

Integration of health services in the care of people living with aids: an approach using a decision tree

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Abstract *The care offer to people living with HIV/AIDS must transcend specialized outpatient services and include the participation of the Family Health Strategy. By understanding the importance of integration between these two points in the care network, the study aimed to build a decision support model to assist professionals of specialized health services in identifying behavior patterns in the use of Family Health Strategy services by people living with HIV/AIDS attended in the outpatient clinic. Thus, was proposed a model called decision tree, created from a database of 141 people with AIDS, users of a specialized outpatient clinic. The decision-making variable was the use of Family Health Strategy services by evaluating the integration of care. The model enabled the establishment of 23 rules with 80.1% hit percentage, what may support the decision-making of professionals in identifying situations in which it is necessary to stimulate the use of the Family Health Strategy by users.*

Key words *Acquired immunodeficiency syndrome, Health services, Decision trees, Integration of systems*

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Introduction

The Acquired Immune Deficiency Syndrome (AIDS) is a global, continuous and unstable phenomenon. The dynamics of the disease epidemiological profile and its alarming mortality and morbidity rates have made the epidemic a serious problem of global public health and a challenge for the health care organization. It is necessary to rethink the dynamics of health care for people living with HIV/AIDS (PLWHA)^{1,2}.

In Brazil, investments in public health policies are increasingly targeted for measures of prevention and transmission control, particularly after the antiretroviral therapy (ART) that favored infection control, improvement of clinical condition and quality of life, increased survival, reduction of morbidity and mortality rates from the disease, and the risk of virus transmission from the plasma viral loads of people on treatment³⁻⁶.

However, in addition to measures aimed at epidemic control, the Brazilian policy of battle against AIDS supported by the principles of the Unified Health System (SUS) has the proposition of offering comprehensive care attained not only by a single service, but with provision of coordinated care in the health care network (HCN). In this perspective, interventions should facilitate the access to programs and services of varied technological density, ensuring continuity and the whole range of services offered, as well as the integration of health teams and their structural and participative insertion in the HCN^{1,4,6-8}.

Although the care for PLWHA is provided mostly by specialized health services, mainly in outpatient clinics, putting the Family Health Strategy (FHS) as the preferred gateway to the HCN is an important element in the prevention and appropriate management of complications and disorders in various health contexts. It stands out not only by the implementation of basic actions of prevention and care, but for strengthening the integration between the different points of health care services on the network^{9,10}.

From the perspective of completeness, even though the FHS team have to make referrals to specialized care, they must work in coordination with these services to participate in the follow-up of users in the HCN in order to provide efficient and system integrated care.

It is noteworthy that the FHS focuses on counseling activities, health education and distribution of prevention materials to contribute with infection control, however, the care actions

destined to those already infected or in the disease process are scarce or nonexistent at this level of attention, besides the unarticulated and fragmented care network¹¹.

Therefore, we emphasize the importance of the FHS team participating in the care for PLWHA with the objective of mobilizing the service potentialities in the support of users in treatment. This involves the transit through the reference and counter-reference system and acting on care needs, taking into consideration the biopsychosocial dimensions of individuals and families¹¹.

Given the importance of integrating care services to PLWHA, this study aimed to build a decision support model to assist professionals in specialized health services with identifying behavior patterns in the use of FHS services by PLWHA seen at the outpatient clinic. This tool can facilitate and expedite the decision-making process and guide institutional arrangements that promote a more integrated and participative care management.

Method

The study was based on the elaboration of a decision tree model, a data mining technique aimed to discover the knowledge from a base. It is a statistical model based on predicting decisions and elaborating classification rules¹².

This model was chosen because of the easy interpretation of data, quick presentation of results, the possibility of allowing categorical and nominal variables, and the low computational cost¹³. It is also possible to predict which of the independent variables available to the specialized clinic team in the follow-up of PLWHA will lead to the outcome of interest in the investigation: the use of FHS services by the clinic users.

To build the model, we used the database variables of the Research of Programmatic Vulnerability to HIV/AIDS: evaluation of supply and integration of actions and health services, conducted from 2011 to 2012, relating to 141 users of a specialized outpatient service (reference in the state of Paraíba - PB) available in the Notifiable Diseases system (Sinan) from 1980 to 2011, on ART for a period exceeding six months, aged 18 years and over, and not imprisoned.

We used the Weka program version 3.7.8. to generate the decision tree since it allows the creation of decision logics from the variables of interest¹⁴. We employed the J48 (C4.5 algorithm)

model, considered easy to use and of better quality measure. We also used the cross-validation technique, widely applied to predictive models, used to measure performance and progress in the model learning, applying a 10-fold cross-validation, considered a relevant value to obtain precise measurements, which resulted in the random division of the base of examples in 10 subsets¹⁵.

As the variable selection criterion, we used the entropy index calculation to measure the heterogeneity and the information gain. From the entropy calculated of subsets, we defined the variables with greater Information Gain (IG) in relation to the outcome. The attribute with most significant IG composed the root node, useful in building the tree for decision support¹⁶.

The classification of variables occurred from calculating the probability of decisions in the database set, and in the subsets of independent variables related to the decision. The IG of each variable determined which ones had more information about the outcome, and selected those for composing the hierarchical tree. The variables that showed no statistically significant IG in relation to the outcome were discarded.

The variables used in the preparation of the decision tree were: integration of care (yes, no); age (18-71 years); clinical manifestations at the time of notification (yes, no); operation of the FHS team in the treatment (yes, no); treatment for other disease (s) (yes, no); socioeconomic class (classified as A, B, C, D, E, according to the Economic Classification Criteria of the Brazilian Association of Research Company - ABEP); time of outpatient follow-up (less than 5 years, 5-10 years, over 10 years); abandonment of outpatient follow-up (yes, no); use of emergency care services (never uses, uses sometimes, always uses); gender (male, female); reason that led to the search of diagnosis (onset of signs and symptoms, other reasons). The decision-making variable was the use of FHS (satisfactory, unsatisfactory), based on the service demand by the study participants.

For the evaluation of model performance, we used the decision matrix formed by the hits and errors of decisions from the tree model¹³.

After the formation of the tree structure, its rules were prepared, the textual representations obtained from its structure, identifying the decision-making variables that took their course in the tree from the root node (first variable) through the internal nodes and branches toward the terminal node with the decision.

The research that originated data was ap-

proved by the Research Ethics Committee of the Universidade Federal da Paraíba (UFPB).

Results

Eleven variables were selected for the tree attributes considering the calculations of probability of decisions in the database set, which showed influence on the outcome variable. Of the total participants, 58.2% were male, aged between 18 and 71 years, an average age of 41.7 years, and 56.7% belonged to the socioeconomic class C.

With regard to the variables related to outpatient follow-up, we observed that 52.5% of participants diagnosed the infection from the onset of signs and symptoms, 80.9% showed clinical symptoms at the time of notification, 61.7% were on exclusive ART treatment, while 38.3% combined ART treatment with the use of drugs for treating other disease (s).

Among the selected variables, 41.1% of users were in outpatient follow-up for 5-10 years, 18.4% abandoned the health care, and 17.7% said they used emergency care services.

Regarding the integration of care between specialized services and the FHS, 89.4% of participants did not receive any encouragement, guidance nor were questioned about the assistance they received from the FHS team; 35.5% admitted that the FHS team was unaware of their HIV/AIDS diagnosis, and 48.9% said that even aware of the case, the FHS team did not take any action nor follow-up of treatment.

For the graphical formation of the tree (Figure 1) were used ten variables of the eleven selected. The age variable was not included in the graphical formation of the model for not showing a statistically significant IG in relation to the outcome. However, it was important for the model construction in the steps of attribute classification.

The constructed model has 80.1% percentage of hits, enabling to correctly classify 113 individuals according to the decision matrix (Table 1), which details the hits and errors of the model. The main diagonal shows the hits, and the errors are outside of it.

The decision tree for the studied sample allowed the formulation of 23 decision rules (Chart 1), highlighting the importance of the variables used as decision-making in the use of FHS by the PLWHA. The variables located more closely to the root of the tree are more relevant in the separation and classification of groups of

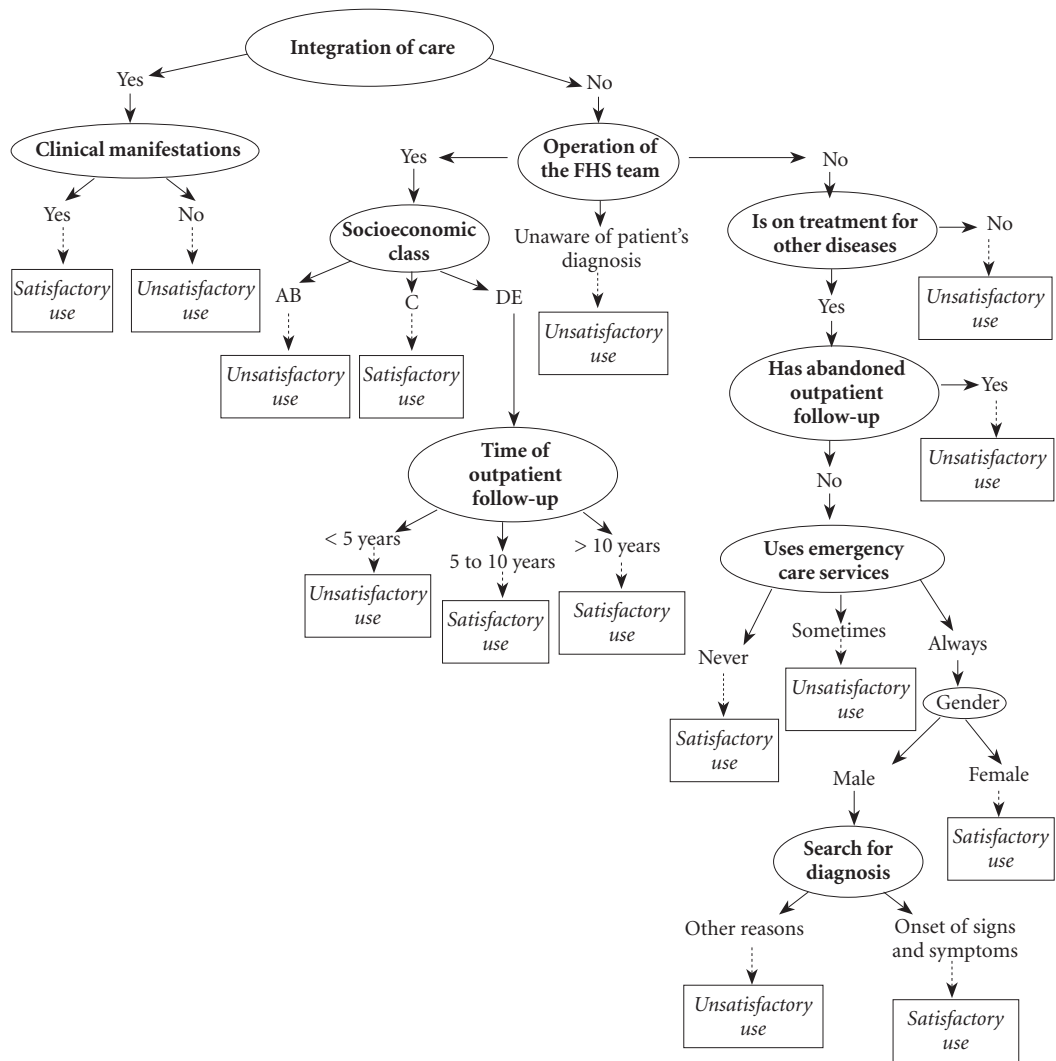


Figure 1. Decision tree to classify the use of FHS by PLWHA. João Pessoa – PB, 2014.

*The root node of the tree is the variable of Care integration.

users. Thus, the *integration of care* variable is the main decision-making variable and responsible for the outcome – satisfactory use or unsatisfactory use of the FHS service.

To illustrate the use of the model, we applied its rules to a case of the study sample (Chart 2), in order to identify the likely behavior of users in relation to the use of FHS services.

Discussion

The fact that the variable *integration of care* has the highest IG within the model reaffirms the importance of coordination between the health care services for PLWHA. The three levels of health care are responsible for the assistance to these individuals hence it should not be restricted to specialized services. The centralization of such assistance in a single service results in discontinuity and fragmentation of care and contributes to the unpreparedness of professionals to work on the specificities generated by the infection and illness⁴.

Table 1. Decision matrix of the use of FHS by the PLWHA. João Pessoa – PB, 2014.

	Classification of the decision tree			Total
	Use of FHS	Satisfactory	Unsatisfactory	
Sample classification (real)	Satisfactory	23*	17	40
	Unsatisfactory	11	90*	101
	Total	34	107	141
	Total hits			80.1%

* Main diagonal containing the model hits, totaling 113 (80.1%) individuals correctly classified.

Chart 1. Decision rules elaborated from the decision tree: the variable is the necessary condition (IF) and the decision (THEN) is the result obtained in the decision variable. João Pessoa – PB, 2014

Decision rules	
Attribute	Decision
1. IF there is integration of care	THEN the existence of clinical manifestations at the time of notification should be should verified
2. IF there is integration of care and clinical manifestations	THEN the use of FHS will be satisfactory
3. IF there is integration of care and no clinical manifestations	THEN the use of the FHS will be unsatisfactory
4. IF there is no integration of care	THEN it should be verified if there is operation of the FHS team in patient care
5. IF there is no integration of care and the FHS team is unaware of the patient case	THEN the use of FHS will be unsatisfactory
6. IF there is no integration of care and there is operation of the FHS team	THEN the patient's socioeconomic class should be verified
7. IF there is no integration of care, there is operation of the FHS team, and the patient belongs to socioeconomic class B	THEN the use of FHS will be unsatisfactory
8. IF there is no integration of care, there is operation of the FHS team, and the patient belongs to socioeconomic class C	THEN the use of FHS will be satisfactory
9. IF there is no integration of care, there is operation of the FHS team, and the patient belongs to socioeconomic class D	THEN the patient's time of outpatient follow-up should be verified
10. IF there is no integration of care, there is operation of the FHS team, the patient belongs to socioeconomic class D, and has less than five years of outpatient follow-up	THEN the use of FHS will be unsatisfactory
11. IF there is no integration of care, there is operation of the FHS team, the patient belongs to socioeconomic class D, and has five to ten years of outpatient follow-up	THEN the use of FHS will be satisfactory

it continues

Chart 1. continuation

Decision rules	
Attribute	Decision
12. IF there is no integration of care, there is operation of the FHS team, the patient belongs to socioeconomic class D, and has more than ten years of outpatient follow-up	THEN the use of FHS will be satisfactory
13. IF there is no integration of care and no operation of the FHS team	THEN it should be verified if the patient is on treatment for (an)other disease (s)
14. IF there is no integration of care, no operation of the FHS team, and the patient is not on treatment for (an)other disease (s)	THEN the use of FHS will be unsatisfactory
15. IF there is no integration of care, no operation of the FHS team, and the patient is on treatment for (an)other disease (s)	THEN it should be verified if the patient has ever abandoned outpatient follow-up
16. IF there is no integration of care, no operation of the FHS team, the patient is not on treatment for (an)other disease (s), and has already abandoned the outpatient follow-up	THEN the use of FHS will be unsatisfactory
17. IF there is no integration of care, no operation of the FHS team, the patient is not on treatment for (an)other disease (s), and has not abandoned the outpatient follow-up	THEN it should be verified how often the patient uses emergency care services
18. IF there is no integration of care, no operation of the FHS team, the patient is on treatment for (an)other disease (s), and has not abandoned the outpatient follow-up	THEN it should be verified how often the patient uses emergency care services
19. IF there is no integration of care, no operation of the FHS team, the patient is on treatment for (an)other disease (s), has not abandoned the treatment, and has never used emergency care services	THEN the use of FHS will be satisfactory
20. IF there is no integration of care, no operation of the FHS team, the patient is on treatment for (an)other disease (s), has not abandoned the treatment, and has used emergency care services sometimes	THEN the use of FHS will be unsatisfactory
21. IF there is no integration of care, no operation of the FHS team, the patient is on treatment for (an)other disease (s), has not abandoned the treatment, and has always used emergency care services	THEN there should be attention with the patient's gender
22. IF there is no integration of care, no operation of the FHS team, the patient is on treatment for (an)other disease (s), has not abandoned the treatment, has always used emergency care services and is female	THEN the use of FHS will be satisfactory
23. IF there is no integration of care, no operation of the FHS team, the patient is on treatment for (an)other disease (s), has not abandoned the treatment, has always used emergency care services, and is male	THEN the use of FHS will be unsatisfactory

Source: Own elaboration.

Chart 2. Application of the rules extracted from the decision tree.

<p>Clinical case: Male user of the economic class B, has not abandoned the outpatient follow-up, and continues in follow-up in service for more than five years. At the time of notification presented some clinical manifestations, on exclusive use of ART, not treating any other disease. Rarely uses emergency care services, is unaware of the integration between specialized outpatient services and the FHS for his health care, even though the FHS team operates in this care and follows-up his treatment. In this context, what will be the behavior of this patient regarding the use of FHS services?</p>	<p>Model application: The decision tree follows a hierarchy from the root node, which is represented by the variable of integration of care in this model. Since there is no integration of care in the observed clinical case, the interpretation begins by the Rule 4: IF there is no integration of care, THEN it should be verified if there is operation of the FHS team in patient care. As the FHS team is acting in this care, there should be analysis of the Rule 6: IF there is no integration of care and there is operation of the FHS team, THEN the patient's socioeconomic should be verified taking into consideration that if it is class B, it will be explored the Rule 7: IF there is no integration of care, there is operation of the FHS team and the patient belongs to socioeconomic class B, THEN the use of FHS <i>will be unsatisfactory</i>.</p>
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Source: Own elaboration.

Therefore, the centralization of assistance into a single service favors the discontinuity and fragmentation of care and contributes to the unpreparedness of professionals to act in a resolute way on the specificities generated by the infection and illness⁴. These represent obstacles to the effectiveness of the HCN, a problematic situation experienced in the organization of health systems at national and international contexts. Coping with it involves allocating resources and strategies in favor of care coordination¹⁷⁻¹⁹.

In this sense, the proposed model contributes to support the decision-making of professionals for strengthening the integration of services. It is based on the concept of the HCN that are organizational structures formed by clusters of health services, which must be articulated among themselves and act for a purpose: to offer an attention to health through the sustained and comprehensive care for the individual and/or community, and in which the actions should be coordinated from the Primary Health Care (PHC)¹⁷.

The role of the FHS team is critical for the effectiveness of care integration, since one of its main features is the possibility of establishing a stronger bond with individuals/families. This service is inserted in the community and it should assume the coordination of care together with other levels and monitor the entire course of users through the network¹⁸.

The activities carried out at this level of care have greater focus on actions for prevention and promotion of health, such as identification of vulnerable groups, availability of rapid exams,

counseling and health education activities¹⁰. Such a configuration can lead to a smaller demand for PHC services by the PLWHA, because they do not recognize the FHS as a space for the assistance aimed at individuals already experiencing the disease process.

Linked to the scarce demand caused by the lack of adequate assistance, there are also cases in which the family health team is unaware of the user's HIV/AIDS diagnosis, resulting in ineffectiveness of the professionals responsible for the care of these people.

In this context, the studies discuss difficulties experienced by PLWHA in the search for health care, such as the embarrassment of revealing the HIV status to the service provider, because this disease still carries a significant social stigma, present even in health care environments. The fear of facing this situation motivates the search for specialized services, which requires a more technically and ethically prepared multidisciplinary team to care for the PLWHA²⁰⁻²².

The Service of Specialized Care (SAE) on HIV/AIDS as part of SUS (Sistema Único de Saúde - Brazilian Unified Health System) was created with the goal of providing quality care to PLWHA. It is guided by comprehensive care, provided by a multidisciplinary health team and articulated with others points of the network, since a single service does not hold all the structure required to meet the care needs generated by the infection, disease and treatment of these individuals⁴. Hence the importance of investing in mechanisms to support the integration of es-

sential services such as the SAE and FHS in order to contribute to the legitimacy of the decentralization process of care to PLWHA¹⁹.

It is essential that health services and their professionals recognize the need for care integration and understand the dynamics of the current epidemiological profile of HIV/AIDS in Brazil and its transitions. This way, they can provide a more qualified assistance to these individuals and identify the most vulnerable groups to acquire HIV infection. In the case of already infected people, they can identify vulnerabilities to opportunistic diseases or exacerbations of the clinical condition that worsen the health status and compromise their survival.

The present study corroborates previous studies^{23,24} that emphasize the change in the HIV/AIDS profile in recent years, highlighting the feminization process that is changing the epidemiological profile of the disease. The findings emphasize that the male gender is prevalent among the number of cases, accounting for 58.2%. Although predominant, when relating the number of male cases with the number of female cases, we have a very close relationship of 1.39:1, similar to the proportion presented in the national scene¹⁹.

As evidenced in the model, women seen in the clinic use the emergency care services often, and use the FHS satisfactorily, regardless of the integration between the services and the operation of the family health team in their treatment. This fact is in accordance with the findings of a study conducted in Belo Horizonte (state of Minas Gerais - MG), which showed that female patients have a greater association with the demand for health services when compared to men²⁵.

Regarding the use of health services by men, the model showed satisfactory use among those already ill or with the diagnosis of HIV infection by any signs and symptoms of the disease. Such behavior exposes this group to greater vulnerability linked to the onset of diseases and, especially, causing delayed diagnosis in cases that would have a higher chance of intervention if discovered early²⁶.

The use of emergency care services by both genders suggests that the absence and/or irregularity of ambulatory follow-up and the lack of integration between services could contribute to the increase in complications and consequent demand for emergency and urgency services.

The highest concentration of studied cases in the lower socioeconomic classes (C, D and E) and prevalence in the age group 40-59 years may

be related to the aspect of impoverishment that has characterized the epidemiological profile of HIV/AIDS cases in the last years. The satisfactory use of the FHS among individuals in less favored economic situation confirms recent findings that showed the socioeconomic status as an important determinant in the use of health services, with SUS users as those on lower income²⁷.

The model obtained shows that users who had clinical manifestations at the time of notification were diagnosed with the infection from the onset of signs and symptoms, and have been in outpatient follow-up for more than five years without abandonment reports, tend to make a satisfactory use of the services offered by the FHS. This information can be justified by understanding that experiencing the disease process stimulates the search for care and services in health.

This practice is opposed to the principles of PHC, which recommends the preventive action on the disease process²⁶, therefore, it reduces the performance effectiveness of the FHS team in relation to the care demands when the process is already installed. This finding reinforces the model relevance in the direction of facing this issue from a preventive approach.

However, due to previous treatments, these individuals may find it easy to adapt to a health care routine, which can influence a greater adherence to outpatient clinical treatment and to other health services, such as the using the FHS²⁷.

Final considerations

The model allows that healthcare professionals identify inappropriate behavior of individuals living with HIV/AIDS on the use of PHC services. Such behaviors culminate in ineffective care focused on specialized health services, leading to the HCN fragmentation.

The model achieved greater accuracy in the classification of individuals who make poor use of the FHS, which is a positive aspect considering the importance of identifying these situations for the timely intervention of professionals from specialized services.

Identifying situations of greater vulnerability contributes with the decision-making of professionals and managers regarding the necessary rearrangements to intervene on this issue through integration actions and strategies between health services to strengthen the PHC and the role of the FHS in care coordination for PLWHA within a perspective of network.

Therefore, the decisions subsidized by this model collaborate to improve the care for PLWHA through a more integrated and participatory care management, achieving satisfactory results that serve the purpose for which it was created, and confirming its effectiveness. Given the scarcity of studies encompassing the HIV/AIDS issue in the context of FHS, this study is expected to encourage further discussion about the assistance to these individuals at this level of health care.

The increasing use of statistical models in the health field in recent years can be justified by the effectiveness of the models created to support decision-making, especially those related to public health problems of greater complexity such as HIV/AIDS.

However, the development of other studies on the subject is necessary to explore the possible obstacles in the integration of the FHS with specialized services, which was a study limitation since the model was created with data from specialized services and it must be applied to this reality.

Collaborations

LB Medeiros worked in the conception, design, analysis and interpretation of data, and final drafting. DRSG Trigueiro worked in the critical review and final drafting. DM Silva worked in the critical review. JA Nascimento worked in the design of the methodology and analysis and interpretation of data. AA Monroe worked for final review and approval of the final version to be published. JA Nogueira worked in the critical review, final drafting and approval of the version to be published. ODCP Leadebal worked in the conception, study design, methodology and final drafting.

References

1. Brasil. Ministério da Saúde (MS). Secretaria de Vigilância em Saúde. Departamento de DST, Aids e Hepatites Virais. *Boletim Epidemiológico Aids e DST - até semana epidemiológica 26ª*. Brasília: MS; 2013.
2. Sousa CSO, Silva AL. O cuidado a pessoas com HIV/AIDS na perspectiva de profissionais de saúde. *Rev Esc Enferm USP* [periódico na Internet]. 2013 [acessado 2014 Mar 11]; 47(4): [cerca de 8 p.]. Disponível em: http://www.scielo.br/scielo.php?pid=S0080-62342013000400907&script=sci_arttext
3. Cohen MS, Chen YQ, McCauley M, Gamble T, Hosseinipour MC, Kumarasamy N, Hakim JG, Kumwenda J, Grinsztejn B, Pilotto JHS, Godbole SV, Mehendale S, Chariyalertsak S, Santos BR, Mayer KH, Hoffman IF, Eshleman SH, Piwo-war-Manning E, Wang L, Makhema J, Mills LA, Bruyn G, Sanne I, Eron J, Gallant J, Havlir D, Swindells S, Ribaudo H, Elharrar V, Burns D, Taha TE, Nielsen-Saines K, Celentano D, Essex M, Fleming TR. Prevention of HIV-1 infection with early antiretroviral therapy. *N Engl J Med* [serial on the Internet]. 2011 [cited 2014 Dez 01]; 372(6): [about 12 p.]. Available from: <http://www.nejm.org/doi/pdf/10.1056/NEJMoa1105243>
4. Palácio MB, Figueiredo MAC, Souza LB. O cuidado em HIV/AIDS e a Atenção Primária em Saúde: possibilidades de integração da assistência. *Psico* [periódico na Internet]. 2012 [acessado 2014 Dez 01]; 43(3): [cerca de 8 p.]. Disponível em: <http://revistaseletronicas.pucrs.br/ojs/index.php/revistapsico/article/download/9816/8237>
5. Wilson DP, Law MG, Grulich AE, Cooper DA, Kaldor JM. Relation between HIV viral load and infectiousness: a model-based analysis. *Lancet* [serial on the Internet]. 2008 [cited 2014 Dez 28]; 372: [about 7 p.]. Available from: <http://www.aidslaw.ca/EN/lawyers-kit/documents/5.Wilson2008.pdf>

6. Montaner JSG. Treatment as prevention: toward an AIDS-free generation. *Top Antivir Med.* [serial on the Internet]. 2013 [cited 2014 Dez 01]; 21(3): [about 4 p.]. Available from: <http://www.iasusa.org/sites/default/files/tam/21-3-110.pdf>
7. Organização Mundial de Saúde (OMS). *Cuidados Inovadores para condições crônicas: componentes estruturais de ação - relatório mundial.* Brasília: OMS; 2003.
8. Hartz ZMA, Contandriopoulos AP. Integralidade de atenção e integração de serviços de saúde: desafios para avaliar a implantação de um "sistema sem muros". *Cad Saude Publica* [periódico na Internet]. 2004 [acessado 2014 Nov 08]; 20(Supl. 2): [cerca de 7 p.]. Disponível em: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0102-311X2004000800026&lng=en.
9. Brasil. Ministério da Saúde (MS). Secretaria de Atenção à Saúde. Departamento de Atenção Básica. *HIV/Aids, hepatites e outras DST.* Brasília: MS; 2006.
10. Silva JAS, Val LF, Nichiata LYI. A estratégia saúde da família e a vulnerabilidade programática na atenção ao HIV/Aids: uma revisão da literatura. *O Mundo da Saúde* [periódico na Internet]. 2010 [acessado 2014 Ago 31]; 34(1): [cerca de 6 p.]. Disponível em: http://www.saocamilo-sp.br/pdf/mundo_saude/74/14_revisao_estrategia.pdf
11. Zambenedetti G, Both NS. Problematizando a atenção em HIV/Aids na Estratégia Saúde da Família. *Polis e Psique* [periódico na Internet]. 2012 [acessado 2014 Out 14]; 2(1): [cerca de 21 p.]. Disponível em: <http://seer.ufrgs.br/index.php/PolisePsique/article/view/30512/25707>
12. Soares RAS, Pereira APJT, Moraes RM, Vianna RPT. Modelo de suporte à decisão para a gravidade de ferimentos das vítimas de acidentes de trânsito atendidas pelo SAMU 192. *Rev. Saúde. Com.* [periódico na Internet]. 2013 [acessado 2014 Set 10]; 9(2): [cerca de 14 p.]. Disponível em: <http://www.uesb.br/revista/rsc/v9/v9n2a01.pdf>
13. Beckmann M. *Algoritmos genéticos como estratégia de pré-processamento em conjuntos de dados balanceados* [dissertação]. Rio de Janeiro: Universidade Federal do Rio de Janeiro; 2010.
14. Turban E, Aronson JE, Liang T-P. *Decision support systems and intelligent systems.* 9ª ed. Upper Saddle River: Prentice Hall; 2011.
15. Forman G, Scholz M. Apples-to-apples in cross-validation studies: pitfalls in classifier performance measurement. *ACM SIGKDD Explorations Newsletter* [serial on the Internet]. 2010 [cited 2014 Ago 31]; 12(1): [about 9 p.]. Available from: <http://dl.acm.org/citation.cfm?id=1882479> Doi:10.1145/1882471.1882479
16. Lin S-W, Chen S-C. Parameter determination and feature selection for C4.5 algorithm using scatter search approach. *Soft Comput* [serial on the Internet]. 2011 [cited 2014 Ago 31]; 16(1): [about 13 p.]. Available from: <http://link.springer.com/article/10.1007/s00500-011-0734-z/fulltext.html#Bib1>
17. Mendes EV. As redes de atenção à saúde. *Cien Saude Colet* 2010; 15(5):2297-2305.
18. Almeida PF, Giovanella L, Mendonça MHM, Escorel S. Desafios à coordenação dos cuidados em saúde: estratégias de integração entre níveis assistenciais em grandes centros urbanos. *Cad Saude Publica* [periódico na Internet]. 2010 [acessado 2014 Nov 29]; 26(2): [cerca de 13 p.]. Disponível em: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0102-311X2010000200008.
19. Lopes LM, Magnabosco GT, Andrade RLDP, Ponce MAZ, Wysocki AD, Ravanholi GM, et al. Coordenação da assistência prestada às pessoas que vivem com HIV/AIDS em um município do Estado de São Paulo, Brasil. *Cad Saude Publica* [periódico na Internet]. 2014 [acessado 2015 Mar 20]; 30(11): [cerca de 15 p.]. Disponível em: <http://dx.doi.org/10.1590/0102-311X00091213>
20. Garbin CAS, Garbin AJL, Moimaz SAS, Carmo MP. Bioética e HIV/Aids: discriminação no atendimento aos portadores. *Revista bioética* [periódico na Internet]. 2009 [acessado 2014 Ago 08]; 17(3): [cerca de 11 p.]. Disponível em: http://revistabioetica.cfm.org.br/index.php/revista_bioetica/article/viewArticle/514
21. Brasil. Ministério da Saúde (MS). Secretaria de Vigilância em Saúde. Departamento de Análise de Situação de Saúde. *Saúde Brasil 2008: 20 anos de Sistema Único de Saúde (SUS) no Brasil.* Brasília: MS; 2009.
22. Fagundes VHV, Oliveira JHT, Vieira S, Spack Junior M, Pupulin. Infecções oportunistas em indivíduos com infecção pelo HIV e relação com uso de terapia antirretroviral. *Acta Scientiarum. Health Sciences* [periódico na Internet]. 2010 [acessado 2013 Ago 08]; 32(2): [cerca de 5 p.]. Disponível em: <http://periodicos.uem.br/ojs/index.php/ActaSciHealthSci/article/view/4508/4508>
23. Silva SFR, Pereira MRP, Motta Neto R, Ponte MF, Ribeiro IF, Costa PFTF, Silva SL. Aids no Brasil: uma epidemia em transformação. *RBAC* [periódico na Internet]. 2010 [acessado 2014 Dez 01]; 42(3): [cerca de 4 p.]. Disponível em: <http://www.sbac.org.br/rbac/020/302.pdf>
24. Silva RAR, Duarte FHS, Nelson ARC, Holanda JRR. A epidemia da aids no Brasil: análise do perfil atual. *Rev enferm UFPE on line* [periódico na Internet]. 2013 [acessado 2014 Set 03]; 7(10): [cerca de 9 p.]. Disponível em: <http://www.revista.ufpe.br/revistaenfermagem/index.php/revista/article/view/4882> DOI: 10.5205/reuol.4377-36619-1-ED.0710201327
25. Lima-Costa MF, Loyola Filho AI. Fatores associados ao uso e à satisfação com os serviços de saúde entre usuários do Sistema Único de Saúde na região metropolitana de Belo Horizonte, MG, Brasil. *Epidemiol. Serv. Saude* [periódico na Internet]. 2008 [acessado 2014 Nov 30]; 17(4): [cerca de 11p.]. Disponível em: <http://scielo.iec.pa.gov.br/pdf/ess/v17n4/v17n4a02.pdf>
26. Siqueira EL, Oliveira GR, Mendes JD, Ximenes JM, Moraes KM. Atenção à saúde do homem: trabalhando a percepção do profissional enfermeiro na estratégia saúde da família. *SANARE* [periódico na Internet]. 2014 [acessado 2014 Nov 30]; 13(1): [cerca de 8 p.]. Disponível em: <http://sanare.emnuvens.com.br/sanare/article/view/432>
27. Levorato CD, Mello LM, Silva AS, Nunes AA. Fatores associados à procura por serviços de saúde numa perspectiva relacional de gênero. *Cien Saude Colet* 2014; 19(4):1263-1274.

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