Back pain prevalence and associated factors in Brazilian Unified Health System users

Prevalência de dor nas costas e fatores associados em usuários do Sistema Único de Saúde

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ABSTRACT

BACKGROUND AND OBJECTIVES: Back pain is one of the main causes of disability worldwide, resulting in higher rates of work absenteeism and years lived with disability. This study aimed to evaluate back pain prevalence and its associated factors in Primary Health Units (PHU) users.

METHODS: A community-based cross-sectional study was conducted at PHU located in Pelotas, Brazil. Fifteen individuals of each PHU, aged 18 years or more, were interviewed (n=540). Back pain was defined as pain in one to three back areas (neck, dorsal and lumbar). Demographic, economic, behavioral, nutritional status (body mass index) and health characteristics were assessed as covariates. Poisson regression was used to estimate the prevalence ratio and 95% confidence intervals.

RESULTS: Prevalence of back pain in PHU users was 20% (95%CI 16.8 - 23.6). Fair (PR 2.66 95%CI 1.00 - 7.09) and poor (PR 3.65 95%CI 1.31 - 10.16) self-perceived health, musculoskeletal disease (RP 2.71 95%CI 1.84 - 3.98) and current smoking (PR 1.71 95%CI 1.18 - 2.47) were associated with back pain.

CONCLUSION: Back pain is a common problem in PHU users in Brazil. Patients with musculoskeletal disease, who are current smokers and have a poor self-perceived health, are more likely to experience back pain.

Keywords: Back pain, Chronic pain, Unified Health System.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A dor nas costas é uma das principais causas de incapacidade em todo o mundo, resultando em maiores taxas de absenteísmo no trabalho e anos vividos com incapacidade. Este estudo teve como objetivo avaliar a prevalência de dor nas costas e seus fatores associados em usuários de Unidades Básicas de Saúde (UBS).

MÉTODOS: Foi realizado um estudo transversal de base comunitária em UBS localizadas em Pelotas, Brasil. Foram entrevistados 15 indivíduos de cada UBS, com idade igual ou superior a 18 anos (n=540). A dor nas costas foi definida como dor em uma a três áreas das costas (pescoço, dorsal e lombar). Características demográficas, econômicas, comportamentais, nutricionais (índice de massa corporal) e de saúde foram avaliadas como covariáveis. A regressão de Poisson foi utilizada para estimar a razão de prevalência e os intervalos de confiança de 95%.

RESULTADOS: A prevalência de dor nas costas em usuários de UBS foi de 20% (IC95% 16,8 - 23,6). Autopercepção de saúde regular (RP 2,66 IC95% 1,00 - 7,09) e ruim (RP 3,65 IC95% 1,31 - 10,16), doença musculoesquelética (RP 2,71 IC95% 1,84 - 3,98) e tabagismo atual (RP 1,71 IC95% 1,18 - 2,47) foram associados à dor nas costas.

CONCLUSÃO: A dor nas costas é um problema comum em usuários de UBS. Pacientes com doença musculoesquelética, fumantes atuais e com autopercepção de saúde ruim são mais propensos a sentir dor nas costas.

Descritores: Dor crônica, Dor nas costas, Sistema Único de Saúde.

INTRODUCTION

Back pain is one of the main causes of disability worldwide, resulting in higher rates of work absenteeism and years lived with disability[1]. In Southern Latin America, low back pain (LBP) and neck pain have a prevalence of 8.0% and 5.6%, respectively[2]. Furthermore, chronic back pain prevalence, defined as pain in cervical, thoracic or lumbar area, is 17.7%[3].

LBP etiology includes myofascial pain, facet joint pain, discogenic pain, spinal stenosis, and might be worsened by psychological and disease related factors[4]. Approximately 80% of patients who experience LBP seek a healthcare professional to manage their pain. The general practitioner is the healthcare professional most sought by LBP patients[5,6].

The Brazilian Unified Health System (SUS – *Sistema Único de Saúde*) was founded based on a new political and organizational formulation, aiming to reorganize health actions

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and services established in Brazil's 1988 Constitution[7]. This system emerges as a decentralized strategy for attention and healthcare, using primary care as users main gateway[8,9]. Additionally, communication with SUS' entire healthcare network takes place through Primary Health Units (PHU)[10].

PHU are strategically located close to people's home, school, and work. They are composed of multidisciplinary teams which play an important role to provide quality primary care to Brazilian public health system users[10]. Simple and cheap procedures are performed at PHU, where staff members are capable of solving most of the community's common health problems.

However, their organization, applicability and development demand complex studies and deep knowledge regarding population reality[11]. Users who seek care in PHU are, in general, individuals from a less privileged social level and can also be in vulnerability, who need equity in healthcare[12]. As PHU are the community closest option of health care, this study aimed to 1) evaluate the prevalence of back pain (cervical, thoracic and lumbar) in PHU users and 2) to evaluate what factors were associated with back pain prevalence in this population.

METHODS

A community-based cross-sectional study was conducted at PHU located in the city of Pelotas, RS, Brazil. The structure of the manuscript agreed with STROBE requirements[13]. According to 2010 Demographic Census (IBGE), Pelotas is a city with approximately 327,778 inhabitants. Overall, there are 38 PHU located in the city urban area. Two PHU for specific populations (prisoners and children) were excluded. Following the worldwide prevalence of chronic pain (i.e., 35.5%)[14], a sample size of 540 participants was calculated, with 80% power and 95% confidence level. In each PHU (i.e., 36 in urban Pelotas), 15 individuals, aged 18 or more, were interviewed (n=540). Participants were asked to take part in the study regardless of the reason they sought care in the PHU.

After the Municipal Health Department authorized the study, the PHU were contacted. Interviews were scheduled with the PHU head chief aiming not to disturb the unit's normal operation. Data collection took place between March and June 2018, and interviews were conducted individually.

The first subject located on the right side of the room, starting from the entrance door was the first person asked to participate in the study. Then, the next subject located on the left side of the first participant was the next and so on, until the predetermined number of 15 participants was reached[15,16]. Individuals who were accompanying patients, who were not PHU users, as well as people unable to express themselves due to a health disability, did not participate in the study.

Back pain was defined as pain in one to three back areas (neck, dorsal and lumbar). Participants were asked about pain experience by the question: "*Did you feel any pain this week*"? If participants answered positively, a human body image in supine position was showed, and participants were then asked to point the pain location on the image. Participants who pointed one or more back areas on the image were considered as experiencing back pain.

Covariates

Demographic (age and gender), economic (wage), behavioral (smoking, alcohol intake, physical activity level and TV watching), nutritional status (body mass index) and health (self-perceived health, depression, musculoskeletal disease and drug treatments) characteristics were assessed. Age was divided into three categories: 18-39, 40-59, 60 or more years. Economic level was determined by the number of self-reported wages and classified in less than one wage, one to two wages and more than three (one minimal wage was R$ 954,00). Medical diagnostic of depression and musculoskeletal disorders were assessed by the questions of a Brazilian national survey[17]. Self-perceived health was classified in excellent/very good, good, fair and poor. Participants were asked about alcohol intake and had three response options: "no"; "yes, sometimes"; and "yes, every day". For analysis purposes, participants who reported alcohol intake sometimes or every day were classified by "yes". The number of continuously used drugs was classified in none, one or two and three or more.

Body mass index was calculated from self-reported height and weight, following the World Health Organization recommendation (normal <25 kg/m^2, overweight 25-29.9 kg/m^2 and obese ≥30 kg/m^2). Smoking was categorized into never smoked, former-smoker and current smoker (one or more cigarettes per day for more than one month). Leisure-time physical activity was assessed through the International Physical Activity Questionnaire long version (IPAQ). A cut-off point of 150 minutes per week was used to classify subjects as active (150 min/week or more) or insufficiently active (below 150 min/week)[18]. Television time was calculated considering three or more hours per day.

The study was approved by the Research Ethics Committee from the Physical Education Faculty, Federal University of Pelotas (protocol number: 2.496.718).

Statistical analysis

EpiData 3.1 was used to structure the dataset. Descriptive analyzes of the sample, according to back pain report, are presented as relative and absolute frequencies. Prevalence ratio and 95% confidence interval between back pain and independent variables were estimated with crude and adjusted analyzes, using Poisson regression. A p<0.2 was considered aiming to control for potential confounders. Analyzes were conducted using Stata statistical software (StataCorp. 2012, Stata Statistical Software: Release 12, Version 12.1, StataCorp LP, College Station, TX, USA) with the significance level set at 0.05.

RESULTS

Overall, data of 540 users in 36 PHU from Pelotas were analyzed. Back pain prevalence was 20.0% (95%CI 16.8; 23.6). Higher frequencies of back pain were observed in

those participants who were female, aged 40-59, smokers, with fair and poor self-perceived health, reported musculoskeletal disorders, depression, and continued use of drugs (Table 1).

The crude analyzes between back pain and covariates is displayed in Table 1. Mid-age adults were 71% (95%CI 1.11; 2.65) more likely to report back pain. Regarding health characteristics, those who perceived their health as fair or poor (PR 3.88 95%CI 1.46; 10.32; PR 6.75 95%CI 2.51; 18.19, respectively), who reported depression (PR 1.85 95%CI 1.31; 2.56) and musculoskeletal disease (PR 3.41 95%CI 2.43; 4.78) were more likely to experience back pain. Smoking (PR 1.73 95%CI 1.15; 2.60) and using one or more drugs (PR 1.83 95%CI 1.16; 2.89; PR 1.98 95%CI 1.27 - 3.10, for 1-2 and ≥ 3, respectively) were also associated with back pain.

Table 2 shows the adjusted analyzes between back pain and covariates. No association was observed with gender, age, income, depression, alcohol intake, BMI, TV watching and leisure-time physical activity. Fair (PR 2.66 95%CI 1.00 - 7.09) and poor (PR 3.65 95%CI 1.31 - 10.16) self-perceived health

Table 1. Descriptive characteristics, and crude analysis of back pain of Brazil Primary Health Unit users, 2018 (n=540)

Variables	Total sample n	Back pain %	PR	CI 95%	p-value
Gender					0.131
Male	147	15.7	1.0	–	
Female	393	21.6	1.38	(0.91 – 2.10)	
Age (years)					0.051
18-39	179	14.0	1.0	–	
40-59	213	23.9	1.71	(1.11 – 2.65)	
60-90	147	21.8	1.56	(0.97 – 2.51)	
Income					0.401
< 1 wage	205	21.0	1.0	–	
1-2 wages	274	20.4	0.97	(0.68 – 1.39)	
> 3 wages	60	15.0	0.72	(0.37 – 1.38)	
Health self-perception					<0.001
Excellent/very good	63	6.4	1.0	–	
Good	199	12.1	1.90	(0.68 – 5.27)	
Fair	215	24.7	3.88	(1.46 – 10.32)	
Poor	63	42.9	6.75	(2.51 – 18.19)	
Depression					<0.001
No	388	16.2	1.0	–	
Yes	151	29.8	1.84	(1.31 – 2.56)	
Musculoskeletal disease					<0.001
No	374	11.5	1.0	–	
Yes	166	39.2	3.41	(2.43 – 4.78)	
Smoking					0.007
Never smoker	276	15.9	1.0	–	
Former smoker	155	21.9	1.38	(0.92 – 2.06)	
Smoker	109	27.5	1.73	(1.15 – 2.60)	
Alcohol intake					0.785
No	359	20.3	1.0	–	
Yes	181	19.3	0.95	(0.66 – 1.37)	
Leisure-time physical activity					0.172
0-149 minutes	432	21.2	1.0	–	
≥ 150 minutes	106	15.1	0.71	(0.44 – 1.16)	
TV watching					0.306
< 3 hours	339	18.9	1.0	–	
≥ 3 hours	195	22.6	1.20	(0.85 – 1.68)	
Body mass index					0.577
Normal	174	20.1	1.0	–	
Overweight	186	22.6	1.12	(0.75 – 1.67)	
Obesity	154	17.5	0.87	(0.55 – 1.37)	
Use of drugs					0.002
None	197	12.7	1.0	–	
1-2	172	23.3	1.83	(1.16 – 2.89)	
≥ 3	171	25.2	1.98	(1.27 – 3.10)	

PR = Prevalence ratio; CI = Confidence interval of 95%.

and musculoskeletal disease diagnosis (PR 2.71 95%CI 1.84 - 3.98) as well as current smoking (PR 1.71 95%CI 1.18 - 2.47) remained associated with back pain. (Table 2).

Table 2. Adjusted analysis of back pain according to exposure variables of Brazil Primary Health Unit users, 2018 (n=540)

Variables	PR	CI 95%
Gender		
Male	1.0	–
Female	0.95	(0.63 – 1.42)
Age (years)		
18-39	1.0	–
40-59	0.92	(0.58 – 1.46)
60-90	0.78	(0.47 – 1.29)
Income		
< 1 wage	1.0	–
1-2 wages	0.95	(0.67 – 1.35)
> 3 wages	0.91	(0.47 – 1.78)
Health self-perception		
Excellent/Very good	1.0	–
Good	1.76	(0.65 – 4.73)
Fair	2.66	(1.00 – 7.09)
Poor	3.65	(1.31 – 10.16)
Depression		
No	1.0	–
Yes	1.18	(0.84 – 1.66)
Musculoskeletal disease		
No	1.0	–
Yes	2.71	(1.84 – 3.98)
Smoking		
Never smoker	1.0	–
Former smoker	1.23	(0.84 – 1.82)
Smoker	1.71	(1.18 – 2.47)
Alcohol intake		
No	1.0	–
Yes	1.03	(0.72 – 1.48)
Leisure physical activity per week		
0-149 minutes	1.0	–
≥ 150 minutes	0.85	(0.53 – 1.36)
TV watching		
< 3 hours	1.0	–
≥ 3 hours	1.22	(0.89 – 1.68)
Body mass index		
Normal	1.0	–
Overweight	1.21	(0.83 – 1.75)
Obesity	0.83	(0.54 – 1.27)
Use of drugs		
None	1.0	–
1-2	1.30	(0.80 – 2.12)
≥ 3	0.96	(0.53 – 1.72)

PR = Prevalence ratio. CI = Confidence interval of 95%.

DISCUSSION

One out of five PHU users reported pain in their back. Having a poor health self-perception, a musculoskeletal disease and smoking were associated with higher prevalence of back pain in PHU users. Other sociodemographic, health and behavior characteristics were not associated with back pain in this population.

Back pain prevalence in PHU users is in the range of general population prevalence studies worldwide. Specifically, studies on back pain report prevalence of 13.9% in México[19], 22.6% in Poland, 28.8% in Germany[20] and 31.5% in Australia[21]. A population-based study conducted in Pelotas, southern Brazil, found a one-year prevalence of 63.1% of back pain, being LBP the most prevalent, followed by thoracic and neck pain, respectively[22].

Sampling variation process, as well as different characterization and the establishment of pain site, could make it difficult to compare data with other studies and could also explain the high range of prevalence among them. Also, one should note that PHU users are a specific population, which includes low economic status people and who exclusively use the public health system in Brazil. This population particularity could explain the difference among back pain prevalence in a population-based study and in a PHU-based study conducted in the same city.

LBP is the reason for 2.3% of general practitioner visits[23]. Patients seek care in PHU for many reasons (e.g., take control drugs, routine practitioner visit, dental care, specialist referral, group activities diagnosis and treatment of chronic conditions such as diabetes, tuberculosis, and hypertension). Additionally, Brazil has a self-medication prevalence of 35%, which could lead individuals to take analgesics and non-steroidal anti-inflammatory drugs without consulting a general practitioner first. These factors could also have an influence on back pain prevalence found in this study.

The worse the subject's perception of his/her health, the higher the frequency of comorbidities, being chronic spinal pain the most reported chronic condition[24]. LBP had a negative effect in functionality, presenting negative implications on life quality, and a higher impact on this parameter than knee pain[25,26]. Also, health-related quality of life in LBP patients could be as low as in other chronic condition patients, such as kidney failure[27]. Even though, health perception was measured by a general question, this study indicates an association among fair/poor self-perceived health and back pain.

Back pain could be related to specific spine conditions such as inflammatory or mechanical disturbances, as well as other conditions (e.g., inflammatory or infectious disease, tumor, or metabolic disease). Also, could be considered non-specific, that is, without a specific diagnosis[28,29]. Patients with musculoskeletal disorders generally look for general practitioner treatment, as well as for drugs to relieve pain intensity, which might explain the present findings on the association of back pain and musculoskeletal disease. Furthermore, it is

important to highlight that PHU are the easiest and nearest health facility to seek care.

Association between smoking and back pain has been well established in literature. Data from a meta-analysis study indicate higher odds of back pain in former smokers (OR 1.27) and ever smokers (OR 1.26), in comparison with never smokers[30]. Additionally, a study with US adults observed that back pain prevalence in current smokers is higher when compared to former and never smokers. Also, back pain prevalence of former smokers is higher than never smokers[31]. However, only ever smoker category was associated with back pain in the present study.

Even tough there is evidence on the protective effect of leisure-time physical activity on back pain[32], the present study did not show an association between these variables. However, people who experience pain might be less likely to engage in physical activity to avoid worsening their pain[16]. This might explain the lack of association found in this study. However, future studies in PHU users should focus on physical activity and back pain.

Limitations of this study should be listed. First, different types of PHU (standard, Family Health, or mixed) offer different health care treatments. Actions and resources are more adequate in Family Health Program, because they are directed to programmatic actions, home activities and greater involvement with the community. On the other hand, in standard PHU, treatment depends on the patient's initiative to seek care, which could interfere in their pain condition[33]. Second, pain was assessed only in the last week, which doesn't allow to make inferences about pain chronicity. However, to the authors knowledge this is the first study to evaluate back pain prevalence in PHU user's population. In addition, the study assessed a representative sample of PHU users, providing information on a well-represented sample of such population.

CONCLUSION

In summary, the conclusion is that back pain is a common problem among PHU users, and is associated with musculoskeletal disease, smoking behavior and a poor health perception. Further studies are necessary to elucidate pain outcomes in this population, such as pain intensity, duration and disability.

CONTRIBUTIONS OF THE AUTHORS

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REFERENCES

1. Hartvigsen J, Hancock MJ, Kongsted A, Louw Q, Ferreira ML, Genevay S, et al. What low back pain is and why we need to pay attention. Lancet. 2018;391(10137):2356-67.
2. March L, Smith EU, Hoy DG, Cross MJ, Sanchez-Riera L, Blyth F, et al. Burden of disability due to musculoskeletal (MSK) disorders. Best Pract Res: Clin Rheumatol. 2014;28(3):353-66.
3. Gerhardt A, Hartmann M, Blumenstiel K, Tesarz J, Eich W. The prevalence rate and the role of the spatial extent of pain in nonspecific chronic back pain--a population--based study in the south-west of Germany. Pain Med. 2014;15(7):1200-10.
4. Urits I, Burshtein A, Sharma M, Testa L, Gold PA, Orhurhu V, et al. Low back pain, a comprehensive review: pathophysiology, diagnosis, and treatment. Curr Pain Headache Rep. 2019;23(3)23.
5. Freburger JK, Holmes GM, Agans RP, Jackman AM, Darter JD, Wallace AS, et al. The rising prevalence of chronic low back pain. Arch Int Med. 2009;169(3):251-8.
6. Ferreira ML, Machado G, Latimer J, Maher C, Ferreira PH, Smeets RJ. Factors defining care-seeking in low back pain--a meta-analysis of population based surveys. Eur J Pain. 2010;14(7):747.e1-7.
7. Brazil. ABC do SUS: Doutrina e Princípios. 1990.
8. Brazil. Política Nacional de Gestão Estratégica e Participativa no SUS - Participa SUS. 2009.
9. Paim J, Travassos C, Almeida C, Bahia L, MacInko J. The Brazilian health system: history, advances, and challenges. Lancet. 2011;377(9779):1778-97.
10. Brazil. Política Nacional de Atenção Básica. 2012.
11. Plano Municipal de Saúde de Pelotas. 2013.
12. Brazil. Política de Promoção de Equidade em Saúde. 2013.
13. Vandenbroucke JP, von Elm E, Altman DG, Gøtzsche PC, Mulrow CD, Pocock SJ, et al. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): explanation and elaboration. PLoS Med; 2022;4(10):1628-54.
14. IASP. How prevalent is chronic pain? . Clinical Updates. 2003;11(2).
15. Häfele V, Siqueira FV. Aconselhamento para atividade física e mudança de comportamento em Unidades Básicas de Saúde. Rev Bras Ativ Física & Saúde. 2022;21(6):581-92.
16. Souza DF da S, Häfele V, Siqueira FV. Dor crônica e nível de atividade física em usuários das unidades básicas de saúde. Rev Bras Ativ Física & Saúde. 2019;11(24);1-10.
17. Brasil M da S. VIGITEL Brasil 2019: vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico: estimativas sobre frequência e distribuição sociodemográfica de fatores de risco e proteção para doenças crônicas nas capitais dos 26 estados br. SVS/MS Brasília; 2019.
18. Craig CL, Marshall AL, Sjöström M, Bauman AE, Booth ML, Ainsworth BE, et al. International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports and Exerc. 2003;35(8):1381-95.
19. Peláez-Ballestas I, Flores-Camacho R, Rodriguez-Amado J, Sanin LH, Valerio JE, Navarro-Zarza E, et al. Prevalence of back pain in the community. A COPCORD-based study in the Mexican population. J Rheumatol Suppl. 2011;;86:26-30.
20. Henn L, Schier K, Brian T, Hardt J. Back pain in Poland and Germany: a survey of prevalence and association with demographic characters. BioMed Research International. Hindawi Publishing Corporation; 2014.
21. Dennis D, Tampin B, Jacques A, Hebden-Todd T, Carter V, McLintock M, et al. The prevalence of back pain in patients in one Australian tertiary hospital population. Musculoskeletal Care. 2018;16(1):112-7.
22. Ferreira GD, Silva MC, Rombaldi AJ, Wrege ED, Siqueira FV, Hallal PC. Prevalence and associated factors of back pain in adults from southern Brazil: a population-based study. Rev Bras Fisioter. 2011;15(1):31-6.
23. Deyo RA, Mirza SK, Martin BI. Back pain prevalence and visit rates: estimates from U.S. national surveys, 2002. Spine (Phila Pa 1976). 2006;31(23):2724-7.
24. Araujo MEA, Silva MT, Galvao TF, Nunes BP, Pereira MG. Prevalence and patterns of multimorbidity in Amazon Region of Brazil and associated determinants: a cross--sectional study. BMJ Open. 2018;1;8(11):e023398.
25. Muraki S, Akune T, Oka H, En-Yo Y, Yoshida M, Saika A, et al. Health-related quality of life in subjects with low back pain and knee pain in a population-based cohort study of Japanese men: the Research on Osteoarthritis Against Disability study. Spine. 2011;36(16):1312-9.
26. Horng YS, Hwang YH, Wu HC, Liang HW, Mhe YJ, Twu FC, et al. Predicting health-related quality of life in patients with low back pain. Spine. 2005;30(5):551-5.
27. Yamada K, Matsudaira K, Takeshita K, Oka H, Hara N, Takagi Y. Prevalence of low back pain as the primary pain site and factors associated with low health-related quality of life in a large Japanese population: a pain-associated cross-sectional epidemiological survey. Mod Rheumatol. 2014;24(2):343-8.
28. Broonen JP, Marty M, Legout V, Cedraschi C, Henrotin Y. Is volition the missing link in the management of low back pain? Vol. 78, Joint Bone Spine. 2011;78(4):364-7.
29. Endean A, Palmer KT, Coggon D. Potential of magnetic resonance imaging findings to refine case definition for mechanical low back pain in epidemiological studies: a systematic review. Spine (Phila Pa 1976). 2011;36(2):160-9.
30. Shiri R, Karppinen J, Leino-Arjas P, Solovieva S, Viikari-Juntura E. The association between smoking and low back pain: a meta-analysis. Am J Med. 2010;123(1):87.e7-87.e35.

31. Green BN, Johnson CD, Snodgrass J, Smith M, Dunn AS. Association between smoking and back pain in a cross-section of adult Americans. Cureus. 2016;8(9):e806.
32. Alzahrani H, Mackey M, Stamatakis E, Zadro JR, Shirley D. The association between physical activity and low back pain: a systematic review and meta-analysis of observational studies. Sci Rep. 2019;9(1):8244.
33. Facchini LA, Piccini RX, Thumé E, Silveira DS, Siqueira FV, Rodrigues MA, et al. Performance of the PSF in the Brazilian South and Northeast: Institutional and epidemiological Assessment of Primary Health Care. Ciencia e Saude Coletiva. 2006;11(3):669-81.