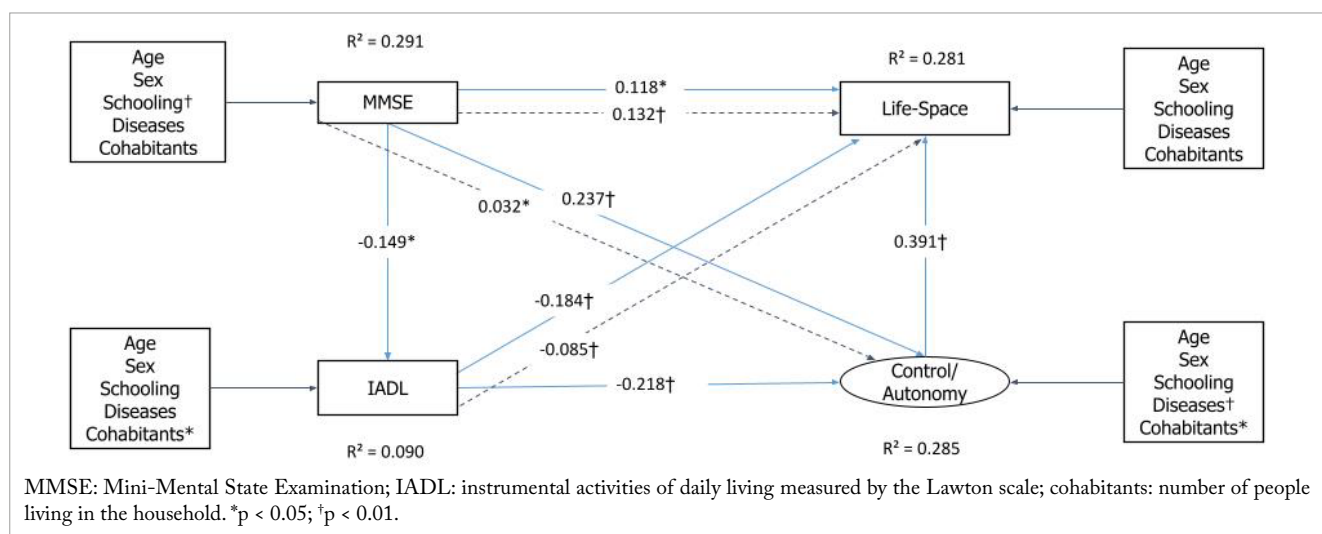


**FIGURE 2.** Model 1 with the variables of interest without controlling for covariables. Solid lines represent direct relationships between variables. Dashed lines represent indirect relationships between variables. The Figure also indicates R<sup>2</sup>, showing how the variables are explained by the model; n = 391 (when excluding missing data for the LSA variable). The items comprising the control/autonomy latent variable and measurement errors are not present in the Figure for conciseness.

by dependency in IADL, also showed predictive capacity for LSM. The influence of cognition on LSM is explained by its capacity to provide means for processing increasingly complex information from hierarchically higher levels in the life-space continuum.<sup>7</sup> Functional capacity is an indicator of physical health and of the prediction of adverse outcomes,<sup>23</sup> which include LSM.<sup>8</sup> Moreover, our results suggest that the effects of cognition and functional capacity indicated by dependency in IADL are felt on life-space levels measured by perceived control and autonomy.

IADL are considered more complex than basic activities such as bathing and dressing with no assistance, thus demanding higher cognitive function.<sup>23</sup> Indeed, cognitive alterations due to aging interfere with everyday functioning.<sup>24</sup> Our findings indicate that the effect of cognition on everyday functioning is reflected on other areas of the older person's life, such as perceived control and autonomy. The mediation of the relationship between cognition and perceived control and autonomy, exerted by dependency in IADL, suggests that the complexity of daily life is a source of information when forming perceived control and autonomy. Difficulties experienced when performing IADL may lead to frustration regarding one's capabilities and possibilities for action.<sup>11</sup> Frustration may influence how autonomous individuals see themselves when faced with restrictions imposed by their own capabilities and environmental demands, also reflecting on how they perceive control over their lives.

Perceived control and autonomy mediate the relationship between personal competencies and LSM. The previously



**FIGURE 3.** Model 2 with the variables of interest controlling for covariables. Solid lines represent direct relationships between variables. Dashed lines represent indirect relationships between variables. The Figure also indicates R<sup>2</sup>, showing how variables are explained by the model; n = 384 (when excluding missing data for the LSA and number of cohabitants variables). The items comprising the control/autonomy variable and measurement errors are not present in the Figure for conciseness.

mentioned relationships between cognition, dependency in IADL, and perceived control and autonomy are reflected in life-space levels. Perceived control and autonomy are involved in the process of adopting behaviors, as they influence the processes of choice, intentionality, effort employed, persistence, and engagement.<sup>10,25</sup> This study demonstrates the effect of perceptions in the adoption of behaviors by identifying the prediction of perceived control and autonomy on life-space levels. From the assessment of capabilities and environmental demands, individuals form their perceived control and autonomy and thus can adjust when facing the life-space levels they consider themselves able to thrive in. Therefore, these perceptions serve as adaptive mechanisms when dealing with changes in personal competencies.

Previous studies have highlighted associations between cognition and LSM,<sup>7</sup> cognition and functional capacity,<sup>6</sup> and functional dependency and perceived competencies.<sup>26</sup> As Webber et al.<sup>5</sup> suggest, there are interactions between determinants of mobility. This study aimed to understand the relationships between these variables in a single model, seeking to clarify the dynamics between them, corroborated previous findings, and elucidated some of the mechanisms through which these correlations occur.

Relationships found in the tested model support the model proposed by Miller and Lachman,<sup>22</sup> indicating that changes experienced with aging may initiate a cycle of deleterious effects that are maintained by subjective assessments of capabilities. The study by Sartori et al.<sup>11</sup> showed that perceived control acted as a moderator in the relationship between cognition and LSM. This study also indicated a moderating role of perceived control between functional ability and life-space levels, indicating that perceptions may intensify the effect of functional capacity on LSM. Similarly, this study indicates the mediation exerted by perceived control and autonomy on the relationship between dependency in IADL and LSM. Higher perceived control and autonomy will lead to a higher persistency of individuals in their activities, preventing the perpetuation of a harmful and cyclic effect.

Our findings provide important information for interventions that aim to preserve life-space levels. The domain of cognitive rehabilitation is increasingly recognizing the importance of intervening with psychological aspects related to people's motivation;<sup>27</sup> this way, interventions on perceived control and autonomy stand out as a possible research area. Perceived control may be the object of cognitive behavioral interventions, such as the cognitive restructuring technique.<sup>10</sup> Psychoeducation on autonomy-promoting forms of care may be useful when promoting higher perceived autonomy.<sup>28</sup>

An interesting finding of this study is that a higher number of cohabitants was associated with worse perceived control and autonomy and higher dependency in IADL. The number of cohabitants may have served as an indicator of social relations marked by age-based discrimination, which affects individuals' perceived control and autonomy. Age-based discrimination has been increasingly discussed in the literature.<sup>29</sup> Negative stigma related to aging influences the individuals' perceptions of themselves.<sup>26</sup> However, we did not use any variable measuring age-based discrimination, indicating that this hypothesis deserves further investigation. Moreover, older adults who demand more assistance when performing IADL could simply require more people in the household to help them.

Life-space mobility allows individuals to satisfy their personal needs; consequently, it is associated with well-being and quality of life.<sup>3</sup> This is a complex and multidetermined area of knowledge<sup>5</sup> and it is important to develop strategies that consider this outcome in a broad manner, including areas of action for individual and also social aspects.

### Limitations

This study did not use a measure developed specifically for measuring perceived control and autonomy. CASP-19 is a measure of quality of life that frequently joins the control and autonomy domains into a single factor<sup>18,19</sup>; however, this union was not supported in this sample. It is important to note that an inconsistency of CASP-19 has been reported by other studies.<sup>19</sup> After excluding items based on their factor loadings and possible redundancy, we obtained a latent variable with good fit to the sample data.

The fact that none of the control and autonomy items had a good fit in a single factor in this study may be explained by the translation and adaptation of the instrument in the Brazilian context. CASP-19, used in the FIBRA follow-up study, was based on the validation study carried out by Neri and colleagues.<sup>18</sup> In this study, the translation of item 7 was conceptually similar to the self-realization domain, being grouped together with other items of this domain in the analyses. The residual correlation between items 1 and 8 was also found by Marques, Bastos, and d'Orsi.<sup>19</sup> The authors suggest this could happen due to redundancy in the translation of CASP-19 items to the Brazilian context. One of the justifications is that population aging in the country was fast and not followed by a decline in morbidity, making the terms "age" and "health" show such redundancy in analyses.

The latent variable used in this study contained items related to specific restrictions to autonomy and control, such as family responsibilities, health, and shortage of money, in

addition to the absence of restrictions such as “I can do the things I want to” and lack of control. The items may refer to the number of obstacles that people perceive when faced with the possibility of exerting control and autonomy, which is similar to what is conceived as “perceived constraints.” Perceived constraints are a domain of perceived control that concerns what individuals perceive as constraints and/or obstacles to reaching their goals.<sup>30</sup> We highlight the need for studies of convergent validity between the cited items and specific measures of perceived constraints.

The results were obtained from data imputation; therefore, they were not necessarily the answers given by individuals. This limits the generalization of our findings. Nevertheless, it is important to note that this is a robust technique for missing data that was executed only for those that were completely random.

Studies that approach more specific aspects of cognition apart from screening tests are required, since the domains of cognition are differently related to life space.<sup>7</sup> Executive function is underrepresented in the MMSE.<sup>7</sup> Executive functions may be investigated in future studies, as they are related to LSM.<sup>3</sup>

Few older adults in our sample presented dependency in IADL, which indicates this is a healthier sample. When using data from the FIBRA follow-up study, losses in relation to the baseline must be considered, as these could lead to selection bias when retaining older adults in better health. When excluding older adults who scored less than the cutoff score for the MMSE along with those who met the exclusion criteria adopted by the FIBRA study, we limited the possibility of generalization by selecting for older adults in better health. Therefore, generalizations from these findings must be made with caveats.

Although the model and direction of variables was constructed considering the models by Webber et al.<sup>5</sup> and Miller and Lachman,<sup>22</sup> cause-and-effect inferences cannot be made given the cross-sectional nature of this study. Therefore, future

studies should consider the relationship between these variables in a longitudinal perspective.

## CONCLUSION

There are interactions between cognitive, functional, and psychological determinants on the influence on mobility measured by life space. Perceived control and autonomy have a potentially adaptive role when individuals are faced with changes in personal competencies, being reflected in the adjustment of environmental levels experienced by individuals. Studies aimed at promoting a good relationship between individuals and their context should consider perceived control and autonomy as important mechanisms in this relationship. In order to cope with the complex interaction between determinants of mobility in different life spaces, a multidisciplinary approach is indispensable to the older population.

## Conflicts of interest

The authors declare that they have no conflicts of interest.

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## Author contributions

EAR: formal analysis, conceptualization, data curation, writing – first draft, investigation, methodology, visualization. ALN: project administration, data curation, writing – review & editing, funding acquisition, resources, supervision, validation. MSY: project administration, data curation, writing – review & editing, funding acquisition, resources, supervision. SSTB: conceptualization, writing – first draft, methodology, supervision, visualization.

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