Classification tree for the assessment of sedentary lifestyle among hypertensive

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Objective. To develop a classification tree of clinical indicators for the correct prediction of the nursing diagnosis "Sedentary lifestyle" (SL) in people with high blood pressure (HTN). **Methods.** A cross-sectional study conducted in an outpatient care center specializing in high blood pressure and Mellitus diabetes located in northeastern Brazil. The sample consisted of 285 people between 19 and 59 years old diagnosed with high blood pressure and was applied an interview and physical examination, obtaining socio-demographic information, related factors and signs and symptoms that made the defining characteristics for the diagnosis under study. The tree was generated using the CHAID algorithm (*Chi-square Automatic Interaction Detection*). **Results.** The construction of the decision tree allowed establishing the interactions between clinical indicators that facilitate a probabilistic analysis of multiple situations allowing quantify the probability of an individual presenting a sedentary lifestyle. The tree included the clinical indicator Choose daily routine without exercise as the first node. People with this indicator showed a probability of 0.88 of presenting the SL. The second node was composed of the indicator Does not perform physical activity during leisure, with 0.99 probability of presenting the SL with these two indicators. The predictive capacity of the tree was established at 69.5%. **Conclusion.** Decision trees help nurses who care HTN people in decision-making in assessing the characteristics that increase the probability of SL nursing diagnosis, optimizing the time for diagnostic inference.

Key words: cross-sectional studies; decision trees; diabetes mellitus; hypertension; nursing diagnosis; sedentary lifestyle.

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Árbol de clasificación para la evaluación del estilo de vida sedentario entre las personas con hipertensión

Objetivo. Desarrollar un árbol de clasificación de indicadores clínicos para la predicción correcta del diagnóstico de enfermería "Estilo de Vida Sedentario" (EVS) en personas con hipertensión arterial (HTA). **Métodos.** Estudio transversal, desarrollado en un centro ambulatorio especializado en hipertensión arterial y diabetes mellitus ubicado en el Noreste de Brasil. La muestra consistió en 285 personas entre 19 y 59 años con diagnóstico de hipertensión arterial a quienes se les practicó una entrevista y evaluación física, obteniéndose información sociodemográfica, factores relacionados y los signos y síntomas que conformaron las características definitorias para el diagnóstico en estudio. El árbol fue generado usando el algoritmo CHAID (Chi-square Automatic Interaction Detection). **Resultados.** La construcción del árbol de decisión permitió establecer las interacciones entre los indicadores clínicos que facilita un análisis probabilístico de múltiples situaciones, posibilitando cuantificar la probabilidad de un individuo de presentar un estilo de vida sedentario. El árbol incluyó el indicador clínico *Elección de una rutina diaria de bajo contenido en actividad física* en el primer nodo. Las personas con este indicador mostraron una probabilidad de 0.88 de presentar el EVS. El segundo nodo fue compuesto por el indicador *No realiza actividades físicas en el tiempo libre,* siendo la probabilidad de presentar el EVS por los individuos con estos dos indicadores de 0.99. La capacidad predictiva del árbol se estableció en un 69.5%. **Conclusión.** Los árboles de decisión ayudan a los enfermeros, que prestan cuidados a personas con HTA, en la toma de decisiones para realizar una evaluación de las características que aumentan la probabilidad de ocurrencia del diagnóstico de enfermería EVS, optimizando así el tempo para la inferencia diagnóstica.

Palabras clave: estudios transversales; árboles de decisión; diabetes mellitus; hipertensión; diagnóstico de enfermería; estilo de vida sedentario.

Árvore de classificação para a avaliação do estilo de vida sedentário entre pessoas com hipertensão

Objetivo. Desenvolver uma árvore de classificação de indicadores clínicos para a predição correta do diagnóstico de enfermagem "Estilo de vida sedentário" (EVS) em pessoas com hipertensão arterial (HTA). Métodos. Estudo transversal, desenvolvido em um Centro de atendimento ambulatorial especializado em hipertensão arterial e diabetes mellitus localizado no nordeste do Brasil. A amostra consistiu em 285 pessoas entre 19 e 59 anos com diagnóstico de hipertensão arterial às quais se aplicou uma entrevista e avaliação física, obtendo-se informação sócio-demográfica, fatores relacionados e os sinais e sintomas que compunham as características definidoras para o diagnóstico em estudo. A árvore foi gerada utilizando o algoritmo CHAID (Chi-square Automatic Interaction Detection). **Resultados.** A construção da árvore de decisão permitiu estabelecer as interações entre os indicadores clínicos que facilita uma análise probabilística de múltiplas situações possibilitando quantificar a probabilidade de um indivíduo apresentar um estilo de vida sedentário. A árvore incluiu o indicador clínico Escolhe rotina diária sem exercício físico como primeiro nó. As pessoas com este indicador mostraram uma probabilidade de 0.88 de apresentar o EVS. O segundo nó foi composto pelo indicador Não realiza atividades físicas no tempo de lazer, sendo a probabilidade de apresentar o EVS com estes dois indicadores de 0.99. A Capacidade preditiva da árvore foi estabelecida em 69.5%. **Conclusão.** As árvores de decisão ajudam os enfermeiros que prestam cuidados a pessoas com HTA na tomada de decisão na avaliação das características que aumentam a probabilidade de ocorrência do diagnóstico de enfermagem EVS, otimizando assim o tempo para a inferência diagnóstica.

Palavras chave: estudos transversais; árvores de decisões; diabetes mellitus; hipertensão; diagnóstico de enfermagem; estilo de vida sedentário.

Introduction

Trees Classification (TC) are graphic tools that allow a clearer and large view and needs the different directions they can take to multiple decision alternatives based on conditional probabilities for assistance in the diagnosis inference.[1] This help in the decision-making process, allowing a

quick visualization of the occurrence of diagnosis probabilities and can be used in clinical trial processes maintaining the accuracy of diagnostic inference. The development of TC for diagnostic inference has been described in previous studies as a tool to support the clinical reasoning of nurses. A previous study developed classification trees for the inference of Ineffective clearance of airways and Ineffective breathing pattern in children with acute respiratory infection.[1] Other researchers developed a classification tree for differentiation of nursing diagnoses activity Intolerance and Impaired physical mobility among elderly.[2]

In particular, the use of TC can be a useful tool for the care of individuals with clinical conditions including changes in their health habits. The early identification and subsequent evaluations of these changes enable a quick assessment of the effectiveness of interventions and analysis of the achieved health results. Although assist in this process and based on clinical indicators with greater interaction with a diagnosis, studies with this approach are still scarce. A sedentary lifestyle is a nursing diagnosis example linked to health habits and various chronic conditions that require prolonged clinical monitoring. The NANDA International (NANDA-I) included this diagnosis in the domain 1: Health promotion and it has three defining characteristics: "Choose a daily routine without exercise"; "It shows a lack of physical fitness"; "Verbalizes preference for activities with little exercise"; and five related factors, "Deficient knowledge about the benefits that physical activity brings to health"; "Lack of interest"; "Lack of motivation"; "Lack of resources"; "Lack of training to exercise".[3]

A recent review of this diagnosis for people with hypertension identified three other defining characteristics which are: "Does not perform physical activity during leisure"; "Overweight" and "Deficient performance in instrumental activities of daily living", in addition to proposing the division of the characteristic shows a lack of physical fitness in three: "Decreased cardiorespiratory capacity"; "Diminished muscle strength" and "Diminished flexibility of joints".[4] The sedentary lifestyle is considered one of the main risk factors for the development of hypertension and other cardiovascular problems and may result in severe consequences to the body. Hypertension is considered a serious public health problem, generating high costs of hospitalization, the patient's disability, and early retirement.[5] The main form of prevention and control of HTN is the adoption of healthy habits.[6-9] Few studies have proposed the use of classification trees in the diagnostic inference based on defining characteristics. Given this context, this study aimed to generate a Tree Classification (TC) from clinical indicators for classification and correct prediction of the nursing diagnosis "Sedentary lifestyle" in patients with Hypertension.

Methods

It is a cross-sectional study conducted in an outpatient care center for individuals with high blood pressure and diabetes. 285 patients with hypertension were included in the study, aged between 19 and 59 years old, registered in the institution's monitoring program where the study was developed. Due to the inexistence of statistical formulas to determine the sample size in classification trees development studies, an approach similar to the one used in the development of scales has applied this study, considering the relationship between the number of indicators and the number of subjects to be evaluated.[10] Thus, was initially determined a minimum of 35 individuals per indicator to be included in the analysis. In this study, a total of 8 clinical indicators were included in the analysis generating the need for at least 280 individuals (35 x 8). However, the final sample was expanded to 285 individuals.

The data collection was performed by a team previously submitted to training, lasting eight hours. It used an instrument with the variables related to identification, socio-demographic profile, to the related factors and signs and symptoms that constitute the defining characteristics of the nursing diagnosis "Sedentary lifestyle" of NANDA-I.

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The diagnostic inference was made by four nurses previously trained at a course lasting eight hours. These nurses were evaluated for efficiency, trend, false-positive taxes and false negative in their diagnostic inferences as recommended in the specialized literature.[11] Data were compiled in an Excel spreadsheet and forwarded subsequently to every diagnostician nurse. The occurrence or not of the diagnosis has been determined by the absolute agreement between the diagnosticians. The agreement between evaluators was measured by Kappa coefficient and ranged from 0.790 to 0.979 indicating excellent concordance.[11]

The data obtained from the nurse diagnosticians were compiled in Excel, and the statistical analysis was done in 2105 with the help of SPSS programs version 20.0 and R version 2.12.1. The tree was generated based on CHAID algorithm (*Chi-square Automatic Interaction Detection*), sequentially adding in three steps the indicator with higher initial interaction. The CHAID algorithm is based on Chi-square test for detection of interactions between variables. The independent variable that has greater interaction with the dependent variable is elected every step of induction of TC. For the goodness of fit verification, the cross-validation method was adopted, in which delimited a maximum depth of 8 levels (node) with a minimum of 50 cases to the primary node and 10 cases to the secondary. The study was previously approved by the local Ethics Committee, and all participants were informed about the research objectives and signed an Informed Consent form.

Results

The 285 patients in this study had a mean age of 51.34 ± 07.09 years old, were mostly female (55.4%), 62.8% lived with a partner, and had an average of 9.52 ± 4.41 years of schooling. A total of 55.8% had a sedentary lifestyle. The CHAID algorithm generated a classification tree with two defining characteristics: "Choose daily routine without exercise" and "Does not perform the physical activity during leisure" of the nursing

diagnosis Sedentary Lifestyle, as illustrated in Figure 1. This tree contains five nodes in total, being three terminal nodes, presenting even two deep levels.

Before the defining characteristic "Choose a daily routine without exercise", the probability of occurrence of the nursing diagnosis Sedentary Lifestyle (SL) was 88.8%. By associating the defining characteristic before the "Does not perform physical activity during leisure", obtained the probability of 99.4%. The power of global prediction of this tree using the cross-validation method was 69.5%, as shown in Table 1.

Discussion

Conserning socio-demographic data, the results obtained in this study are similar to those found in literatura[12-14] since most individuals with hypertension are female, live with a partner, are aged between 40 and 50 years old, per capita income slightly more than a salary and schooling of up to 9 years for the most part. The literature[12] shows that sedentary lifestyle is present in 35.5% of patients with hypertension and/or Mellitus diabetes treated at a Family Health Center. Another study about the risk factors and coronary artery disease, showed prevalence of sedentary lifestyle with values above 60% of the sample, being this disease closely associated with hypertension.[15] Regarding the nursing diagnosis of Sedentary Lifestyle, it is noticed that this was present in 60% of patients enrolled in a Basic Health Unit.[16] In the same study, it was observed that 81% of hypertension patients were female consonant with the elaborate the study. This is because women seek more medical attention than men even in primary care.

As for the classification tree generated to aid in the inference of the nursing diagnosis Sedentary Lifestyle as seen in Figure 1, the presence of the defining characteristics Choose daily routine without exercise and Does not perform physical activity during leisure predict the occurrence of SL in 99.4%, in contrast, the absence of the first
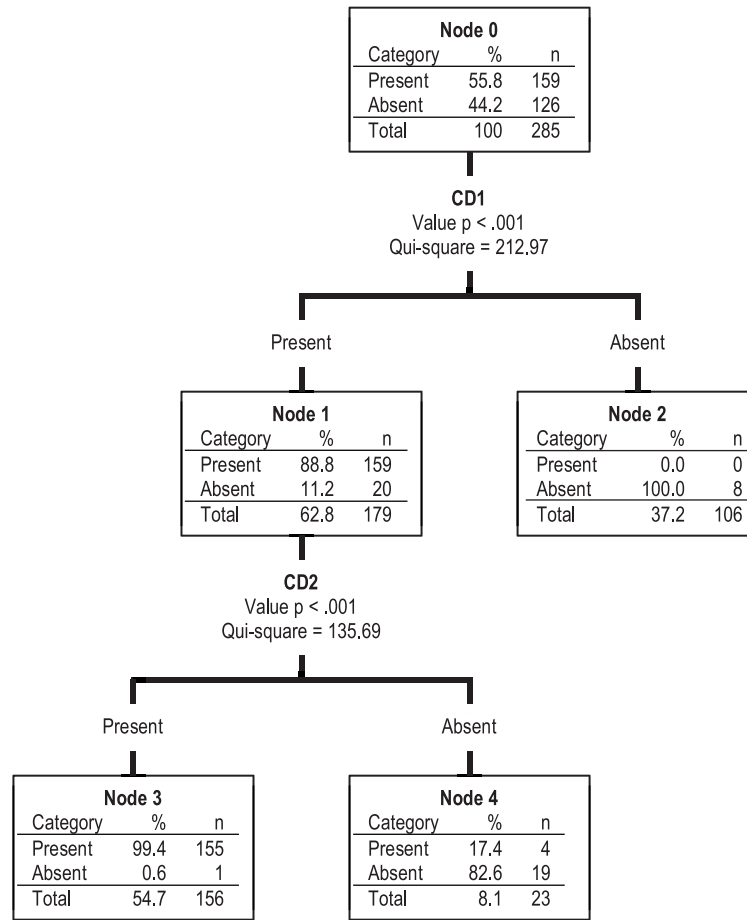
Figure 1. Classification tree generated with the defining characteristics of the nursing diagnosis. Sedentary Lifestyle using the CHAID method.

* CD1: Choose daily routine without exercise; CD2: Does not perform physical activity during leisure

Table 1. Adjusting Features and prediction of classification tree constructed for Sedentary Lifestyle

	Classification Present		Expected	
		Absent	**Correct Percentage**	
	Present	158	1	99.4%
Observed	**Absent**	86	40	31.7%
	General Percentage	85.6%	14.4%	69.5%

one is sufficient to determine the absence of the nursing diagnosis in question. The defining feature Does not perform physical activity during leisure is not included in the Taxonomy of NANDA-I however it increases the probability of SL. Thus, a sedentary lifestyle can be identified as non-participation in physical activities during leisure, considering physical activity as any bodily movement produced by skeletal muscles that result in energy expenditure, with components and determinants of biopsychosocial, cultural and behavioral.[17]

Nurses who care for people with hypertension should be sensitive to the signs and symptoms presented by this population that may evidence the presence of nursing diagnosis Sedentary Lifestyle. When adopted the classification trees for diagnostic inference, nurses can make inferences based on a limited set of defining characteristics. These trees help in decision-making, that relate which present or absent defining characteristics significantly increase the probability or not of the nursing diagnosis, thereby optimizing the time for diagnostic inference. Also, the construction of decision trees generates a set of interactions between clinical indicators that allows a probabilistic analysis of multiple situations in which it is possible to quantify the opportunity for an individual presenting a Sedentary Lifestyle.

The limitation of this study is based on the fact having done with a specific sample of adults, suffering high blood pressure and ambulatory monitored. Thus, the results should not be extrapolated to the general population; there is need for further research on the same nursing diagnosis, but involving different populations. Noteworthy is that there are few studies in the literature using classification trees, and is, therefore, difficult to compare with other samples.

References

1. Chaves DBR. Árvores de Decisão para inferência de Desobstrução ineficaz de vias aéreas e Padrão respiratório ineficaz de Crianças com infecção Respiratória Aguda. [Dissertation]. Fortaleza: Universidade Federal do Ceará; 2011.

2. Hur H, Park S, Kim S, Storey MJ, Kim G. Activity intolerance and impaired physical mobility in elders. Int J Nurs Terminol Classif. 2005; 16(3-4):47-53.

3. NANDA International (NANDA-I). Diagnósticos de Enfermagem da NANDA: Definições e classificações, 2009–2011. Porto Alegre: Artmed; 2010.

4. Guedes NG, Lopes MVO, Cavalcante TF, Moreira RP, Araujo TL. Revisão do diagnóstico de enfermagem Estilo de vida sedentário em pessoas com hipertensão arterial: análise conceitual. Rev Esc Enferm USP. 2013; 47(3):742-49.

5. Carvalho MV, Siqueira LB, Sousa ALL, Jardim PCBV. A Influência da Hipertensão Arterial na Qualidade de Vida. Arq Bras Cardiol. 2013; 100(2):164-74.

6. Reis MG, Glashan RQ. Adultos hipertensos hospitalizados: percepção de gravidade da doença e de qualidade de vida. Rev Latino-Am Enfermagem. 2000; 9(3):51-7.

7. Feijão AM, Gadelha FV, Bezerra AA, Oliveira AM, Silva MS, Lima JW. Prevalência de excesso de peso e hipertensão arterial em população urbana de baixa renda. Arq Bras Cardiol. 2005; 84(1):29-33.

8. Simonetti JP, Batista L, Carvalho LR. Habitos de salud y factores de riesgo en pacientes con hipertensión arterial. Rev Latino-Am Enfermagem. 2002; 10(3):415-22.

9. Arslantas D, Ayranci U, Unsal A, Tozun M. Prevalence of hypertension among individuals aged 50 years and over and its impact on health related quality of life in a semi-rural area of western Turkey. Chin Med J (Engl). 2008; 121(16): 1524-31.

10. Pasquali L. Instrumentação psicológica: fundamentos e práticas. Porto Alegre: Artmed; 2010.

11. Lopes MVO, Viviane MS, Thelma LA. Methods for Establishing the Accuracy of Clinical Indicators in Predicting Nursing Diagnoses. Int J Nurs Knowl. 2012; 23:134-39.

12. Kastenbaum B. Epidemiology and Bioestatistics: An Introduction to Clinical Research. Seatle: Springer; 2009.

13. Santos JC. Fatores de risco e complicações em hipertensos/diabéticos de uma regional sanitária do Nordeste brasileiro. Rev Esc Enferm USP. 2012; 46(5):1125-32.

14. Silva NT, Giacon TR, Costa MP, Vitor ALR, Vanderlei LCM. Moreira TMM. Prevalência de correlação entre obesidade, hipertensão arterial e a prática de atividade física. Colloquium Vitae. 2011; 3(1):32-6.

15. Nascente FMN, Jardim PCBV, Peixoto RMG, Monego ET, Moreira HG, Vitorino PVO, et al. Hipertensão arterial e sua correlação com alguns fatores de risco em uma cidade brasileira de pequeno porte. Arq Bras Cardiol. 2010; 95(4):502-9.

16. Gus I, Fischmann A, Medina C. Prevalência dos fatores de risco da doença arterial coronariana no Estado do Rio Grande do Sul. Arq Bras Cardiol. 2002; 78(5):478-83.

17. Guedes NG. Acurácia das características do diagnóstico de enfermagem Estilo de vida sedentário em portadores de hipertensão arterial. [Dissertation] Fortaleza: Universidade Federal do Ceará; 2008.