

Disability assessment of individuals with diabetes mellitus: a cross-sectional study with the WHODAS 2.0

Avaliação da incapacidade de indivíduos com diabetes mellitus: um estudo transversal com o WHODAS 2.0

Evaluación de la incapacidad de individuos con diabetes mellitus: un estudio transversal con WHODAS 2.0

Andressa Camargo¹, Debora Boguchewski Campos², Aline Aparecida Chociai de Lima³, Gladson Ricardo Flor Bertolini⁴, Andersom Ricardo Fréz⁵, Aline Cristiane Binda⁶

ABSTRACT | Diabetes mellitus (DM) causes several functional limitations, which can negatively affect the personal and professional life of individuals. This effect can lead to more complications and disabilities. This study aimed to analyze in which domains of the World Health Organization Disability Assessment Schedule version 2.0 (WHODAS 2.0) individuals with diabetes mellitus have the greatest disabilities. A cross-sectional study was performed with 111 individuals with diabetes mellitus, of any type. A sociodemographic questionnaire and the WHODAS 2.0 with 36 questions were applied to assess individuals' difficulties in the last 30 days. Most individuals were women (60.3%) and classified as independent in the community (90.1%). The highest prevalence was among retired individuals (35.1%). The mobility domain presented the highest impairment (48±23) whereas the life activities domain presented the lowest impairment (28±13). However, for all domains, the impairment was below 50 on a scale ranging from zero to 100. All individuals with diabetes mellitus showed some disability, but the greatest impairment was in the mobility domain.

Keywords | Diabetes Mellitus; Health Assessment; Statistics on Sequelae and Disability.

RESUMO | A diabetes mellitus (DM) causa diversas limitações funcionais, que podem impactar negativamente na vida pessoal e profissional do indivíduo, acarretando mais complicações e incapacidades. O objetivo do estudo foi identificar em quais domínios do *World Health Organization Disability Assessment Schedule* versão 2.0 (WHODAS 2.0) os indivíduos com DM apresentam as maiores incapacidades. Para tanto, foi realizado um estudo transversal com 111 pessoas com diagnóstico da doença, independentemente do tipo. Foram aplicados um questionário sociodemográfico e o WHODAS 2.0 com 36 questões, para avaliar as dificuldades apresentadas nos últimos 30 dias. A amostra foi composta predominantemente pelo sexo feminino (60,3%) e classificada como independente na comunidade (90,1%). A maior prevalência foi de indivíduos aposentados (35,1%). O domínio mobilidade apresentou o maior comprometimento (48±23),

¹Universidade Estadual do Centro-Oeste (Unicentro) – Guarapuava (PR), Brazil. E-mail: dre.andressacamargo@gmail.com. ORCID-0000-0003-2346-3369

²Universidade Estadual do Centro-Oeste (Unicentro) – Guarapuava (PR), Brazil. E-mail: deboraboguchewski@hotmail.com. ORCID-0000-0002-6562-5728

³Universidade Estadual do Centro-Oeste (Unicentro) – Guarapuava (PR), Brazil. E-mail: aline_chociai@live.com. ORCID-0000-0001-5820-2703

⁴Universidade Estadual do Oeste do Paraná (Unioeste) – Cascavel (PR), Brazil. E-mail: gladsonricardo@gmail.com. ORCID-0000-0003-0565-2019

⁵Universidade Estadual do Centro-Oeste (Unicentro) – Guarapuava (PR), Brazil. E-mail: frez@unicentro.com.br. ORCID-0000-0001-6085-1382

⁶Universidade Estadual do Centro-Oeste (Unicentro) – Guarapuava (PR), Brazil. E-mail: acbinda@hotmail.com. ORCID-0000-0002-6870-777X

enquanto o domínio atividades de vida apresentou o menor comprometimento (28 ± 13). Porém, para todos os domínios, o comprometimento ficou abaixo de 50, em uma escala que varia de 0 a 100. Todos os indivíduos com DM apresentaram alguma deficiência, havendo maior comprometimento do domínio relacionado à mobilidade.

Descritores | Diabetes Mellitus; Avaliação em Saúde; Estatísticas de Sequelas e Incapacidade.

RESUMEN | La diabetes mellitus (DM) causa varias limitaciones funcionales que pueden impactar negativamente la vida personal y profesional del individuo, ocasionándole más complicaciones e incapacidades. El objetivo de este estudio fue identificar en qué dominios del *World Health Organization Disability Assessment Schedule*, versión 2.0 (WHODAS 2.0), las personas con DM presentan las mayores incapacidades.

Para ello, se realizó un estudio transversal con 111 personas diagnosticadas con la enfermedad, independientemente del tipo. Se aplicaron un cuestionario sociodemográfico y WHODAS 2.0 con 36 preguntas para evaluar las dificultades presentadas en los últimos 30 días. La muestra fue predominantemente femenina (60,3%) y clasificada como independiente en la comunidad (90,1%). La mayor prevalencia fue de individuos jubilados (35,1%). El dominio movilidad tuvo mayor comprometimiento (48 ± 23), mientras que el dominio actividades de la vida presentó el menor comprometimiento (28 ± 13). Sin embargo, para todos los dominios, el comprometimiento fue inferior a 50 en una escala que varía de 0 a 100. Todos los individuos con DM presentaron una discapacidad, con mayor implicación del dominio relacionado con la movilidad.

Palabras clave | Diabetes Mellitus; Evaluación en Salud; Estadísticas de Secuelas y Incapacidad.

INTRODUCTION

Diabetes mellitus (DM) is a chronic systemic disease that can affect different organs, depending on its progression¹. Individuals with DM may have altered sensation in the extremities, especially in the feet, which predisposes them to fall and, in more severe cases, leads to ulcers and even amputation. The diabetic foot, for example, can cause loss of functioning and decrease in quality of life, resulting in expenses with hospitalization, medication, and rehabilitation²⁻⁴. Moreover, renal dysfunction, gastrointestinal, cardiovascular, and genitourinary disorders, sexual dysfunctions, and predisposition to infections may occur, impairing these individuals' health, who become increasingly weakened, and affecting their professional, personal, and social life⁵⁻⁸.

DM causes functional limitations according to the disease duration and its comorbidities, greatly affecting the personal and professional life of individuals and possibly leading to more complications. However, early diagnosis and control of the disease may diminish the damage. Thus, knowing the limitations and, especially, disabilities of individuals with DM is greatly significant, as it allows for professionals to direct health promotion and prevention actions and the treatment of diseases⁹⁻¹¹.

According to the International Classification of Functioning, Disability and Health (ICF), the term

“functioning” encompasses all body functions, activities, and participation and the term “disability” comprises impairments, activity limitations, and participation restriction¹². The ICF constitutes the conceptual basis for the definition and measurement of these conditions¹²⁻¹⁴. Although ICF is wide-ranging, it is not a tool to assess and to measure disabilities in daily activities⁹. To measure functioning and disability, the World Health Organization (WHO) developed, based on ICF items¹⁵, the World Health Organization Disability Assessment Schedule version 2.0 (WHODAS 2.0) to measure disability in a cross-cultural way. This tool has already been validated for individuals with HIV/AIDS¹⁶, institutionalized older adults¹⁷, and individuals with DM¹⁸, blindness¹⁹, and temporomandibular disorder²⁰.

As changes in DM lead to limitations and disabilities that negatively affect quality of life and functioning during daily life activities, assessing the individuals' functioning using a wide-ranging tool is important. The WHODAS 2.0 allows for health professionals to measure disability by a validated tool that considers multiple aspects of human functioning and, thus, enables a more assertive intervention. Therefore, this study aimed to identify in which domains of the WHODAS 2.0 individuals with DM present higher disabilities, which is relevant due to the lack of epidemiological data on their state of health and disability.

METHODOLOGY

This study was performed in the municipality of Guarapuava, PR, with a convenience, non-probabilistic sample. Women and men, aged over 18 years, diagnosed with DM (type 1 and 2), and living in Guarapuava were included. Individuals who presented and/or reported difficulty in verbal and/or written comprehension were excluded.

Data were collected from June to September 2017. Individuals who agreed to participate in the interview received the necessary clarification and signed an informed consent form. Sample recruitment and evaluation were performed in the general community. All individuals answered a questionnaire, which was self-applied, when they could answer without help, and applied by a trained researcher, when individuals did not have a good understanding.

This questionnaire was elaborated by the authors and was used to collect sociodemographic data with the following variables: age, sex, living condition, schooling level, marital status, and occupation.

Reported disability was considered a variable and, for its measurement, the Brazilian version of the WHODAS 2.0 with 36 items was used (applied by an interviewer or self-applied)¹⁸. All questions concern difficulties faced by individuals in six life domains during the 30 days before application of the questionnaire. The WHODAS 2.0 assesses the level of functioning of six life domains: cognition (understanding and communication), mobility (movement and locomotion), self-care (self-hygiene, dressing and eating autonomy, and remaining alone), getting along (interactions with other people), life activities (household responsibilities, leisure, work, and school), and participation (involvement in community activities and society).

Regarding the participation domain, the questions assessed how much individuals' difficulties affected their lives. Question H1 referred to the number of days in which individuals presented difficulties, question H2 referred to the number of days in which individuals were completely unable to perform their normal work activities due to their health condition, and question H3 assesses the number of days in which individuals reduced their normal or work activities due to their health condition^{15,21}.

The spreadsheet provided by the WHO was used to estimate the WHODAS 2.0 score¹⁵. This evaluation method was based on the item response theory, which considers multiple levels of difficulty for each item of the questionnaire. For the score, three steps were followed:

sum of the scores of recoded items within each domain; sum of all scores of the six domains; and conversion of the score summary into a metrics ranging from zero to 100 (where zero corresponds to no impairment and 100 corresponds to complete impairment)¹⁵.

Data were initially subjected to a descriptive statistical analysis; qualitative data were presented as frequency and quantitative data as mean and standard deviation. As the variables sex and age interfere in the level of disability, a linear regression analysis was performed. For this analysis, sex and age of individuals were considered independent variables and the values of the six domains and the overall mean of the WHODAS 2.0 were dependent variables. The prerequisites of multicollinearity, autocorrelation, normally distributed errors, and independence were prospectively tested²². For the statistical analysis, the Statistical Package for the Social Sciences software version 23 was used.

RESULTS

In total, 111 individuals participated in this study and all of them met the pre-established inclusion criteria. Table 1 shows the sample characteristics.

Table 1. Sample characterization

Sex, n (%)	
Female	68 (61.3)
Male	43 (38.7)
Age (years old), mean±SD	53.2±16.8
Schooling level (years), mean±SD	9.2±5.7
Living condition, n (%)	
Independent in the community	100 (90.1)
With assistance	10 (9.0)
Hospitalized	0 (0.0)
Not informed	1 (0.9)
Marital status, n (%)	
Never married	19 (17.1)
Married	69 (62.2)
Separated	2 (1.8)
Divorced	6 (5.4)
Widowhood	9 (8.1)
Lives together	5 (4.5)
Not informed	1 (0.9)
Occupation, n (%)	
Paid work	34 (30.6)
Self-employed	11 (9.9)
Unpaid work	0 (0.0)
Student	1 (0.9)
Housewife	21 (18.9)
Retiree	39 (35.1)

(continues)

Table 1. Continuation

Unemployed (for health reasons)	1 (0.9)
Unemployed (for other reasons)	0 (0.0)
Other	3 (2.7)
Not informed	1 (0.9)

In the analysis of the WHODAS 2.0, the life activities domain showed greater impairment and the getting along domain showed lower impairment (Table 2).

Question H1 presented the highest number of days in which individuals presented difficulties and H2 presented the lowest mean (Table 3).

The linear regression models of the adjusted domains of the WHODAS 2.0 and overall mean for the variables age and sex were significant only for age, except for the cognition domain (Table 4).

Table 2. Values of the WHODAS 2.0 domains (mean±SD)

Cognition	41±17
Mobility	48±23
Self-care	33±16
Getting along	37±14
Life activities	28±13
Participation	45±19
Overall mean	39±12

Table 3. Number of days in which individuals' difficulties affected their lives (mean±SD)

H1	14.11±38.14
H2	6.86±36.85
H3	9.95±37.68

Table 4. Linear regression of the adjusted domains of the WHODAS 2.0 and overall mean for the variables age and sex

	Age				Sex			
	Beta	R ² (%)	F	p	Beta	R ² (%)	F	p
Cognition	0.179	0.032	3.502	0.064	0.163	0.026	2.966	0.088
Mobility	0.432	0.186	24.283	<0.001	0.94	0.009	0.975	0.326
Self-care	0.259	0.067	7.636	0.007	0.024	0.001	0.060	0.806
Getting along	0.238	0.057	6.383	0.013	0.020	0.000	0.044	0.835
Life activities	-0.312	0.097	11.418	0.001	0.161	0.026	2.899	0.091
Participation	0.214	0.046	5.077	0.026	0.127	0.016	1.798	0.183
Overall mean	0.283	0.080	9.232	0.003	0.140	0.020	2.192	0.142

DISCUSSION

This study analyzed the disabilities of individuals with DM by the WHODAS 2.0. The mobility and social participation domains presented the greatest impairments whereas daily living activities shows the lower impairment. Participants age ranged from 19 to 80 years and most individuals were women (61.3%). However, the International Diabetes Federation estimates that by 2040, 328.4 million men and 313 million women will have DM²³. Moreover, in 2017, around 451 million adults had DM worldwide and this number is expected to increase to 693 million by 2045²⁴. In our study, most individuals were married (62.2%) and independent in the community (90.1%), and the prevalence of retirees was higher (35.1%).

The cognition domain presented the third highest mean (41±17), however, as it scored below 50, it was considered a small impairment. According to Fernandez

and Torres-Alemán²⁵ and Hamed²⁶, the brain needs energy from glucose in an appropriate amount of circulating insulin to perform its functions and, if this amount is exacerbated or reduced, it causes cognitive changes in individuals.

The mobility domain presented the highest score among the six domains, but its mean was close to 50. Chiles et al.²⁷ evaluated the physical performance of individuals with DM and the peripheral nerve function (which included nerve conduction velocity, vibration, and sensitivity) of 983 individuals aged 65 years or older. The authors observed that individuals with diabetes had greater gait alteration (decreased walking speed), reduced nerve conduction, and greater neuropathy in comparison with non-diabetic individuals. In this study, we did not compare mobility between diabetics and non-diabetics, which was one of its limitations.

Ferreira et al.²⁸ assessed functional mobility related to cognitive capacity in 118 individuals—50 of them

with type 2 DM (with altered glycemic control) and a control group with 68 individuals—using the mini-mental state examination and the clock drawing test to assess cognition, and the timed up and go test to assess mobility. The authors observed that reduced mobility was associated with cognitive decline. In this study, the mobility and cognition domains were slightly impaired, as both reached values below 50. Notably, the correlation between domains was not performed.

The self-care domain presented a mean of 33 ± 16 , thus, the fact that most individuals reported living independently in the community (90.1%) may have contributed to this low impairment. Weinger, Beverly, and Smaldone¹¹ stated that self-care depends on the cognitive level, the environment where individuals live, and their limitations, and that these aspects changes throughout life. Each individual must be carefully analyzed, since self-care depends on the context in which each person is inserted. Walker et al.²⁹ showed that psychological health, socioeconomic factors, and self-knowledge, as well as knowledge about DM, are determinant for self-care.

The participation and getting along domains were little impaired and the life activities domain presented the lowest impairment. This low score may be associated with occupation, since 35.1% were retirees and, therefore, they did not respond to this domain. According to Ducat et al.³⁰, the mental health of individuals with type 1 DM may be impaired by the diagnosis of the disease, as it changes the daily life of individuals, making them adapt to the new reality. The participation domain is directly influenced by the individuals' mental health, causing a great impact that can further aggravate their general state. In the study, the participation and getting along domains were little impaired, however, the disease duration and the presence of complications were not considered.

The life activities domain—which refers to leisure activities, work, school, household responsibilities, etc.—presented the lowest impairment. This low score was correlated with occupation, since 35.1% of individuals were retirees and, therefore, did not respond to this domain. Krstović-Spremo et al.³¹ stated that individuals with DM presented physical and mental limitation in work activities and a high level of anxiety, reducing their quality of life. This study presented changes in the number of days in which individuals presented difficulties (14.11 ± 38.14), in which they were completely unable to perform their activities (6.86 ± 36.85), and in which

they reduced their normal or work activities due to their health condition (9.95 ± 37.68).

Regarding the possible interferences in the level of disability, only the variable age was significant. Another study already showed that aging increases the prevalence of disability for mobility, basic daily life activities, and instrumental daily life activities³².

Although the ICF considers contextual factors, the WHODAS 2.0 do not address them. According to the ICF, contextual factors represent the complete history of an individual's life and lifestyle and consists of environmental factors and personal factors¹². Personal factors can affect the health condition and health or health-related state of individuals. Environmental factors, on the other hand, include the physical, social, and attitudinal environment in which people live. These factors are external to individuals and may positively or negatively influence their performance as a members of society, their ability to perform actions or tasks, or the function or structure of their bodies¹². Although the WHODAS 2.0 does not address contextual factors as a whole, it incorporates environmental factors by asking individuals to always respond to the questions considering how they usually perform the activity, mentioning the aid used or the difficulty experienced.

Knowing the profile of the sample and the impairments of individuals with DM enables the proposition of an appropriate conduct aimed at this population. However, in this study, we did not consider the disease duration and control, the DM type, and whether individuals were in rehabilitation or not. Moreover, we did not perform a cognition screening test. Therefore, future studies shall consider these limitations.

CONCLUSION

This study showed in which domains individuals with DM have the highest disabilities. Although the sample showed impairment in all of them, mobility was the domain with the greatest impairment.

REFERENCES

1. Petersmann A, Müller-Wieland D, Müller UA, Landgraf R, Nauck M, Freckmann G, et al. Definition, classification and

- diagnosis of diabetes mellitus. *Exp Clin Endocrinol Diabetes*. 2019;127(S 01):S1-7. doi: 10.1055/a-1018-9078.
2. Ahmad J. The diabetic foot. *Diabetes Metab Syndr*. 2016;10(1):48-60. doi: 10.1016/j.dsx.2015.04.002.
 3. Almeida SA, Silveira MM, Santo PFE, Pereira RC, Salomé GM. Assessment of the quality of life of patients with diabetes mellitus and foot ulcers. *Rev Bras Cir Plast*. 2013;28(1):142-6. doi: 10.1590/S1983-51752013000100024.
 4. Anjos DMC, Araújo IL, Barros VM, Pereira DAG, Pereira DS. Avaliação da capacidade funcional em idosos diabéticos. *Fisioter Pesqui*. 2012;19(1):73-8. doi: 10.1590/S1809-29502012000100014.
 5. La Vignera S, Condorelli RA, Di Mauro M, Lo Presti D, Mongioi LM, Russo G, et al. Reproductive function in male patients with type 1 diabetes mellitus. *Andrology*. 2015;3(6):1082-7. doi: 10.1111/andr.12097.
 6. Lastra G, Syed S, Kurukulasuriya LR, Manrique C, Sowers JR. Type 2 diabetes mellitus and hypertension: an update. *Endocrinol Metab Clin North Am*. 2014;43(1):103-22. doi: 10.1016/j.ecl.2013.09.005.
 7. Sharma S, Tripathi P. Gut microbiome and type 2 diabetes: where we are and where to go? *J Nutr Biochem*. 2019;63:101-8. doi: 10.1016/j.jnutbio.2018.10.003.
 8. Trevelin SC, Carlos D, Beretta M, Silva JS, Cunha FQ. Diabetes mellitus and sepsis: a challenging association. *Shock*. 2017;47(3):276-87. doi: 10.1097/shk.0000000000000778.
 9. Costa AF, Flor LS, Campos MR, Oliveira AF, Costa MFS, Silva RS, et al. Burden of type 2 diabetes mellitus in Brazil. *Cad Saude Publica*. 2017;33(2):e00197915. doi: 10.1590/0102-311x00197915.
 10. van Netten JJ, Price PE, Lavery LA, Monteiro-Soares M, Rasmussen A, Jubiz Y, et al. Prevention of foot ulcers in the at-risk patient with diabetes: a systematic review. *Diabetes Metab Res Rev*. 2016;32 Suppl 1:84-98. doi: 10.1002/dmrr.2701.
 11. Weinger K, Beverly EA, Smaldone A. Diabetes self-care and the older adult. *West J Nurs Res*. 2014;36(9):1272-98. doi: 10.1177/0193945914521696.
 12. World Health Organization. *International Classification of Functioning, Disability and Health (ICF)*. Geneva: WHO; 2001.
 13. Farias N, Buchalla CM. A classificação internacional de funcionalidade, incapacidade e saúde da Organização Mundial da Saúde: conceitos, usos e perspectivas. *Rev Bras Epidemiol*. 2005;8(2):187-93. doi: 10.1590/S1415-790X2005000200011.
 14. Di Nubila HBV. Uma introdução à CIF: classificação internacional de funcionalidade, incapacidade e saúde. *Rev Bras Saude Ocup*. 2010;35(121):122-3. doi: 10.1590/S0303-76572010000100013.
 15. Organização Mundial da Saúde. *Avaliação de saúde e deficiência: manual do WHO Disability Assessment Schedule - WHODAS 2.0* [Internet]. Uberaba: Universidade Federal do Triângulo Mineiro; 2015 [cited 2017 Oct 15]. Available from: http://apps.who.int/iris/bitstream/10665/43974/1/9788562599514_por.pdf
 16. Barbosa KSS, Castro SS, Leite CF, Nacci FR, Accioly MF. Validation of the Brazilian version of the World Health Organization Disability Assessment Schedule 2.0 for individuals with HIV/AIDS. *Cienc Saude Colet*. 2020;25(3):837-44. doi: 10.1590/1413-81232020253.18992018.
 17. Grou TC, Castro SS, Leite CF, Carvalho MT, Patrizzi LJ. Validação da versão brasileira do World Health Organization Disability Assessment Schedule 2.0 em idosos institucionalizados. *Fisioter Pesqui*. 2021;28(1):77-87. doi: 10.1590/1809-2950/20024628012021.
 18. Castro SS, Leite CF, Nacci FR, Barbosa KSS, Accioly MF. Validation of the Brazilian version of the World Health Organization Disability Assessment Schedule in individuals with diabetes mellitus. *Fisioter Pesqui*. 2019;26(4):413-8. doi: 10.1590/1809-2950/18033926042019.
 19. Silveira LS, Castro SS, Leite CF, Oliveira NML, Salomão AE, Pereira K. Validade e confiabilidade da versão brasileira do World Health Organization Disability Assessment Schedule em pessoas com cegueira. *Fisioter Pesqui*. 2019;26(1):22-30. doi: 10.1590/1809-2950/17013126012019.
 20. Mendes LMR, Fiamengui LMSP, Bevilacqua-Grossi D, Castro SS. Validation of the Brazilian version of WHODAS 2.0 for individuals with temporomandibular disorders. *Fisioter Pesqui*. 2021;28(4):408-15. doi: 10.1590/1809-2950/20025428042021.
 21. Silveira C, Parpinelli MA, Pacagnella RC, Camargo RS, Costa ML, Zanardi DM, et al. Adaptação transcultural da Escala de Avaliação de Incapacidades da Organização Mundial de Saúde (WHODAS 2.0) para o português. *Rev Assoc Med Bras (1992)*. 2013;59(3):234-40. doi: 10.1016/j.ramb.2012.11.005.
 22. Field A. *Descobrimo a estatística usando SPSS*. 2nd ed. Porto Alegre: Artmed; 2009.
 23. International Diabetes Federation. *Diabetes atlas* [Internet]. 7th ed. Brussels: IDF; 2015 [cited 2018 Oct 15]. Available from: <https://www.diabetesatlas.org/upload/resources/previous/files/7/IDF%20Diabetes%20Atlas%207th.pdf>
 24. Cho NH, Shaw JE, Karuranga S, Huang Y, Rocha Fernandes JD, Ohlogge AW, et al. IDF Diabetes Atlas: global estimates of diabetes prevalence for 2017 and projections for 2045. *Diabetes Res Clin Pract*. 2018;138:271-81. doi: 10.1016/j.diabres.2018.02.023.
 25. Fernandez AM, Torres-Alemán I. The many faces of insulin-like peptide signalling in the brain. *Nat Rev Neurosci*. 2012;13(4):225-39. doi: 10.1038/nrn3209.
 26. Hamed SA. Brain injury with diabetes mellitus: evidence, mechanisms and treatment implications. *Expert Rev Clin Pharmacol*. 2017;10(4):409-28. doi: 10.1080/17512433.2017.1293521.
 27. Chiles NS, Phillips CL, Volpato S, Bandinelli S, Ferrucci L, Guralnik JM, et al. Diabetes, peripheral neuropathy, and lower-extremity function. *J Diabetes Complications*. 2014;28(1):91-5. doi: 10.1016/j.jdiacomp.2013.08.007.
 28. Ferreira MC, Tozatti J, Fachin SM, Oliveira PP, Santos RF, Silva MER. Redução da mobilidade funcional e da capacidade cognitiva no diabetes melito tipo 2. *Arq Bras Endocrinol Metabol*. 2014;58(9):946-52. doi: 10.1590/0004-2730000003097.
 29. Walker RJ, Gebregziabher M, Martin-Harris B, Egede LE. Independent effects of socioeconomic and psychological social determinants of health on self-care and outcomes

- in type 2 diabetes. *Gen Hosp Psychiatry*. 2014;36(6):662-8. doi: 10.1016/j.genhosppsy.2014.06.011.
30. Ducat L, Rubenstein A, Philipson LH, Anderson BJ. A review of the mental health issues of diabetes conference. *Diabetes Care*. 2015;38(2):333-8. doi: 10.2337/dc14-1383.
31. Krstović-Spremo V, Račić M, Joksimović BN, Joksimović VR. The effects of diabetes mellitus and hypertension on work productivity. *Acta Med Acad*. 2014;43(2):122-33. doi: 10.5644/ama2006-124.111.
32. Silva SLA, Peixoto SV, Lima-Costa MF, Simões TC. Efeito da idade, período e coorte de nascimento na incapacidade de idosos residentes na comunidade: coorte de idosos de Bambuí (1997-2012). *Cad Saude Publica*. 2019;35(9):e00156018. doi: 10.1590/0102-311x00156018.