

## Family vulnerability index to disability and dependence (FVI-DD), by social and health conditions

Fernanda Amendola <sup>1</sup>

Márcia Regina Martins Alvarenga <sup>2</sup>

Maria do Rosário Dias de Oliveira Latorre <sup>3</sup>

Maria Amélia de Campos Oliveira <sup>4</sup>

**Abstract** *The Family Vulnerability Index to Disability and Dependence (FVI-DD) aims to summarize the dimensions of vulnerability to disability and dependence using family data monitored by Family Health Strategy (ESF) teams. This study aims to analyze the FVI-DD according to the social and health vulnerability, to validate and extract a cutoff point for each dimension. The FVI-DD was built with a sample of 248 families living in a region of São Paulo. The dimension related to health conditions was validated with good internal consistency, with respect to the Katz Index and the Lawton Scale, whereas the dimension related to social conditions was only validated in relation to Lawton Scale. Thus, a vulnerable family was defined as one with 15 or more points in the Total FVI-DD, and a vulnerable family in health conditions that with a score of 6 or more points in that dimension. Therefore, it is possible to classify families as not vulnerable, vulnerable in the social aspects, vulnerable in the health aspects and the more vulnerable family (social and health) using social indicators of empowerment and wear and health indicators related not only to the biological sphere, but also in the access to health services, health self-assessment and existing vulnerable groups.*

**Key words** *Index, Vulnerability, Family, Disability, Dependence*

<sup>1</sup> Pós-Graduação em Enfermagem, Universidade Guarulhos. Praça Tereza Cristina, Centro. 07023-070 Guarulhos SP Brasil. famendola@usp.br

<sup>2</sup> Universidade Estadual do Mato Grosso do Sul. Campo Grande MS Brasil.

<sup>3</sup> Faculdade de Saúde Pública, Universidade de São Paulo (USP). São Paulo SP Brasil.

<sup>4</sup> Escola de Enfermagem, USP. São Paulo SP Brasil.

## Introduction

Current social and health indicators evidence a worrying reality regarding the provision of care and care to people with some disability or dependence.

According to data from the Ministry of Health<sup>1</sup>, 72% of deaths recorded in Brazil in 2007 were due to chronic non-communicable diseases (CNCD)<sup>2</sup>. IBGE estimates indicate that, in 2025, Brazil will have more than 30 million individuals aged 60 years or more and about 85% will have at least one chronic disease<sup>3</sup>.

Population aging is now a reality in the country: the 0-4 years age group fell by 1.2% in 10 years, while the group over 65 years old advanced by 1.5%<sup>4</sup>. Population aging occurs not only through increased population longevity, but also through reduced fertility. In Brazil, the fertility rate is 1.90 children per woman, below the replacement rate. In addition, the family structure has also been changing. Marital dissolutions had an increase of 161.4% in 10 years (from 2004 to 2014)<sup>5</sup>, and the number of people living alone increased from 10.0% to 14.4% in the same period<sup>6</sup>. Thus, together with increased chronic health conditions, there may be a shortage of family support to care for people with dependence.

Increased chronic conditions and population aging can lead to a higher number of people with disabilities and dependence, requiring home health care. Caring for these people requires a social and health system to support the patient and the family, but Brazil has a low supply of public social and health services to meet this new demand. Family members are primarily responsible for patient care and costs arising from their conditions. In addition, women who have historically and culturally always been the “natural” family caregiver are increasingly entering the labor market and assuming the role of head of the family.

In this context, the evaluation of disabilities as a health problem in the communities should be carried out considering social and health aspects, monitoring the determinants related to their appearance.

The development of disabilities is not only a biological phenomenon, resulting from chronic diseases, aging or accidents but, above all, it is a social phenomenon that, depending on conditions, may favor or aggravate this condition<sup>7</sup>.

In an earlier study<sup>8</sup>, a Family Vulnerability Index to Disability and Dependence (FVI-DD) was developed and validated in order to synthesize the dimensions of vulnerability to disability

and dependence using data from families monitored by Family Health Strategy (ESF) teams. Considering that, in Brazil, in principle, family is the object of care and health care actions focus of Primary Health Care (PHC), the establishment of tools that capture social and health conditions among its members, besides the social network and support associated with disabilities can contribute to the early detection and planning of promotion and prevention actions.

The FVI-DD consists of social and health dimensions and evidenced good psychometric properties, indicating that it is valid to evaluate the vulnerability of families to disability and dependence<sup>8</sup>. However, it is difficult to sort such families by level of vulnerability to disabilities and dependence, phenomena that require a multidimensional approach. That is, if family “A” has certain favorable and unfavorable social and health conditions in some dimensions and family “B” in others, which one is more vulnerable? In this case, it is only possible to state that the family “A” has a better situation in some dimensions than family “B” and vice versa. Therefore, one family may be more vulnerable under social aspects related to disabilities and another, to health aspects, or even vulnerable under both aspects.

Thus, this study aims to analyze the vulnerability index of families to disabilities and dependence (FVI-DD), by social and health vulnerability to validate and extract a cut-off point for each underlying dimension of the FVI-DD.

## Methods

This is an observational, descriptive, transversal and quantitative approach study. The FVI-DD was built with a sample of 248 families living in the Lapa sub-municipality. This region was chosen for the development of the Index due to its demographic characteristics, since the proportion of elderly people (60 years and over) is the highest in the Municipality (16.5%) and the aging index is also high (110.1 %), higher than the general index of the city of São Paulo (57.3%)<sup>9,10</sup>.

The Lapa sub-municipality covers an area of 40.57 km<sup>2</sup> of the city of São Paulo<sup>8</sup>, with 96.7% of households with sewage collection network and only 8.3% of the population living in favelas; 8.5% of family heads of households have less than three years of schooling and 21.5% of the population has a family income of less than Brazilian 190 dollars<sup>9,10</sup>.

Regarding epidemiological indicators, gross

birth rate values are similar in all regions of the Municipality, with 15.2 live births/1,000 inhabitants in the Midwest region<sup>9,10</sup>. There is no similarity in gross mortality rates, and the Midwest region has the highest rate in the municipality (8.05 deaths/1,000 inhabitants).

Infant mortality rate has been decreasing over the years in all regions of the city of São Paulo, with the Midwest region recording the lowest rate (8.9 deaths/1,000 live births)<sup>9,10</sup>. The age-standardized mortality rate for cerebrovascular disease and diabetes mellitus is 27.3 deaths/100,000 inhabitants. The proportion of deaths is 11.4/100,000 inhabitants and the mortality rate by homicide is 10.3 deaths/100,000 inhabitants, the lowest among all the regions of the Municipality<sup>9,10</sup>.

In 2011, the Lapa sub-municipality had three Family Health Facilities (USF), in which the study was performed. The study population consisted of the families serviced by the Family Health teams of the Lapa sub-municipalities. Inclusion criteria were family enrolled in the facility and someone staying at home at the time of the interview to answer on behalf of the family. Exclusion criteria of the study were to be enrolled in the facility, but not residing with the family at the registered address; no one found at home after two attempts; families considered “weekenders” because they do not stay at home during facility’s working hours.

Based on the prevalence of vulnerability of 30%, error of  $\pm 10\%$ ,  $\alpha = 5\%$  and power of 80%, it was estimated that a sample of 138 families would be necessary. In order to draw a sample of the sample among the registered families, we decided to double the size of the sample to cater for any losses, totaling a draw of 276 families, of which 248 were interviewed. We performed a systematic probability sampling and databases of the Primary Health Care Information System (SIAB) were obtained in February 2011 from the facilities of the Lapa region for the draw. Variables selected from the SIAB database were the team number, the micro-area number, the family register number and the number of people in the household. After selecting these variables in the database of each facility, databases of the three facilities of the region were consolidated and a systematic drawing of the family register was made, sorting the draw list according to the team number, the micro-area number and the number of people in the household.

The detailed FVI-DD description and validation are available in a previous publication<sup>8</sup>.

Briefly, the exploratory factorial analysis resulted in 7-component index. The clustering of these components resulted in the final index that obtained good internal consistency, evaluated by the Cronbach’s alpha coefficient and evidenced concurrent and discriminant validity through Katz and Lawton scales.

This study shows a review of the seven proposed factors, gathering variables related to the same theme. Factor 1 refers to favorable social conditions; Factors 2 and 3 refer to the issues of aging and chronic diseases, and so we decided to create another factor that is the sum of these two (2 + 3), which has been called factor 23. Factors 4 and 6 are related to unfavorable social conditions; therefore, it was also decided by their grouping, which resulted in factor 46 from the sum of these two factors. The remaining two factors, 5 and 7, were also grouped, since they both refer to social relationships (network and social support), making up factor 57. The index was then composed of four factors, namely:

- Factor 1: Favorable social conditions (Factor 1)
- Factor 23: Aging and chronic diseases (Factors 2 and 3)
- Factor 46: Unfavorable social conditions (Factors 4 and 6)
- Factor 57: Social relationships (Factors 5 and 7)

Thenceforth, the indices based on the sum of the variables defined in each factor were calculated. After calculating indices, we used Cronbach’s alpha coefficient to analyze its internal consistency. In this study, coefficients above 0.70<sup>11</sup> will be considered satisfactory.

The validation of these new proposed factors in relation to dependence was made through discriminant and concurrent validity. In the discriminant validity analysis, we compared the means of indicators, analyzing the families with and without dependents. For this definition, we applied Katz Index and Lawton’s Scale to all family members. Families with any classification in the Katz Index, except letter “A” (independence for all activities) and scores lower than 27 on the Lawton Scale were considered dependent. We used Mann-Whitney’s test in this analysis.

In the analysis of concurrent validity, we calculated Spearman’s correlation coefficient between Katz and Lawton scales’ indicators and scores. In view of the result, a cutoff point was established for vulnerability through the ROC curve for the factor that, on a stand-alone basis, had better performance in the validity tests (val-

idated for both Katz and Lawton scales). Thus, we sought to create a specific score for this social or health factor, which will make the index more specific in relation to which aspect (social or health) the family is more vulnerable.

The significance level used for this study was  $p < 0.05$ . Data processing was done using SPSS Software 15.0 (Statistical Package for the Social Sciences).

The Ethics Committees of the Nursing School and the São Paulo Municipal Health Secretariat approved the study. In accordance with Resolution 196/96, we informed participants about the objectives of the research and data confidentiality and they signed an informed consent form in agreement.

## Results

### Description of factors

Table 1 shows that the internal consistency of the four factors, even when grouped, can be considered good, since Alpha is equal to or greater than 0.73.

### Validation of indicators in relation to dependence through discriminant validity

Factor 23 (Aging and chronic diseases) identified families with and without dependence for the Basic Activities of Daily Living (BADL). Means of these factors were always higher in families with people with dependence ( $p < 0.01$ ), as shown in Table 2.

For instrumental activities of daily living (IADL), we verified that both factors 23 and 46 identified families with and without dependence. Factor 23 had higher means in families with people with dependence ( $p < 0.01$ ). Factor 46, on the other hand, had a higher mean in families without people with dependence (Table 3).

### Validation of indicators in relation to dependence through concurrent validity

Table 4 shows the correlation of FVI-DD factors with the Katz Index and the Lawton Scale scores, using Spearman's correlation. We observed that factor 23 had a statistically significant weak positive correlation with the Katz index ( $r = 0.33$ ;  $p < 0.01$ ), indicating that the higher the factor score (greater vulnerability), the higher the score in the Index (greater dependence). The correlation was moderate negative with the Lawton Scale ( $r = -0.58$ ;  $p < 0.01$ ); therefore, the higher the factor 23 score (greater vulnerability), the lower the score on the Scale (greater dependence).

Factor 46 had a statistically significant weak positive correlation only with the Lawton Scale ( $r = 0.21$ ,  $p < 0.01$ ), indicating that the higher the factor score (greater vulnerability), the higher the score on the Scale (lower dependence).

In light of the above, we verified that factor 23 was validated with good internal consistency in relation to the Katz Index and the Lawton Scale, while factor 46 was only validated in relation to the Lawton Scale.

Factor 23 had a better performance than the other factors because it correlated significantly with both Katz and Lawton scales, while factor 46 was significantly correlated only with the Lawton Scale. Factors 1 and 57 were not validated in relation to the Scales.

In view of these results, we propose that the analysis be done in two ways: one by means of the Total Index, validated in a previous study, which will be called Total FVI-DD, consisting of the clustering of all factors (1+23+46+57), in which factors 1, 46 and 57 refer to social conditions (SC) and factor 23, to health conditions (HC).

One can also analyze separately factor 23 that evaluates the health conditions and that henceforth will be called Dimension HC. Thus, the FVI-DD will be structured as follows: Total FVI-DD = Dimension HC + Dimension SC, with Di-

**Table 1.** FVI-DD descriptive statistics. São Paulo, 2011.

Factors	Cronbach's Alpha	Mean (SD)	Median	Min-Max
1 - Favorable social conditions	0.86	5.31(3.30)	5.00	0-11
23 - Aging and chronic diseases	0.84	5.53(3.90)	5.00	0-15
46 - Unfavorable social conditions	0.73	1.21(1.60)	0.00	0-6
57 - Social relationships	0.77	3.28(2.74)	3.00	0-13

**Table 2.** Descriptive statistics of the FVI-DD indicators, by existing dependence for the basic activities of the daily life under the Katz Index. São Paulo, 2011.

Factors	Dependence (KATZ)				
	There are no people with dependence in the family		There is at least one person with dependence for BADL		
	Mean	SD	Mean	SD	p#
1 - Favorable social conditions	5.27	3.25	5.70	3.76	0.59
23 - Aging and chronic diseases	5.09	3.71	9.78	3.25	< 0.01*
46 - Unfavorable social conditions	1.23	1.59	1.04	1.74	0.45
57 - Social relationships	3.32	2.70	2.96	3.07	0.33

# Mann-Whitney's Test. \* Statistically-significant difference ( $p < 0.05$ ).

**Table 3.** Descriptive statistics of FVI-DD factors, by existing dependence for the instrumental activities of the daily life under Lawton's Scale. São Paulo, 2011.

Factors	Dependence (LAWTON)				
	There are no people with dependence in the family		There is at least one person with dependence for IADL		
	Mean	SD	Mean	SD	p#
1 - Condições sociais favoráveis	5.12	3.28	5.96	3.31	0.09
23 - Envelhecimento e doenças crônicas	4.26	3.14	9.98	2.96	< 0.01*
46 - Condições sociais desfavoráveis	1.36	1.65	0.67	1.28	< 0.01*
57 - Relações sociais	3.32	2.67	3.16	3.00	0.45

# Mann-Whitney's Test. \* Statistically-significant difference ( $p < 0.05$ ).

**Table 4.** Spearman's correlation coefficients ( $r_{sp}$ ) between the FVI-DD and Katz and Lawton mean scores. São Paulo, 2011.

Factors	Katz Mean Score $r_{sp}(p)$	Média de Pontuação Lawton $r_{sp}(p)$
$r_{sp}(p)$	Lawton Mean Score	-0.12 (0.06)
$r_{sp}(p)$	0.33 (< 0.01)*	-0.58 (< 0.01)*
46 - Unfavorable social conditions	-0.06 (0.39)	0.21 (< 0.01)*
57 - Social relationships	-0.06 (0.34)	0.04 (0.50)

\* Statistically significant correlation ( $p < 0.05$ ).

mension HC consisting of components "Aging, disabilities and dependence" and "Chronic diseases", and Dimension SC consisting of components "Favorable living conditions", "Unfavorable living conditions", "Social network" and "Social support".

Thus, the final instrument consists of two dimensions, six components and 50 indicators. The response options are still YES or NO, and the score will be 1 if the response shows greater vulnerability, and zero in cases of lower vulnerability.

#### Establishing cutoff points for Dimension HC

For the Total FVI-DD and for Dimension HC, the higher the value, the worse the condition. However, it would be interesting to have cutoff points to classify the family as vulnerable or not, both by Total FVI-DD and by Dimension HC.

We used the Lawton Scale-based ROC curve to define the cutoff points. With regard to Total FVI-DD, the ROC curve obtained area = 0.769 ( $p < 0.01$ ) and cutoff point 15 showed sensitivity of

0.80 and specificity of 0.54. Thus, we defined the vulnerable family for disability and dependence as the one scoring 15 or more points in Total FVI-DD.

For the definition of Total Dimension HC cutoff point, the ROC curve obtained area = 0.896 ( $p < 0.01$ ) and cutoff point 6 showed sensitivity of 0.93 and specificity of 0.69. Thus, we defined the vulnerable family for disabilities and dependence as one scoring 6 or more points in Dimension HC.

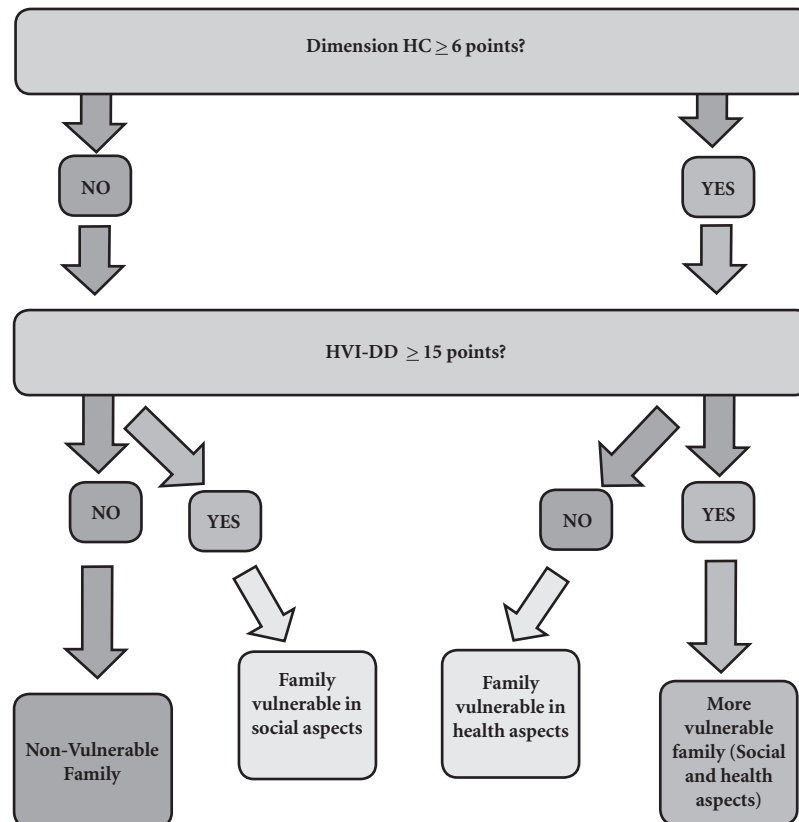
There is therefore a cutoff point for Total FVI-DD and another for Dimension HC. If the family is deemed vulnerable by the Total FVI-DD score, but is not vulnerable by the cutoff point of Dimension HC, we can consider that this family is more vulnerable under social rather than health aspects. Likewise, families that are not considered vulnerable by the cutoff point of Total FVI-DD, but are so by the cutoff point of Dimension HC, will be deemed vulnerable to health conditions and not vulnerable to social conditions. Non-vul-

nerable families will be those below the cutoff point in both the Total FVI-DD and Dimension HC. In turn, families considered most vulnerable will be those that score above the cutoff point in both the FVI-DD and Dimension HC. Figure 1 illustrates these possibilities.

## Discussion

The results of FVI-DD validation tests indicated that factor 23, related to aging and chronic diseases was validated with good internal consistency in relation to the Katz index and Lawton's Scale, while factor 46 (Unfavorable social conditions) was validated only in relation to the Lawton Scale. Factor 23 had better performance in relation to other factors, since it correlated significantly with both Katz and Lawton scales.

Factors 1 and 57, related to social relationships, were the only ones that were not validated for disabilities and dependence, possibly due to



**Figure 1.** Flowchart representation of the evaluation and classification of families through the application of the Total FVI-DD and Dimension HC.



the variability of social relationships that can be positively or negatively affected by the conditions involved in the genesis of disabilities and dependence and the nature of preexisting relationships. The family, the main support social network, as a protective health resource, is already well established, but one must also consider the other side of these relationships, which can generate tensions and conflicts<sup>12</sup>.

Given the most significant performance of Dimension HC in the validity tests, we decided to highlight it in the vulnerability assessment and we defined the cutoff points.

Considering the multidimensionality of the phenomenon of vulnerability, resulting from a complex interaction of conditions, the use of a single score might not express the different situations that affect families. Since dimensions underlying the FVI-DD evaluate different phenomena (social and health), a single score could conceal different situations of vulnerability, such as families that are socially vulnerable to disabilities and dependence and others whose vulnerability is predominantly due to health conditions. With the definition of a cutoff point for the Total Index and another for the Dimension HC, it was possible to identify the dimensions of vulnerability to disabilities and dependence between families.

In a study carried out by Maia<sup>13</sup>, associations were found between physical and social vulnerabilities, in which the socially vulnerable elderly were more likely to become physically vulnerable and the physically vulnerable were more likely to become socially vulnerable. In addition, the physically vulnerable elderly individuals had greater distribution in the average, high and very high social vulnerability.

When evaluating factors associated with home care received by the elderly population, researchers noted that the likelihood of receiving home care in the ESF is greater with age, illiteracy and functional disability. The likelihood of receiving home care was 3.2 times higher in the IADL<sup>14</sup>. Regarding CNCDs, a study published in the Lancet in 2011<sup>2</sup>, indicated that the morbidity and mortality of these diseases was higher in the poor population.

A longitudinal study conducted in the United States found that there was no difference in the care received among the different disability groups. However, in relation to sociodemographic aspects, non-whites with lower income were less likely to receive care<sup>15</sup>.

Given the importance of considering social determinants in health assessment, the proposed

verification of families vulnerability is not only to use a set of indicators related to dependence to classify them, but also to provide a tool that helps professionals capture information, from different perspectives to compose a setting that shows the potential empowerment and wear in families.

In 2013, the Brazilian Ministry of Health (MS) published the "Guidelines for the care of people with chronic diseases in health care networks and in priority care lines"<sup>16</sup> (*English free translation of the title in Portuguese*), and one of the objectives of the organization of the network of care for people with chronic diseases is to contribute to promote the health of the population and prevent the development of chronic diseases and their complications. The chronic conditions care model (MACC) proposed by Mendes<sup>17</sup> is composed, among others, of levels of health promotion and prevention of chronic diseases; at these intervention levels, focus is on social determinants, behaviors and lifestyles<sup>17</sup>.

In carrying out an integrative review on the family approach in ESF, authors noted the lack of studies on this topic and indicate the need and importance of working with the family as an object of care to health care in ESF<sup>18</sup>. The FVI-DD intends to expand the object of care to verify the vulnerability of individuals living in the household, the family.

According to Barata<sup>19</sup>, one of the main methodological challenges for social epidemiology is to carry out population studies that allow appropriate consideration of contextual effects and compositional effects. In addition, the author also highlights the challenge of adequately measuring social aspects and questions whether it is possible to continue using the same tools of "risk factors" without breaching the theoretical assumptions of social epidemiology.

When analyzing the concept of vulnerability to the construction of knowledge in collective health, Sánchez and Bertolozzi<sup>20</sup> consider that studies that restrict analysis from a multifactorial perspective and hide the complex causes of disease determination should be overcome.

The final index consists of social conditions of empowerment (access to durable goods, schooling, employment and income) and wear (illiteracy and poverty). In addition, health conditions are addressed not only in the biological sphere but also in access to health services, health self-assessment and the existence of vulnerable groups, such as the elderly.

Despite the use of statistics to define indicators and the use of cutoff points for household

classification, it is not a risk assessment tool, given the methodological approach used for the election of the indicators and the combination of evaluation indicators of the social development of families aggregated to the specific indicators for the assessment of vulnerability to disabilities and dependence, a condition that is expressed a priori in the biological sphere.

However, the limitation of this study is that the FVI-DD was constructed and tested in a certain location of the city of São Paulo. It is necessary to test it with other populations, in regions with different vulnerabilities, in order to verify if it sustains its psychometric properties and improve its indicators.

### **Collaborations**

F Amendola - responsible for the preparation and writing of all stages of the study, as well as participation in data collection. MRDO Latorre - contributions in the study design, method and data analysis. MRM Alvarenga - contributions in the method and discussion of data. MAC Oliveira - responsible for the orientation of the work, correction of all stages of the study and final review.



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