

## Comparison of measured and estimated height in the elderly with different functional classifications

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### Abstract

One of the effects of aging on the body is the reduction of height, which may overestimate the body mass index (BMI). It is hypothesized that frail elderly people are more affected by this decline in height, however this is not clear in the literature. The aim of this study was to compare the measured and estimated height and the BMI derived from measured and estimated measurements, in the elderly according to the functional classification. A cross-sectional study with secondary data was carried out with elderly people in outpatient care, classified as robust, at risk of fragility, and fragile. Estimated height was calculated from knee height and estimated BMI with the estimated height. In the statistical analysis, ANOVA test and the Hochberg's GT2 test were applied, when comparing the 3 categories of functionality. The sample consisted of 116 elderly people with a mean age of 83.6 (8.5), mostly women 73.0 (62.9%), and classified as robust 54.0 (46.6%). The difference found for height was 4.2 (5.2), 4.6 (4.9), 7.1 (5.3) cm respectively for the robust, at risk of fragility, and fragile. The difference between the robust and the fragile was significant ( $p=0.033$ ). A similar result was obtained by assessing the difference between BMIs ( $p=0.019$ ). The study showed that frail elderly people have greater differences between measured and estimated height, in comparison with robust people, suggesting that frail elderly people have more height impairment, which can directly impact nutritional diagnosis. Caution is suggested in the use of measured height in the elderly, particularly in the frail.

**Palavras-chave:** Height; Elderly; Fragility; Healthy aging.

### INTRODUCTION

Measured height and weight represent the main anthropometric measures used in the assessment of nutritional status, mainly as components for the calculation of body mass index (BMI), although the accuracy of BMI is being questioned in clinical practice<sup>1</sup>, especially in the elderly<sup>2</sup>. In senescence, changes in body composition occur that

cannot be detected by BMI, such as a reduction in muscle tissue, body water, bone mineral density, subcutaneous adipose tissue, and accumulation of fat in the central and intramuscular region<sup>2,3,4,5</sup>; changes that are often masked when body weight remains stable or increases<sup>6</sup>.

On the other hand, BMI continues to be

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widely used in the evaluation of malnutrition and obesity due to its practicality, low cost, and relationship with chronic non-communicable diseases, including in the elderly. The Global Leadership Initiative on Malnutrition (GLIM) recently published a global consensus of indicators for assessing malnutrition in the clinical practice of adults and the elderly and included low BMI as a phenotypic criterion to be considered in diagnosis<sup>7</sup>.

Thus, measures of weight and height must be reliable in order to avoid bias distortions in the calculation of BMI. One of the factors that can influence the result of this index is the reduction in height that happens throughout life<sup>8,9,10</sup>. Deformities in the spine associated with changes in bone metabolism in the vertebrae can cause a reduction in height as one ages. It is estimated that there is an average loss of 1 cm per decade starting from the age of 40<sup>7</sup>, although there is no consensus in the literature regarding these changes. Longitudinal studies suggest that the reduction is greater in women (5 cm) than in men (3 cm) up to 70 years of age, but in octogenarians the differences between the sexes are less significant<sup>10,11</sup>.

The literature suggests that the existing differences between the estimated and measured height in the elderly occur due to the decrease in height<sup>12,13,14</sup>, and although this is more pronounced with age<sup>10,11,15,16</sup>, the relationship with functional decline is not clear of this. As a consequence of the height reduction observed in the elderly, a false increase in BMI of 0.7 and 1.6 kg/m<sup>2</sup>, respectively, in men and women in their seventies, in the absence of significant weight changes, as well as 1.4- 1.5 and 2.5-2.6 kg/m<sup>2</sup> in octogenarian men and women, we can find respectively<sup>10</sup>. Therefore, in cases where the measured height is lower than the actual height, the BMI may overestimate overweight or underestimate malnutrition<sup>17,18</sup>.

Elderly people have different levels of functionality and the hypothesis is that anthropometric changes must be associated with different degrees of functionality. Robust elderly people are independent and autonomous individuals, without functional disability. Those considered at risk of frailty are the elderly who are independent and autonomous; however, they have chronic health conditions, such as sarcopenia or multiple comorbidities that induce functional decline<sup>19</sup>. The frail elderly have an established functional decline, are partially or totally dependent, and have a loss of autonomy due to the presence of single or multiple disabilities<sup>19,20</sup>.

Therefore, it is important to look for ways to predict height that are not affected by compression of the vertebral discs and postural problems present in the elderly. One way is to estimate height by measuring knee height<sup>12,17,18,21,22,23,24</sup>, a quick method that is easy to apply, as it uses only one measurement and can be performed on an individual with standing and walking difficulties, and practically does not change with age<sup>11</sup>. Other methods of estimating height such as self-reported and demispan height are available but have some limitations. The literature shows that self-reported height tends to be overestimated in the elderly<sup>9</sup>. On the other hand, demispan, in addition to overestimating height, is not applicable in individuals with chronic pain and movement limitations in the upper limbs, conditions that are common in the elderly<sup>25, 26,27</sup>, especially in the fragile.

In view of the scarcity of studies found evaluating the estimated height in elderly people according to the classification of their functionality, and based on the hypothesis that frail elderly people have greater height decline when compared to non-frail elderly people, this study aimed to compare height and BMI derived from measured and estimated height in the elderly.

## METHODOLOGY

### Study design

This was a cross-sectional study with secondary data, carried out with individuals seen at the multiprofessional outpatient clinic of the Jenny de Andrade Faria Institute at the Hospital das Clínicas of the Federal University of Minas Gerais (UFMG), evaluated from May 2015 to April 2019. The study was approved by the Teaching and Research Management of Hospital das Clínicas, UFMG and by the Research Ethics Committee of the Federal University of Minas Gerais, under number 80295616.1.0000.5149.

### Participants

The sample consisted of individuals of both sexes, non-institutionalized, aged 60 years or older. Elderly people classified as robust, at risk of fragility, and fragile, according to the Visual Clinical-Functional Fragility Scale<sup>19</sup>, were included. The use of this method is consistent with the World Health Organization's International Classification of Functionality (ICF) which emphasizes functionality.

This scale is based on functionality (dependence or independence for basic instrumental, or advanced activities of daily living) and the presence of risk factors for functional decline, diseases, and comorbidities. The elderly were classified into strata (1 to 10) considering the progressive reduction in vitality associated with the progressive increase in frailty, as well as in 3 categories (robust elderly, elderly at risk of frailty, and frail elderly). Robust elderly people comprise strata 1 to 3, those at risk of fragility, strata 4 and 5, and the fragile strata 6 to 10<sup>19</sup>.

The robust elderly are those who are functionally independent, who may or may not have diseases. The elderly at risk of frailty, are in a dynamic state between senescence

and senility, resulting in the presence of imminent functional decline. Fragile elderly people have reduced homeostatic reserve and/or the ability to adapt to biopsychosocial aggressions and, consequently, reduced autonomy and independence<sup>19</sup>.

The study excluded individuals whose physical condition did not allow a complete anthropometric assessment, with edema and amputations, and individuals with incomplete anthropometric data.

### Variables and measurements

Demographic, health, and anthropometric data were collected from nutrition records. Regarding demographic variables, age, sex, and education (in years of study) were analyzed. For health variables, the classification of functionality and the main health problems were assessed. The functional classification of the elderly according to the Visual Clinical-Functional Frailty Scale, described above, was categorized into robust, at risk of fragility, and fragile<sup>19</sup>. Concerning health problems, the most prevalent diseases in the studied sample were evaluated.

Regarding anthropometric measurements, data on height, weight, and knee height were collected. Height was measured on a stadiometer coupled to a Balmak® mechanical scale, the ruler rod was positioned on top of the individual's head. Their head was in the Frankfurt position, upright within the elderly's possibilities, with the palms of the hands turned toward the body, with legs and feet parallel and bare<sup>28</sup>. Weight was measured with the individual standing, positioned in the center of the base of the scale and barefoot<sup>28</sup>. The knee height was obtained from the left leg with the individual sitting in a chair, with both knees and ankles flexed at 90° using an inextensible measuring tape, with a precision of 1mm positioned from the heel to the upper edge of the patella<sup>28</sup>. The height estimated in centimeters was obtained using the formulas described in Chart 1.

Gender	Formula
Male	$(2.02 \times \text{knee height}) - (0.04 \times \text{age (years)}) + 64.19$
Female	$(1.83 \times \text{knee height}) - (0.24 \times \text{age (years)}) + 84.88$

**Table 1** – Formulas by Chumlea et al. (1985) for the elderly over 60 years<sup>22</sup>.

BMI was calculated by dividing weight in kilograms by height in meters, squared. The cutoff points adopted were those proposed by Lipschitz for the elderly, underweight (<22 kg/m<sup>2</sup>), normal weight (22-27 kg/m<sup>2</sup>) and overweight (>27 kg/m<sup>2</sup>)<sup>29</sup>. The estimated BMI was calculated from the measured weight and the estimated height.

### Statistical analysis

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS Inc., Chicago, Illinois, United States) version 19.0. Continuous variables were tested for normality using the Shapiro-Wilk test and the homogeneity of variances using the Levene test. All variables studied showed normal distribution. Quantitative variables were described as mean and standard

deviation when symmetric, and median and interquartile range when asymmetric. Categorical variables were described in absolute and relative frequency. The independent quantitative variables were compared between measured and estimated height as well as measured and estimated BMI by Student's t-test for independent samples. Categorical variables were compared between BMI categories using Pearson's chi-squared test or Fisher's exact test, according to the proportion of expected frequencies less than 5. The analysis of variance comparing the differences between height and BMI (both measured and estimated) according to the three categories of functionality, was carried out through the analysis of variance test (ANOVA) and Hochberg's GT2 test of multiple comparisons of means. Values of  $p < 0.05$  were considered significant.

## RESULTS

The sample consisted of 116 elderly people, the majority of whom were female 73 (62.9%). The individuals' age ranged from 63 to 107 years with a mean of 83.6 (8.5) years. Most elderly people were classified as robust 54 (46.6%) and 77 (67.0%) had systemic arterial hypertension (Table 1).

As shown in table 2, the estimated height was greater than that measured in all categories

of functionality, ( $p < 0.001$ ). The difference in BMI was also significant, however the BMI calculated with estimated height was lower than the BMI calculated with measured height, in all categories of functionality ( $p < 0.001$ ).

The difference found for height was 4.2 (5.2), 4.6 (4.9), 7.1 (5.3) centimeters (cm), respectively for the robust, at risk of fragility, and fragile elderly. The difference being

between robust and fragile elderly was significant ( $p=0.033$ ). A similar result was obtained by assessing the difference between

BMI calculated with measured and estimated height measurements ( $p=0.019$ ), as shown in Table 3.

**Table 1** – Characteristics of the elderly population studied. Belo Horizonte, MG, 2015-2019.

Studied variables	Studied elderly
<b>Age according to functionality Mean (SD)</b>	
Robust	85.9 (5.6)
Risk of Fragility	88.5 (6.8)
Fragile	77.0 (9.1)
<b>Gender N (%)</b>	
Male	43 (37.1)
Female	73 (62.9)
<b>Complete years of schooling Mean (SD)</b>	
2.9 (3.8)	
<b>Functionality N (%)</b>	
Robust	54 (46.6)
Risk of Fragility	24 (20.7)
Fragile	38 (32.7)
<b>Main health problems N (%)</b>	
Systemic arterial hypertension	77 (67.0)
Diabetes Mellitus	27 (23.3)
Neurological Diseases	21 (18.1)
Osteoporosis	21 (18.1)
Joint disease	12 (10.3)

DP: desvio padrão; N: número

**Table 3** – Distribution of differences between estimated and measured heights, and difference between estimated and measured BMIs, according to the functionality of the elderly. Belo Horizonte, MG, 2015-2019.

Functionality	Height Difference	P-Value <sup>1</sup>	BMI difference	P-Value <sup>1</sup>
Robust <sup>a</sup>	4.2 (5.2)	0.033	-1.7 (1.7)	0.019
Risk of Fragility <sup>a</sup>	4.6 (4.9)		-1.0 (2.2)	
Fragile <sup>a</sup>	7.1 (5.3)		-2.4 (3.1)	

BMI, body mass index. a) mean (standard deviation). 1-ANOVA test and Hochberg's GT2 test of multiple comparisons of means indicated a significant difference between the robust and the fragile, both in height and BMI differences.

**Table 2** – Distribution of averages of the measured and estimated heights, and measured and estimated BMIs, according to the functionality of the elderly. Belo Horizonte, MG, 2015-2019.

Functionality	n	Height measured <sup>a</sup> (cm)	Height estimated <sup>a</sup> (cm)	P Value <sup>1</sup>	BMI measured <sup>a</sup> Kg/m <sup>2</sup>	BMI measured <sup>a</sup> Kg/m <sup>2</sup>	P Value <sup>1</sup>
Robust	54	153.2 (8.4)	157.4 (9.3)	<0.001	26.4 (4.1)	25.1 (4.4)	<0.001
Risk of Fragility	24	151.9 (11.0)	156.5 (10.3)	<0.001	23.2 (4.6)	21.8 (4.2)	<0.001
Fragile	38	152.6 (8.7)	159.7 (7.8)	<0.001	26.5 (7.7)	24.2 (6.7)	<0.001

BMI, body mass index. a) mean (standard deviation). 1- Student's t-test. Measured BMI calculated with measured weight and height data. Estimated BMI calculated with measured weight and estimated height.

**Table 4** – BMI classification as thin and overweight, according to the functionality of the elderly. Belo Horizonte, MG, 2015-2019.

Functionality	N	Thin			Overweight		
		BMI measured <sup>a</sup>	BMI estimated <sup>a</sup>	P value <sup>1</sup>	BMI measured <sup>a</sup>	BMI estimated <sup>a</sup>	P Value <sup>1</sup>
Robust	54	10 (18.5)	13 (24.1)	<0.001	26 (48.1)	17 (31.5)	<0.001
Risk of Fragility	24	7(29.2)	12 (50.0)	<0.001	4 (16.7)	3(12.5)	<0.001
Fragile	38	13 (34.2)	14 (36.8)	<0.001	17 (44.7)	14 (36.8)	<0.001

a) number (percentage). 1- Chi-squared test.

## DISCUSSION

The present study shows that the estimated height differed from the measured height, with the estimated average height being greater than the measured one, a finding that is similar to that of other studies that used the same height estimation methodology as this study<sup>13,14</sup>. The work of Closs *et al.*<sup>13</sup> evaluated elderly people aged 60 to 93 years and found an average difference between the estimated and measured height of +3 cm. Fogal *et al.*<sup>14</sup> found an average difference of +2 cm for females and found no difference between males.

Several factors can contribute to this difference. Malnutrition, sarcopenia, and osteoporosis are some examples. These disorders are caused, among others, by inadequate lifestyle and eating habits<sup>30</sup> that can, in the long term, directly or indirectly impact the postural control of the elderly, making the measured height not a reliable measurement.

In this study, the estimated heights were higher than those measured in all categories of functionality, however the difference was greater in the frail elderly (+ 7.1 cm) compared

to the robust elderly (+4.2 cm). As for the BMI, the estimated was lower than that derived from the measured height, mainly in the frail elderly (-2.4 kg/m<sup>2</sup>), in comparison with the robust (-1.7 kg/m<sup>2</sup>). The present study did not find other studies in the literature with this theme that took into account the functional classification of the elderly, a fact that makes it impossible to compare the results found.

However, understanding the different characteristics of these groups can help us evaluate the results found. Considering the Activities of Daily Living (ADLs), the robust individuals walk without difficulties and, therefore, they have no greater impediments to remain active. They usually have a dietary pattern that keeps them healthy and they display comorbidities of low complexity. The fragile, however, have a pronounced functional decline which makes them partially or totally dependent for basic, instrumental, and advanced ADLs. In general, they are not very active and are affected by diseases that directly impact their quality of life<sup>19,20</sup>. It is believed that these factors may justify the

significant difference found between the estimated and measured heights of these two functional categories of the elderly.

The literature shows that older elderly people have greater postural impairment than younger elderly people<sup>10,11,15</sup>. However, in this study it was found that the difference in height was more pronounced in the fragile, even the fragile elderly with a lower average age than the robust, suggesting that this is more related to frailty and not to the age of individuals. This corroborates with the statement that the reduction in height should not be explained only by senescence, but by deteriorated health conditions<sup>31</sup> present in fragile elderly people. Factors of a social, biological order and the individual's nutritional condition may positively or not interfere in the reduction of height with aging<sup>31</sup>.

In addition, 18% of the elderly people studied had osteoporosis and 34% of fragile elderly people had a measured BMI of less than 22.0 kg/m<sup>2</sup>, situations associated with a possible reduction in measured height<sup>31,32</sup>. With aging, men and women have a decrease in the synthesis of estrogen, a hormone that is related to bone mass health. In males, the decrease in this hormone occurs gradually and at older ages. In women, however, this reduction occurs abruptly soon after the onset of menopause<sup>32</sup>.

Thus, it is believed that the height measured in fragile elderly is not the appropriate measurement to be used in clinical practice, due to the difficulty to position them according to the recommends of the World Health Organization<sup>28</sup>. Fragile elderly people, usually, have difficulties to stand on the scale, need to spread their legs to maintain balance, and are unable to maintain their upright posture due to postural changes.

The difference found in the height of the

elderly reflected directly in the calculation of BMI. The measured BMI underestimated thinness in all functional categories. There was also an overestimation of overweight. Other studies have also found differences in BMI derived from estimated measurements<sup>14,15</sup>, but these did not consider the functionality of individuals, making it impossible to compare the results. Gavriilidou *et al.*<sup>15</sup> observed that the difference in BMI overestimated obesity in younger elderly people and underestimated for older elderly people. In the sample by Fogal *et al.*<sup>14</sup>, obesity was underestimated in women. This study attributes these differences to the postural changes present in the elderly, as previously discussed.

BMI remains a widely used tool in clinical practice for diagnosing malnutrition and obesity and helps in the diagnosis of sarcopenia, in addition to being used in equations to define drug doses<sup>7,33,34,35</sup>. Therefore, the diagnosis derived from the wrong BMI can harm the individual's health. There is a need for studies that propose formulas that estimate the stature of elderly Brazilians and that take into account the individual's functionality for more accurate results, thus, avoiding wrong nutritional diagnoses.

Some limitations must be considered in the present study. The formula used in this study was developed from a sample of Caucasian individuals. Studies show that there can be precision gaps when the formula is used in different populations<sup>14</sup>. Another limitation was that the sample made it impossible to subdivide the functionality categories by sex and age groups. The robust elderly, coming from the healthy aging clinic, have as inclusion criteria only elderly people aged over 80 years, so this functional category did not include younger elderly people.

## CONCLUSION

The estimated height was greater than that measured in all categories of functionality. The fragile elderly have greater differences between the measured and estimated heights, compared to the robust, suggesting that the fragile elderly have greater height impairment

which can directly impact the nutritional diagnosis. Caution is suggested in the use of the height measured in the elderly and the use of the estimated height in the assessment of nutritional status is recommended, particularly in the fragile elderly individuals.

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## Comparação da estatura aferida e estimada em idosos com diferentes classificações funcionais

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445

### Resumo

Um dos efeitos do envelhecimento sobre o organismo é a redução da estatura, podendo superestimar o índice de massa corporal (IMC). Hipotetiza-se que os idosos frágeis são mais afetados por este declínio estatural, no entanto isto não está claro na literatura. O objetivo desse estudo foi comparar a estatura aferida e estimada e, o IMC derivados de medidas aferidas e estimadas, em idosos de acordo com a classificação funcional. Estudo transversal com dados secundários, realizado com idosos em atendimento ambulatorial, classificados em robustos, em risco de fragilização e frágeis. A estatura estimada foi calculada a partir da altura de joelho e o IMC estimado com a estatura estimada. Na análise estatística, teste ANOVA e o teste Hochberg's GT2 foram aplicados, na comparação das 3 categorias de funcionalidade. A amostra foi composta por 116 idosos com média de idade 83,6 (8,5), maioria mulheres 73,0 (62,9%) e classificados como robustos 54,0 (46,6%). A diferença encontrada para estatura foi 4,2 (5,2), 4,6 (4,9), 7,1 (5,3) cm respectivamente para os idosos robustos, em risco de fragilização e frágeis ( $p=0,033$ ), sendo esta diferença entre os robustos e os frágeis. Resultado semelhante foi obtido avaliando-se a diferença entre os IMC's ( $p=0,019$ ). O estudo mostrou que os idosos frágeis têm maiores diferenças entre a estatura aferida e a estimada, em comparação com os robustos, sugerindo que os idosos frágeis têm mais comprometimento da estatura o que pode impactar diretamente no diagnóstico nutricional. Sugere-se cautela na utilização da estatura aferida em idosos particularmente nos frágeis.

**Palavras-chave:** Estatura; Idoso; Fragilidade; Envelhecimento saudável.

### INTRODUÇÃO

A estatura e o peso aferido representam as principais medidas antropométricas utilizadas na avaliação do estado nutricional, principalmente como componentes para o cálculo do índice de massa corporal (IMC), ainda que a acurácia do IMC esteja sendo questionada na prática clínica<sup>1</sup>, principalmente em idosos<sup>2</sup>. Na senescência ocorrem alterações na composição corporal não detectáveis pelo IMC, como a redução de tecido muscular, da água corporal, da

densidade mineral óssea, do tecido adiposo subcutâneo e acúmulo de gordura na região central e intramuscular<sup>2,3,4,5</sup>, alterações estas muitas vezes mascaradas quando o peso corporal se mantém estável ou aumenta<sup>6</sup>.

Por outro lado, o IMC continua sendo amplamente utilizado na avaliação da desnutrição e obesidade por sua praticidade, baixo custo e relação com doenças crônicas não transmissíveis, inclusive em idosos. Recentemente o Global Leadership

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Initiative on Malnutrition (GLIM) publicou um consenso global de indicadores para avaliação da desnutrição na prática clínica de adultos e idosos, e incluiu o baixo IMC como um critério fenotípico a ser considerado no diagnóstico<sup>7</sup>.

Assim, medidas de peso e estatura devem ser fidedignas para não haver vieses no cálculo do IMC. Um dos fatores que pode influenciar o resultado deste índice é a redução da estatura que acontece ao longo da vida<sup>8,9,10</sup>. Deformidades na coluna vertebral associadas às alterações no metabolismo ósseo nas vertebrae podem ocasionar redução na estatura ao envelhecer. Estima-se que haja uma perda média de 1 cm por década a partir dos 40 anos<sup>7</sup>, apesar de não haver consenso na literatura a respeito dessas alterações. Estudos longitudinais sugerem que a redução é maior em mulheres (5 cm) do que em homens (3 cm) até 70 anos, mas em octogenários as diferenças entre os sexos são menos significativas<sup>10,11</sup>.

A literatura sugere que as diferenças existentes entre a estatura estimada e aferida em idosos ocorrem em função da diminuição da estatura<sup>12,13,14</sup>, e apesar desta ser mais pronunciada com a idade<sup>10,11,15,16</sup>, não é clara a relação desta com o declínio funcional. Como consequência da redução da estatura observada em idosos pode-se ter um aumento falso no IMC de 0,7 e 1,6 kg/m<sup>2</sup>, respectivamente, em homens e mulheres septuagenários na ausência significativa de alteração de peso e de 1,4-1,5 e 2,5-2,6 kg/m<sup>2</sup> em homens e mulheres octogenários<sup>10</sup>. Sendo assim, em casos em que a estatura aferida é inferior a estatura real, o IMC pode superestimar o excesso de peso ou subestimar a desnutrição<sup>17,18</sup>.

Idosos apresentam diferentes níveis de funcionalidade e a hipótese é de que as alterações antropométricas devem estar associadas a diferentes graus de

funcionalidade. Idosos robustos são indivíduos independentes e autônomos, sem incapacidade funcional. Os considerados em risco de fragilização são os idosos, independentes e autônomos, porém, apresentam condições crônicas de saúde, como sarcopenia ou comorbidades múltiplas que induzem o declínio funcional<sup>19</sup>. Os idosos frágeis possuem declínio funcional estabelecido, são parciais ou totalmente dependentes e apresentam perda de autonomia, em função da presença de incapacidades únicas ou múltiplas<sup>19,20</sup>.

Portanto é importante buscar formas de predição de estatura que não sofram interferência da compressão dos discos vertebrais e de problemas posturais presentes em idosos. Uma forma é estimar a estatura por meio da medida da altura de joelho<sup>12,17,18,21,22,23,24</sup>, método rápido, de fácil aplicabilidade, pois utiliza apenas uma medida e pode ser realizada em indivíduo com dificuldade de ficar de pé e deambular e praticamente não altera com a idade<sup>11</sup>. Outros métodos de estimativa de estatura como estatura autorreferida e semi-envergadura estão disponíveis, porém possuem algumas limitações. A literatura mostra que a estatura autorreferida tem tendência a superestimação em idosos<sup>9</sup>. Já a semi-envergadura, além de superestimar a estatura, não é aplicável em indivíduos com dor crônica e limitações de movimento em membros superiores, condições essas comuns em idosos<sup>25,26,27</sup>, principalmente nos frágeis.

Diante da escassez de estudos encontrados avaliando a estatura estimada em idosos de acordo com classificação de sua funcionalidade, e a partir da hipótese de que idosos frágeis tem maior declínio estatural quando comparados a idosos não frágeis, este estudo teve como objetivo comparar a estatura e o IMC derivados de medidas aferidas e estimadas em idosos.

## METODOLOGIA

### Desenho do estudo

Trata-se de um estudo transversal com dados secundários, realizado com indivíduos atendidos no ambulatório multiprofissional do Instituto Jenny de Andrade Faria do Hospital das Clínicas da Universidade Federal de Minas Gerais (UFMG), avaliados no período de maio 2015 a abril de 2019. Este estudo foi aprovado pela Gerência de Ensino e Pesquisa do Hospital das Clínicas da UFMG e pelo Comitê de Ética em Pesquisa da Universidade Federal de Minas Gerais, sob o número 80295616.1.0000.5149.

### Participantes

A amostra foi composta por indivíduos de ambos os sexos, não institucionalizados, com idade maior ou igual a 60 anos. Foram incluídos idosos classificados como robustos, em risco de fragilização e frágeis segundo a Escala Visual de Fragilidade Clínico-funcional<sup>19</sup>. A utilização desse método está em coerência com a Classificação Internacional de Funcionalidade (CIF) da Organização Mundial de Saúde cuja ênfase deve ser na funcionalidade.

Essa escala baseia-se na funcionalidade (dependência ou independência para atividades básicas, instrumentais ou avançadas de vida diária) e na presença de fatores de risco para o declínio funcional, doenças e comorbidades. Os idosos são classificados em estratos (1 a 10) considerando-se a redução progressiva da vitalidade associada ao aumento progressivo da fragilidade e em 3 categorias (idoso robusto, idoso em risco de fragilização e idoso frágil). Os idosos robustos compreendem os estratos de 1 a 3, os em risco de fragilização, os estratos 4 e 5, e os frágeis os estratos de 6 a 10<sup>19</sup>.

Os idosos robustos são aqueles independentes funcionais, que podem apresentar doenças ou não. Os idosos em risco de fragilização são independentes funcionais, todavia, encontram-se em um estado dinâmico entre senescência e senilidade, resultando

na presença de declínio funcional iminente. Os idosos frágeis apresentam redução da reserva homeostática e/ou da capacidade de adaptação às agressões biopsicossociais e, conseqüentemente redução da autonomia e independência<sup>19</sup>.

Foram excluídos do estudo os indivíduos cuja condição física não permitiu realizar avaliação antropométrica completa, com edema e amputações e idosos com dados antropométricos incompletos.

### Variáveis e medidas

Os dados demográficos, de saúde e antropométricos foram coletados dos prontuários de nutrição. Em relação às variáveis demográficas analisaram-se idade, sexo e escolaridade (em anos de estudo). Para as variáveis de saúde, avaliaram-se a classificação da funcionalidade e os principais problemas de saúde. A classificação funcional dos idosos de acordo com a Escala Visual de Fragilidade Clínico-funcional, descrita acima, foi categorizada em: idosos robustos, em risco de fragilização e frágeis<sup>19</sup>. Quanto os problemas de saúde foram avaliados as doenças de maior prevalência na amostra estudada.

Em relação às medidas antropométricas, foram coletados dados de estatura, peso e altura do joelho. A estatura foi aferida em estadiômetro acoplado em uma balança mecânica da marca Balmak ®, a haste da régua foi posicionada no topo da cabeça do indivíduo, a cabeça em posição de Frankfurt, posição ereta dentro das possibilidades do idoso, com as palmas das mãos voltadas para o corpo, pernas e pés paralelos e descalços<sup>28</sup>. O peso foi aferido com o indivíduo de pé, posicionado no centro da base da balança e descalço<sup>28</sup>. A altura do joelho foi obtida da perna esquerda com o indivíduo sentado em cadeira, com os dois joelhos e tornozelos flexionados a 90° utilizando fita métrica inextensível, com precisão de 1mm posicionada do calcanhar à borda superior da patela<sup>28</sup>. A estatura estimada em centímetros foi obtida por meio das fórmulas descritas no Quadro 1.

Sexo	Fórmula
Maculino	$(2,02 \times \text{altura do joelho}) - (0,04 \times \text{idade (anos)}) + 64,19$
Femino	$(1,83 \times \text{altura do joelho}) - (0,24 \times \text{idade (anos)}) + 84,88$

**Quadro 1** – Fórmulas de Chumlea et al. (1985) para idosos acima de 60 anos<sup>22</sup>.

O cálculo do IMC foi realizado a partir da divisão do peso em quilogramas pela estatura em metros, elevada ao quadrado. Os pontos de corte adotados foram os propostos por Lipschitz para idosos, baixo peso ( $<22 \text{ kg / m}^2$ ), normal ( $22-27 \text{ kg / m}^2$ ) e sobrepeso ( $> 27 \text{ kg / m}^2$ )<sup>29</sup>. O IMC estimado foi calculado a partir do peso aferido e da estatura estimada.

#### Análise estatística

A análise de dados foi realizada por meio do Statistical Package for the Social Sciences (SPSS Inc., Chicago, Illinois, Estados Unidos) versão 19.0. As variáveis contínuas foram testadas quanto a sua normalidade por meio do teste de Shapiro-Wilk e a homogeneidade das variâncias pelo teste de Levene. Todas as variáveis estudadas apresentaram distribuição normal. As variáveis quantitativas foram descritas em

média e desvio padrão quando simétricas e mediana e intervalo interquartil quando assimétricas. As variáveis categóricas foram descritas em frequência absoluta e relativa. As variáveis quantitativas independentes foram comparadas entre estatura aferida e estimada e IMC aferido e estimado pelo teste t de Student para amostras independentes. As variáveis categóricas foram comparadas entre as categorias de IMC pelo teste de Qui-quadrado de Pearson ou Exato de Fisher, de acordo com a proporção de frequências esperadas menores que 5. A análise de variância comparando as diferenças entre as estaturas e IMC's (ambos aferidos e estimado) segundo as três categorias de funcionalidade, foi realizada por meio do teste de análise de variância (ANOVA) e teste de múltiplas comparações de médias Hochberg's GT2. Consideraram-se significativos valores  $p < 0,05$ .

## RESULTADOS

A amostra foi composta por 116 idosos, sendo a maioria do sexo feminino 73 (62,9%). A idade dos indivíduos variou de 63 a 107 anos com média 83,6 (8,5) anos. A maioria dos idosos foi classificada como robusta 54 (46,6%) e 77 (67,0%) possuíam hipertensão arterial sistêmica (Tabela 1).

Conforme demonstrado na tabela 2, a estatura estimada foi maior do que a aferida em todas as categorias de funcionalidade, ( $p < 0,001$ ). Também a diferença no IMC foi significativa, no entanto o IMC calculado com estatura estimada foi menor do que o IMC calculado com estatura aferida, em todas as

categorias de funcionalidade ( $p < 0,001$ ).

A diferença encontrada para estatura foi 4,2 (5,2), 4,6 (4,9), 7,1(5,3) centímetros (cm) respectivamente para os idosos robustos, em risco de fragilização e frágeis ( $p = 0,033$ ), sendo esta diferença entre os robustos e os frágeis. Resultado semelhante foi obtido avaliando-

**Tabela 1** – Características da população de idosos estudados. Belo Horizonte / MG, 2015-2019.

Variáveis estudadas	Idosos estudados
Idade segundo funcionalidade Média (DP)	
Robusto	85,9 (5,6)
Em risco Fragilização	88,5 (6,8)
Frágil	77,0 (9,1)
Sexo N (%)	
Masculino	43 (37,1)
Feminino	73 (62,9)
Anos completos de escolaridade Média (DP)	
2,9 (3,8)	
Funcionalidade N (%)	
Robusto	54 (46,6)
Em risco Fragilização	24 (20,7)
Frágil	38 (32,7)
Principais problemas de saúde N (%)	
Hipertensão arterial sistêmica	77 (67,0)
Diabetes Mellitus	27 (23,3)
Doenças Neurológicas	21 (18,1)
Osteoporose	21 (18,1)
Doença articulares	12 (10,3)

DP: desvio padrão; N: número

se a diferença entre o IMC calculado com medidas aferidas e com estatura estimada ( $p = 0,019$ ), conforme apresentado na Tabela 3.

De acordo com a Tabela 4, o IMC aferido superestimou a prevalência de sobrepeso e subestimou a magreza em todas as categorias de funcionalidade ( $p < 0,001$ ). Sendo que 9 (7,75%) e 13 (11,2%) dos idosos passaram a ser classificados com magreza e sem sobrepeso, respectivamente quando utilizado o IMC estimado.

**Tabela 3** – Distribuição das diferenças entre a estatura estimada e a aferida e diferença entre o IMC estimado e aferido, de acordo com a funcionalidade dos idosos. Belo Horizonte / MG, 2015-2019.

Funcionalidade	Diferença de Estatura	Valor de P <sup>1</sup>	Diferença de IMC <sup>2</sup>	Valor de P <sup>1</sup>
Robusto <sup>a</sup>	4,2 (5,2)	0,033	-1,7 (1,7)	0,019
Risco de Fragilização <sup>a</sup>	4,6 (4,9)		-1,0 (2,2)	
Frágil <sup>a</sup>	7,1 (5,3)		-2,4 (3,1)	

IMC, Índice de massa corporal. a) média (desvio padrão). 1-Teste de ANOVA e teste de múltiplas comparações de médias Hochberg's GT2 indicou diferença significativa entre os robustos e os frágeis, tanto na diferença de estatura quanto na diferença de IMC.

**Tabela 2** – Distribuição das médias das estaturas aferida e estimada e IMC aferido e estimado, de acordo com a funcionalidade dos idosos. Belo Horizonte / MG, 2015-2019.

Funcionalidade	n	Estatura aferida <sup>a</sup> (cm)	Estatura estimada <sup>a</sup> (cm)	Valor de P <sup>1</sup>	IMC aferido <sup>a</sup> Kg/m <sup>2</sup>	IMC estimado <sup>a</sup> Kg/m <sup>2</sup>	Valor de P <sup>1</sup>
Robusto	54	153,2 (8,4)	157,4 (9,3)	<0,001	26,4 (4,1)	25,1 (4,4)	<0,001
Risco de Fragilização	24	151,9 (11,0)	156,5 (10,3)	<0,001	23,2 (4,6)	21,8 (4,2)	<0,001
Frágil	38	152,6 (8,7)	159,7 (7,8)	<0,001	26,5 (7,7)	24,2 (6,7)	<0,001

IMC, Índice de massa corporal. a) média (desvio padrão). 1- Test t de Student. IMC aferido calculado com dados de peso e estatura aferidos. IMC estimado calculado com peso aferido e estatura estimada.

**Tabela 4** – Classificação do IMC em magreza e sobrepeso, de acordo com a funcionalidade dos idosos. Belo Horizonte / MG, 2015-2019.

Funcionalidade	N	Magreza			Sobrepeso		
		IMC aferido <sup>a</sup>	IMC estimado <sup>a</sup>	Valor de P <sup>1</sup>	IMC aferido <sup>a</sup>	IMC estimado <sup>a</sup>	Valor de P <sup>1</sup>
Robusto	54	10 (18,5)	13 (24,1)	<0,001	26 (48,1)	17 (31,5)	<0,001
Risco de Fragilização	24	7(29,2)	12 (50,0)	<0,001	4 (16,7)	3(12,5)	<0,001
Frágil	38	13 (34,2)	14 (36,8)	<0,001	17 (44,7)	14 (36,8)	<0,001

a) número (percentual). 1- Teste qui quadrado.

## DISCUSSÃO

O presente estudo mostra que a estatura estimada diferiu da medida aferida, sendo a média da estatura estimada maior do que a aferida, achado esse, semelhante aos de outros estudos que utilizaram a mesma metodologia de estimativa de estatura, deste estudo<sup>13,14</sup>. O trabalho de Closs e colaboradores<sup>13</sup> avaliou idosos de 60 a 93 anos e encontrou uma diferença média entre a estatura estimada e aferida de +3 cm. Fogal e colaboradores<sup>14</sup> encontram uma diferença média de +2 cm para os indivíduos do sexo feminino e não encontram diferença entre os homens.

Vários fatores, podem contribuir para que haja essa diferença. Desnutrição, sarcopenia e osteoporose são alguns exemplos. Essas desordens são provocadas entre outros, por estilo de vida e hábitos alimentares inadequados<sup>30</sup> que podem em longo prazo impactam direta ou indiretamente o controle postural do idoso fazendo com que a estatura aferida não seja uma medida confiável.

Neste estudo as estaturas estimadas foram mais elevadas do que as aferidas em todas as categorias de funcionalidade, no entanto a

diferença foi maior nos idosos frágeis (+7,1cm) em comparação aos idosos robustos (+4,2 cm). Quanto ao IMC, o estimado foi inferior ao derivado da estatura aferida, principalmente nos idosos frágeis (-2,4kg/m<sup>2</sup>), em comparação com os robustos (-1,7 Kg/m<sup>2</sup>). O presente estudo não encontrou na literatura estudos com esta temática que levassem em consideração a classificação funcional do idoso, fato esse que impossibilita a comparação dos resultados encontrados.

Entretanto a compreensão das diferentes características destes grupos pode nos ajudar a avaliar os resultados encontrados. Considerando as Atividades de Vida Diária (AVD's) os indivíduos robustos deambulam sem dificuldades e, portanto, não têm maiores impedimentos para se manterem ativos, geralmente possuem um padrão alimentar que os mantém saudáveis, apresentam comorbidades de baixa complexidade. Os frágeis, entretanto, possuem declínio funcional bem pronunciado o que os tornam parcial ou totalmente dependentes para as AVD's básicas, instrumentais e avançadas, no geral

são pouco ativos, são acometidos por doenças que impactam diretamente sua qualidade de vida<sup>19,20</sup>. Acredita-se que estes fatores podem justificar a diferença significativa encontrada entre as estaturas estimadas e aferidas destas duas categorias funcionais de idosos.

A literatura demonstra que idosos mais velhos apresentam maior comprometimento postural do que idosos mais jovens<sup>10,11,15</sup>. No entanto, neste trabalho encontrou-se que mesmo os idosos frágeis apresentando média de idade menor do que a dos robustos, a diferença de estatura foi mais pronunciada nos frágeis, sugerindo que essa está mais relacionada a fragilidade e não à idade dos indivíduos, o que corrobora com a afirmativa de que a redução da estatura não deve ser explicada somente pela senescência, mas pelas condições de saúde deteriorada<sup>31</sup>, condição presente nos idosos frágeis. Fatores de ordem social, biológica e a condição nutricional do indivíduo podem interferir de forma positiva ou não na redução da estatura com o envelhecimento<sup>31</sup>.

Além disso, 18% dos idosos estudados possuíam osteoporose e 34% dos idosos frágeis apresentavam IMC aferido menor que 22,0 Kg/m<sup>2</sup>, situações associadas à possível redução na estatura aferida<sup>31,32</sup>. Com o envelhecimento homens e mulheres têm um decréscimo na síntese de estrogênio, hormônio esse, que está relacionado a saúde da massa óssea. No sexo masculino, a diminuição desse hormônio ocorre de forma gradativa e em idades avançadas. Nas mulheres, no entanto, essa redução ocorre de forma abrupta logo após o início da menopausa<sup>32</sup>.

Assim, acredita-se que a estatura aferida em idosos frágeis não é a medida adequada para ser utilizada na prática clínica. Observa-se, ao aferir a estatura destes idosos, dificuldade do posicionamento conforme preconizado pela Organização Mundial de Saúde<sup>28</sup>. Idosos frágeis, geralmente, apresentam dificuldades para ficar de pé na balança, precisam afastar as pernas para manter o equilíbrio e não conseguem manter a postura ereta em função das alterações posturais.

A diferença encontrada na estatura dos idosos refletiu diretamente no cálculo do IMC. O IMC aferido subestimou a magreza em todas as categorias funcionais. Houve também a superestimação do sobrepeso. Outros trabalhos também encontraram diferenças no IMC derivado de medidas estimadas<sup>14,15</sup>, porém estes não consideraram a funcionalidade dos indivíduos impossibilitando uma comparação de resultados. Gavriliidou e colaboradores<sup>15</sup> observaram que a diferença no IMC superestimou a obesidade em idosos mais jovens e subestimou para idosos mais idosos. Na amostra de Fogal e colaboradores<sup>14</sup> a obesidade foi subestimada em mulheres. Este estudo atribui essas diferenças às alterações posturais presentes nos idosos, conforme abordado anteriormente.

O IMC continua sendo uma ferramenta amplamente utilizada na prática clínica para diagnóstico de desnutrição e obesidade e auxilia no diagnóstico da sarcopenia além de ser utilizado em equações para definir dose de fármacos<sup>7,33,34,35</sup>. Portanto, o diagnóstico derivado de IMC equivocado pode trazer prejuízos para a saúde do indivíduo. Há necessidade de estudos que proponham fórmulas que estimem a estatura dos idosos brasileiros e que levem em consideração a funcionalidade do indivíduo para resultados mais precisos evitando assim diagnósticos nutricionais errados.

Algumas limitações devem ser consideradas no presente estudo. A fórmula utilizada nesse estudo foi desenvolvida a partir de uma amostra de indivíduos caucasianos. Estudos mostram que pode haver falhas de precisão quando a fórmula é utilizada em populações diferentes<sup>14</sup>. Outra limitação foi que a amostra inviabilizou a subdivisão das categorias de funcionalidade por sexo e faixas etárias. Os idosos robustos, oriundos do ambulatório de envelhecimento saudável, tem como critério de inclusão somente idosos com idade maior ou igual a 80 anos, sendo assim essa categoria funcional não compreendeu idosos mais jovens.



## CONCLUSÃO

A estatura estimada foi maior do que a aferida em todas as categorias de funcionalidade. Os idosos frágeis têm maiores diferenças entre a estatura aferida e a estimada, em comparação com os robustos, sugerindo que os idosos frágeis têm maior comprometimento da

estatura o que pode impactar diretamente no diagnóstico nutricional. Sugere-se cautela na utilização da estatura aferida em idosos e recomenda-se a utilização da estatura estimada na avaliação do estado nutricional, particularmente nos frágeis.

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## Receptivity and Factors Associated with Cervical Cancer Preventive Measures in a Capital City of Northern Brazil

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### Abstract

Cervical Cancer is an important public health problem, especially in the North of Brazil, although there is vast academic knowledge about its pathophysiology and preventive measures. This study evaluated receptivity to the HPV vaccine and adherence to the Cervical Cancer Prevention exam (CCP) among Primary Care users in the city of Palmas, TO, in addition to identifying the socio-cultural factors and knowledge about HPV and vaccination associated with these forms of prevention. This was a quantitative cross-sectional study, with a stratified sample of 664 users, between 18 and 60 years old, from 30 Community Health Centers in the city of Palmas, TO. For association of variables, the chi-square test was adopted, with a significance level of 5%. HPV vaccine receptivity by users was 84.79% (n=563), while filial receptivity was 91.85% (n=575). Adherence to the CCP was 66.93% among the women surveyed (n=336). Inadequate knowledge about HPV and the vaccines was 70.34% (n=408) and 43.97% (n=266), respectively. Adequate knowledge about the virus and the HPV vaccination was associated with greater receptivity to filial vaccination ( $p=0.009$  and  $p=0.001$ , respectively) and adherence to CCP ( $p=0.007$  and  $p<0.001$ ), which confirms the importance of education in health in disease prevention.

**Keywords:** Cervical neoplasms, Papillomaviridae, Pap test, Papillomavirus vaccines.

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### INTRODUCTION

Cervical Cancer (CC) is the second most frequent cancer among women in the Northern Region of Brazil (21.20/100 thousand), without considering non-melanoma skin tumors. This region is the only one in the country where cancer rates of breast and cervix are equivalent among women<sup>1</sup>. In a

study by Barbosa and collaborators, when analyzing estimates for 2030, they showed that the mortality rates for this cancer will increase only in the North and Northeastern regions of Brazil; the others regions are expected to show rates with a decreasing trend, mainly due to the reduction of risks<sup>2</sup>.

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The association between Human Papillomavirus (HPV) and CC was first assumed almost 50 years ago. Today, it is known that HPV is necessary for the progression towards cancer<sup>3</sup>. Genital infection with this virus is capable of causing cellular changes that can progress to cancer. These pre-neoplastic changes are discovered on the Papanicolaou exam, also known as the cervical cancer preventive exam (CCP) and are curable in almost all cases<sup>1</sup>. The discovery of the association of cancer with HPV and the possibility of identifying precursor lesions of cancer through the CCP explain why CC is classified as a preventable cause of death by appropriate actions promoting health, prevention, control and care, and is, therefore, an indicator of the quality of the intervention of the Unified Health System (SUS)<sup>4</sup>.

When considering that HPV vaccination constitutes primary prevention and that cancer screening through regular CCP is the most important form of secondary prevention, several studies have suggested that the level of knowledge about HPV and/or about the HPV vaccines has an impact on adherence to the aforementioned forms of prevention<sup>5-8</sup>. However, many of these are studies with small samples or that included only portions of the population<sup>9-11</sup>. In this context, the present research has social and scientific relevance, given the scarcity of publications on the specific theme for the Northern Brazilian region.

The identification of factors associated with vaccine receptivity contributes to actions in favor of vaccination adherence, since favorable receptivity contributes to obtaining satisfactory vaccine coverage<sup>12</sup>. The HPV vaccine was included in the National Immunization Program (NIP) in 2014 and the cumulative coverage of its two doses has not yet reached the target, especially among boys<sup>12</sup>. Therefore, investigating vaccine receptivity is relevant to understand whether low receptivity is the justification for the still

modest adherence.

There are three vaccines available on the market: bivalent, quadrivalent, and nonavalent. In Brazil, the Ministry of Health makes the quadrivalent vaccine available to girls aged between 9 and 14 years, with an expansion in 2017, for boys between 11 and 14 years old, and for men and women from 9 to 26 years old in priority groups<sup>12,13</sup>. All vaccines prevent infections by subtypes 16 and 18 - high-risk HPVs - which cause about 70% of cervical neoplasms, and their safety is guaranteed by the World Health Organization (WHO) with proven effectiveness greater than 90% in prevention of cervical intraepithelial neoplasms, when administered to the population of girls who have not yet started sexual activity<sup>12,13</sup>.

The CCP exam is performed on women aged 25 to 64 years, and it is recommended to repeat the exam every three years after two consecutive normal results obtained with an interval of one year<sup>14</sup>. Even vaccinated women, when they reach the recommended age, should undergo CCP, as the vaccine does not protect against all HPV oncogenic subtypes<sup>14</sup>. In order for there to be an epidemiological impact on the decrease in CC incidence and mortality rates, it is estimated that screening programs should cover 85% of women<sup>2</sup>.

Adherence to the CCP in the city of Palmas, TO was studied in order to find subsidies that justify the still high incidence of CC in the North region, given that the control of the number of new cases is directly related to the quality of access that women have to regular screening services<sup>2,15</sup>. Economic factors are important determinants of this reality<sup>2,5,16</sup>, due to reasons that include poor education about preventive behaviors and the lack of resources allocated for easy and agile access to the health system<sup>5,15</sup>. Consequently, limitations on access to health services not only prevent poorer women from being diagnosed, but they also preclude the opportunity to receive adequate treatment in time to obtain a cure<sup>2,16</sup>.

In view of the scarcity of publications that address the receptivity to preventive measures - primary and secondary - against CC in the Northern Brazil, this study was developed with the objective of assessing receptivity to the HPV vaccine and adherence to the cervical cancer prevention exam among users of Primary Health Care services in the city of Palmas, capital of Tocantins, in addition to checking the association of socio-cultural factors and knowledge about HPV and its vaccine with these forms of prevention.

## METHODOLOGY

It was a quantitative, descriptive, and cross-sectional study, composed of a sample of 664 users registered in the 30 Community Health Centers (CHC) of the Family Health Strategy in the city of Palmas, Tocantins, with data collection carried out between December from 2017 to March 2018. The study included individuals aged 18 to 60 years, of both sexes, and users of Primary Health Care (PHC) services. The sampling was random and stratified by CHC, distributed in the three regions of the urban area of Palmas: North, Central, and South. The sample size was calculated according to the formula proposed by Barbetta<sup>17</sup>, from the estimated number of the population of Palmas (in 2014) with age between 18 and 60 years, according to IBGE/DAB Palmas - provided by the Municipal Health Department of Palmas - of 167,286 inhabitants, reaching a maximum tolerable error of 3.873%.

The study was approved by the Human Research Ethics Committee of the Federal University of Tocantins (UFT), under CAAE No. 72643817.4.0000.5519. Participation in the study was voluntary and occurred while individuals were waiting for care. All participants signed the Informed Consent

Form. For data collection, an instrument with 30 closed questions was elaborated, based on two others already validated<sup>6,9</sup>. A pre-test of the questionnaire was carried out in a small sample of SUS users, which was disregarded in the statistical analysis. This instrument addressed, in addition to the questions related to the characterization of the user's socio-cultural profile, the following themes: relationship between HPV and CC, forms of HPV contagion, risk factors for CC, adherence to CCP, target audience of the HPV vaccine, audience that could benefit from vaccination, receptivity to HPV vaccine, and reasons for not accepting filial vaccination.

The EpiInfo 7.0 program was used for tabulation and statistical analysis of the data. All variables were organized into classes and described by absolute and percentage frequencies. The chi-square test was applied to analyze the association between variables, with a significance level of 5%. Dependent variables considered were: receptivity to the HPV vaccine and adherence to the Prevention exam; and independent variables were: gender, age, skin color, religion, marital status, having children, financially responsible person at home, education of the person responsible for the home, CHC region, in addition to knowledge about HPV and the HPV vaccine.

The "receptivity to the HPV vaccine" refers to the acceptance of the vaccine by the participants as a good intervention. Such a concept does not necessarily imply the action of being vaccinated against the virus. The latter is perceived by the authors, as well as seen in the literature<sup>7</sup>, as adherence to the vaccine. Receptivity was assessed, not adherence, because the vaccine is not provided by SUS for the age group of the sample studied. In addition, the identification of factors associated with acceptance can contribute to actions in favor of adherence. In order to identify adherence to the CCP, the following question was asked: "Have you

performed the Cervical Prevention exam in the last 3 years?"; the answers "yes", "no", and "I am a man" were offered. All analyses related to adherence to the CCP took into account only the female portion of the sample, comprising 502 users aged between 18 and 60 years.

The evaluation of knowledge about HPV consisted of analyzing the following themes: 1) having heard about HPV; 2) knowing the relationship between HPV and CC; 3) knowing how the virus infects; 4) knowing the purpose of the CCP; and 5) knowing the risk factors related to developing CC. The first two themes correspond to one item each. The third theme covers 10 items, the fourth theme "knowing the purpose of the CCP" covers 4 items, and the fifth theme consists of 6 items. Thus, a total of 22 items were analyzed to measure the participant's knowledge concerning HPV. Each item had only one correct answer. A total score was calculated by adding all the correct answers (range 0 to 22) and their knowledge was considered adequate or inadequate according to that score. Thus, adequate knowledge was established when there were more than 50% correct answers (12 or more items); and inadequate knowledge when there were 50% or less correct answers (11 or less items). The criterion for classifying knowledge into adequate or inadequate was based on the study by Martins et al.<sup>18</sup>. Participants who failed to answer 11 or more items (50% or more of the items covered) were excluded from the analysis, totaling 84 questionnaires excluded.

In the construction of the variable on knowledge concerning the HPV vaccine, questions were analyzed according to the themes: knowing about the existence of the vaccine, knowing that it is provided free of charge by SUS, knowing the target audience of the NIP, and knowing the audience that could benefit from the vaccination. Each

of these themes corresponded to 1 item, totaling 4 items. Each item had only one correct answer. A total knowledge score was calculated by adding up all the correct answers (range 0 to 4) and the knowledge was classified according to that score. Thus, it was considered as adequate knowledge if there were more than two correct answers (more than 50%); and as inadequate knowledge when the participant got 2 or less correct responses. In addition, participants who failed to answer 2 or more of the 4 items were disregarded, resulting in the exclusion of 59 questionnaires.

## RESULTS

The sample of 664 people was composed, in its majority, by women (n=502; 75.60%), brown (n=409; 61.60%), up to 45 years old (n=527; 79.37%), with some kind of religion (n=590; 88.86%), with a stable partner (n=405; 60.99%), and are a CHC user in the southern region of the city (n=297; 44.73%).

Among the respondents, faced with the hypothesis that the vaccine is offered free to users, 84.79% (n=563) answered that they would like to be vaccinated against HPV. There was a significant association between the desire to be vaccinated and the variables of gender (p<0.001), age of the participant (p<0.001), and education of the person in charge of the household (p=0.044) (Table 1). Thus, the female sex, people aged between 18 and 45 years old, and residents of a home whose guardian has 9 years or more of study showed greater receptivity to the HPV vaccine.

Of the 626 users who answered the question about the possibility of vaccinating a child (referred to in this text as "filial vaccination"), 575 (91.85%) stated that they would accept filial vaccination. The fact of having children

was not associated with the willingness of users to supposedly vaccinate them. Only the variables addressing knowledge about HPV and knowledge about the HPV vaccine were associated with parental receptivity ( $p=0.009$  and  $p=0.001$ , respectively) (Table 2), so that adequate knowledge about HPV and/or about the HPV vaccine were the factors that were related to the action of agreeing with the hypothesis of vaccinating a child.

Still considering receptivity to filial vaccination, only 51 participants rejected this alternative. Among such participants, 37 spoke about the reasons for non-acceptance: 16 users (31.37%) said they had never thought about the subject; 8 (15.69%) revealed fear of side effects; 6 (11.77%) assessed the vaccine as unnecessary, since the child would not have an active sex life at the time the vaccination is recommended; 5 (9.80%) did not trust the vaccine; and 2 (3.92%) considered that, in the age group that the NIP offers the vaccine, the child would be too young to be vaccinated.

The sample of 664 users was composed of 502 women, among whom there was a 66.93% adherence to the CCP ( $n=336$ ). There was a significant association between having the exam within the last three years and the variables of having children ( $p<0.001$ ), knowledge about HPV ( $p=0.007$ ), and knowledge about the HPV vaccine ( $p<0.001$ ) (Table 3). Therefore, women who were mothers and/or who had adequate knowledge about HPV and/or the vaccine underwent a CCP within the three years prior to the date of data collection.

Of the 664 participants, 526 (79.22%) said they had heard about HPV. A little less than half (45.03%;  $n=299$ ) knew the relationship between HPV and cervical cancer. The other questions that involved knowledge about HPV were analyzed together in the composition of this variable. For this analysis, 580 individuals were considered, of which 408 (70.34%) demonstrated inadequate knowledge (Table 4).

Regarding the vaccine, 498 (75%) said they had heard of it. Of these, 90.16% ( $n=449$ )

knew that it is provided freely by SUS, 34.14% ( $n=170$ ) knew the target audience, and 32.33% ( $n=161$ ) knew its benefit for anyone who has not been previously infected by the vaccine's virus subtypes. These four questions were analyzed together in the variable "knowledge" about the vaccine. Of the 605 users considered in the calculations, 339 (56.03%) demonstrated inadequate knowledge (Table 4).

**Table 1** – Receptivity to the HPV vaccine and its association with socio-cultural variables and knowledge about Human Papillomavirus and its vaccine, in users of Primary Health Care (PHC) in Palmas, TO, 2018.

Variables	HPV vaccine receptivity				P
	Yes		No		
	n.	%	n.	%	
<b>Gender (N=626)</b>					<b>&lt;0.001</b>
Male	119	78.81	32	21.19	
Female	444	93.47	31	6.53	
<b>Age (N=618)</b>					<b>&lt;0.001</b>
18-45 years	460	92.56	37	7.44	
46-60 years	95	78.51	26	21.49	
<b>Skin color (N=614)</b>					0.429
White	108	87.80	15	12.20	
Not white	443	90.22	48	9.78	
<b>Religion (N=624)</b>					0.954
Some religion	500	89.93	56	10.07	
No religion	61	89.71	7	10.29	
<b>Head of the household (N=580)</b>					0.072
Respondent	295	87.54	42	12.46	
Another person	224	92.18	19	7.82	
<b>Education of household head (N=620)</b>					<b>0.044</b>
Up to 8 years of study	133	85.81	22	14.19	
9 years of study or more	425	91.40	40	8.60	
<b>Marital status (N=625)</b>					0.702
Married	344	90.29	37	9.71	
Not married	218	89.33	26	10.66	
<b>Children (N=621)</b>					0.705
Yes	422	89.60	49	10.40	
No	136	90.67	14	9.33	
<b>Region (N=626)</b>					0.639
North	121	90.98	12	9.02	
Central	190	88.37	25	11.63	

to be continued...

...continuation- Table 1

Variables	HPV vaccine receptivity				P
	Yes		No		
	n.	%	n.	%	
South	252	90.65	26	9.35	
Knowledge about HPV (N=564)					0.814
Adequate	153	90.00	17	10.00	
Inadequate	352	89.34	42	10.66	
Knowledge about the HPV vaccine (N=593)					0.509
Adequate	237	90.80	24	9.20	
Inadequate	296	89.16	36	10.84	
Total (N=626)	<b>563</b>	<b>89.94</b>	<b>63</b>	<b>10.06</b>	

n: absolute value per class of variable; N: sample size, variables with N < 664 refer to the absence of answers to the specific question; p-value refers to the Chi-squared test.

**Table 2** – Receptivity to filial vaccination against HPV and its association with socio-cultural variables and knowledge about Human Papillomavirus and its vaccine, in users of Primary Health Care (PHC) in Palmas, TO, 2018.

Variables	Receptivity of filial vaccination				P
	Yes		No		
	n.	%	n.	%	
Gender (N=626)					0.562
Male	137	90.73	14	9.27	
Female	438	92.21	37	7.79	
Age (N=611)					0.815
18-45 years	451	91.85	40	8.15	
46-60 years	111	92.50	9	7.50	
Skin color (N=615)					0.422
White	109	90.08	12	9.92	
Not white	456	92.31	38	7.69	
Religion (N=616)					0.768
Some religion	506	91.83	45	8.17	
No religion	59	90.77	6	9.23	
Head of the household (N=582)					0.870
Respondent	311	91.74	28	8.26	
Another person	222	91.36	21	8.64	
Education of household head (N=620)					0.864
Up to 8 years of study	140	92.11	12	7.89	

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Variables	Receptivity of filial vaccination				P
	Yes		No		
	n.	%	n.	%	
9 years of study or more	429	91.67	39	8.33	
Marital status (N=617)					0.961
Married	346	91.78	31	8.22	
Not married	220	91.67	20	8.33	
Children (N=614)					0.464
Yes	432	90.41	36	7.69	
No	132	92.31	14	9.59	
Region (N=626)					0.787
North	123	92.48	10	7.52	
Central	199	92.56	16	7.44	
South	253	91.01	25	8.99	
Knowledge about HPV (N=564)					<b>0.009</b>
Adequate	165	97.06	5	2.94	
Inadequate	358	90.86	36	9.14	
Knowledge about the HPV vaccine (N=594)					<b>0.001</b>
Adequate	253	95.83	11	4.17	
Inadequate	292	88.48	38	11.52	
Total (N=626)	<b>575</b>	<b>91.85</b>	<b>51</b>	<b>8.15</b>	

n: absolute value per class of variable; N: sample size; variables with N < 664 refer to the absence of answers to the specific question; p-value refers to the Chi-squared test.

**Table 3** – Adherence to the Cervical Cancer Preventive Examination (CCP) and its association with sociocultural variables and knowledge about Human Papillomavirus and its vaccine, in users of Primary Health Care (PHC) in Palmas-TO, 2018.

Variables	Adherence to the CCP				P
	Yes		No		
	n.	%	n.	%	
Age (N=469)					0.157
18-45 years	265	69.37	117	30.63	
46-60 years	67	77.01	20	22.99	
Skin color (N=469)					0.827
White	68	70.10	29	29.90	
Not white	265	71.24	107	28.76	
Religion (N=458)					0.066
Some religion	297	71.57	118	28.43	
No religion	25	58.14	18	41.86	

to be continued...



continuation table 3...

Variables	Adherence to the CCP				P
	Yes		No		
	n.	%	n.	%	
Head of the household (N=437)					0.145
Respondent	158	73.49	57	26.51	
Another person	149	67.12	73	56.15	
Education of household head (N=469)					0.562
Up to 8 years of study	78	68.42	36	31.58	
9 years of study or more	253	71.27	102	28.73	
Marital status (N=458)					0.061
Married	203	73.55	73	26.45	
Not married	119	65.38	63	34.62	
Children (N=455)					<0.001
Yes	259	75.07	86	24.93	
No	62	56.36	48	43.64	
Region (N=475)					0.279
North	66	67.35	32	32.65	
Central	122	75.31	40	24.69	
South	148	68.84	67	31.16	
Knowledge about HPV (N=431)					0.007
Adequate	99	79.84	25	20.16	
Inadequate	205	66.78	102	33.22	

Variables	Adherence to the CCP				P
	Yes		No		
	n.	%	n.	%	
Knowledge about the HPV vaccine (N=452)					<0.001
Adequate	170	80.57	41	19.43	
Inadequate	147	61.00	94	39.00	
Total (N=475)	336	70.74	139	29.26	

n: absolute value per class of variable; N: sample size; variables with N<502 refer to the absence of answers to the specific question; p-value refers to the Chi-square test.

**Table 4** – Knowledge about HPV and HPV vaccine, according to users of Primary Health Care (PHC) in Palmas-TO, 2018.

Knowledge	Adequate		Inadequate	
	n	%	n	%
HPV (N=580)	172	29.66	408	70.34
HPV Vaccine (N=605)	266	43.97	339	56.03

n: absolute value per class of variable; N: sample size; variables with N < 664 refer to the absence of responses.

## DISCUSSION

Potentially high receptivity to the vaccine, above 80%, has also been observed in other studies<sup>6,7</sup>. A meta-analysis<sup>8</sup> carried out in American and Chinese electronic databases, in order to verify receptivity to HPV vaccination in mainland China, identified values close to 70%. Palmas has PHC coverage close to 100%, unlike most cities in the North; a fact that can facilitate receptivity to this primary prevention measure. It is observed, however, that the reduction in the incidence of cancer will occur in the long run, since the CC affects middle-aged women, justifying the still relevant indexes in the state.

From the association between the female gender and receptivity to vaccination, and

considering the HPV vaccine as a primary measure for CCU prophylaxis, a disparity was observed between the sexes regarding health prevention practices, a fact that corroborates with the literature and establishes men as having a more distant and resistant posture to preventive behaviors<sup>8,10,19</sup>. Although men are not at risk for CC, they form part of the infection chain and also transmit the virus. For this reason, collective immunity is fundamental in preventing female infection and its consequences<sup>12</sup>. Furthermore, it should be noted that the incidence rate of HPV-related cancers in sites common to both sexes, such as anus and oropharynx, is twice as high in the male group<sup>20</sup>.

The good receptivity of filial vaccination was also seen in national<sup>6,7,21</sup> and international<sup>8,22</sup> studies, which showed high levels of parental receptivity, some even around 90%. Realizing parental acceptance is important, since the HPV vaccine involves immunizing children and adolescents, in order to protect against a sexually transmitted infection. Thus, this vaccination involves social and cultural issues<sup>9</sup>. For example, studies have shown that some parents fear that the vaccination of adolescents encourages premature sexual intercourse and/or promiscuity<sup>12,23</sup>, opposing the findings of the present study in which no parent reported fear of stimulating the early initiation of sexual life. In the present study, among the users who refused the possibility of vaccinating a child, approximately 12% did not accept the supposed filial vaccination because they considered that the child did not need the vaccine because they did not have an active sex life, revealing ignorance about the importance of the vaccination occurring prior to the beginning of sexual activities, guaranteeing immunity against the main subtypes involved in carcinogenesis. Several studies have shown that the best time for vaccination is, in fact, before sexual activity begins<sup>12,14</sup>.

A study carried out in Ipatinga, SP showed that 84.1% of the women in the sample underwent CCP in 2014<sup>5</sup>. Similar values were observed in Pernambuco women aged 25 to 59 years, among which the coverage of the preventive examination was approximately 82%<sup>24</sup>. According to IBGE<sup>5</sup>, 79.4% of Brazilian women, between 25 and 64 years of age, underwent the preventive exam in the three years prior to the survey. According to WHO<sup>26</sup>, with a coverage of the target population of at least 80% and the guarantee of adequate diagnosis and treatment of altered cases, it is possible to reduce, on average, from 60 to 90% the incidence of invasive cervical cancer. When considering these values, adherence to the CCP in the city

of Palmas, TO was below expectations.

Women who declared that they did not have children were associated with lower adherence to the exam. Research carried out in Pernambuco<sup>24</sup> showed similar results, which pointed to the condition of not having children as the main factor associated with failure to perform the preventive exam. In addition, this same study concluded that the CCP offer was strongly associated with maternal experience and obstetric or family planning consultation. The prenatal consultation provides guidance and health education which are important for adherence to the exams, but these should also be offered in other consultations.

Directing the investigation to the factors related to the actions of the health services that allow access to the examination, in addition to those inherent to the female public, would contribute to the organization of a system capable of recognizing women who are not regularly doing their exams, which are the majority of women who will develop invasive cancer<sup>15</sup>. A study in Bahia showed that almost 30% of women had difficulties accessing the exam in the public network, in addition to affirming that they did not know how to schedule the exam at Community Health Centers in their neighborhood<sup>27</sup>. It is emphasized that the CC mainly affects women of lower socioeconomic status and with difficulties in accessing health services<sup>1,2,5,12,15</sup>.

Several studies<sup>5,6,8,10</sup> showed a lack of knowledge about HPV, with most people not having basic information about sexual transmission, high frequency, absence of symptoms, and the causal relationship with cancer, which corroborates with the outcome of the present study. HPV infection is recognized as a causal factor for the development of CC; however, it is still a subject poorly discussed, even among women<sup>28</sup>. Despite this, authors<sup>7,29</sup> have pointed to greater knowledge about the vaccine and the virus as a facilitator of receptivity to the vaccine and/or positively associated with

greater adherence and intention to vaccinate. Such results are partially consistent with this study, which showed a positive association of knowledge about the virus and the vaccine only with receptivity to filial vaccination and no association with the intention to be vaccinated.

When observing the variables "knowledge about HPV" and "knowledge about the vaccine", users demonstrated greater knowledge about the vaccine than about the virus. Recent vaccination campaigns are noted, which can make information about the vaccine more accessible. The important role that campaigns play in health education has already been described in the literature<sup>5,21</sup>. Contact with an HPV campaign resulted in a 4.5 times greater probability of knowing about the virus compared to those who did not have this contact<sup>5</sup>.

It was demonstrated in this work that being aware of the existence of the virus, by itself, did not characterize adequate knowledge on the subject. Thus, the need to improve information on the subject is affirmed, in order to involve and mobilize the population towards the effective adoption of preventive behaviors linked to Public Health<sup>5,6</sup>. The simple identification of the cause of a specific cancer may not be enough to trigger preventive efforts, thus, the need for education, individual motivation, and collective efforts to

control cancer are highlighted<sup>30</sup>. Some studies suggest that health professionals should assume a central role in this scenario<sup>23,24,29</sup>, with interventions aimed at verifying the level of knowledge about HPV and encouraging preventive actions aimed at limiting diseases<sup>5</sup>.

The present study sought to measure the knowledge about the HPV vaccine in order to address its specificities, not only considering whether the participant had heard about or knew about the existence of the vaccine, as some authors have done<sup>6</sup>. Most studies identify knowledge about the HPV virus, but not specifically the knowledge inherent to its vaccine<sup>5</sup>.

It is noteworthy that this study examined a diverse and comprehensive sample, which represents the population using PHC - a scenario in which primary and secondary prevention measures, in fact, are carried out - from a capital city in the North of Brazil. Few studies address the receptivity to the vaccine in PHC. Only studies that contained specific conditions (private health services, colleges, schools, women with a history of intraepithelial neoplasia, etc.) were found<sup>9-11,22</sup>. In addition, including men in this study made it possible to assess the preventive behavior of a group that, despite not being affected by cervical cancer, plays a crucial role in the transmission of the HPV virus and, therefore, in the effectiveness of preventive measures.

## CONCLUSÃO

Cervical Cancer (CC), although highly preventable, still remains a significant public health problem, especially in the northern region of the country. It was found that people assisted by Primary Health Care (PHC) have little knowledge about the etiology and the main preventive measure against CC: HPV and its vaccine. Despite this, receptivity to the HPV vaccine was high, both in relation to the vaccination itself and its provision to

children (filial vaccination). It is noteworthy that being male, less educated, and of an older age were factors related to less receptivity to vaccination itself, different from receptivity to filial vaccination, which was influenced only by knowledge about the virus and about the HPV vaccine. Adherence to the Cervical Cancer Preventive examination (CCP) was low in the PHC population in Palmas, TO, especially among women who were not mothers and

who had little knowledge about HPV and its vaccine.

Thus, it was observed that insufficient knowledge about HPV and the vaccine impairs people's involvement with the preventive measures proposed by PHC. In addition, the degree of knowledge was also investigated, unlike most studies that only considered the

fact of having heard about HPV. This study covered a comprehensive sample, composed of men and women of varying ages, attended at Community Health Centers (CHC), in order to represent the population of the entire capital. There are few studies of this magnitude on the subject, particularly in the Northern Brazil.

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