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e-SUS APS strategy: Case of success on Primary Care informatization in Brazil

Estratégia e-SUS APS: Um Caso de sucesso na informatização da Atenção Primária no Brasil

Estrategia e-SUS APS: Caso de éxito de informatización de Atención Primaria en Brasil

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Keywords: Primary Health Care; Public Health; Electronic Health Records; Health Information System; Brazil

ABSTRACT

Objectives: To present the main actions of the Brazilian government that led to the successful implementation of the strategy for the computerization of Primary Care, e-SUS APS, throughout the whole country, as well as the difficulties in implementing such a national health information system (NHIS). **Methods:** Report on the experience of implementing an NHIS in Brazilian Primary Care, identifying the actions taken by the government to mitigate the risks and overcome difficulties. **Results:** The e-SUS Primary Care strategy (e-SUS APS) initiated the restructuring of the health information system at the national level. This action focused on the effective management of information, considered essential to increase the quality of care. This strategy aims to create different realities of technological infrastructure and allow all cities to interconnect with an NHIS across the country. Since e-SUS AB was implemented, more than 3 billion records of Primary Health Care (PHC) from all regions of the country have been received by the government. Today, even cities with weak technological infrastructure are able to transmit their data to NHIS, which manages all information. **Conclusion:** The implementation of the new strategy for primary care at almost 100% of Brazilian municipalities has been a success due to a number of factors. However, efforts must be maintained to ensure the success of its implementation.

Descritores: Atenção Primária à Saúde; Saúde Pública; Registros Eletrônicos de Saúde; Sistemas de Informação em Saúde; Brasil

RESUMO

Objetivos: Apresentar as principais ações do governo brasileiro que levaram ao sucesso da implantação da estratégia da informatização da Atenção Primária, e-SUS APS, em todo o país, bem como as dificuldades para se implantar um sistema nacional de informações em saúde (NHIS). **Métodos**: Relato da experiência da implantação de um NHIS na Atenção Primária brasileira, identificando as ações adotadas pelo governo para mitigar os riscos e superar as suas dificuldades. **Resultados:** A estratégia e-SUS Atenção Básica (e-SUS APS) iniciou a reestruturação do sistema de informação em saúde em nível nacional. Essa ação se concentrou no gerenciamento eficaz das informações, considerado como essencial para aumentar a qualidade do atendimento. Essa estratégia foi construída com o intuito de criar diferentes realidades de infraestrutura tecnológica e permitir que todas as cidades se interconectem com um NHIS em todo o país. Desde que o e-SUS APS foi implantado, mais de 3 bilhões de registros de atenção primária à saúde (APS) de todas as regiões do país, foram recebidos pelo governo. Hoje, mesmo cidades com fraca infraestrutura tecnológica são capazes de transmitir seus dados ao NHIS, que gerencia todas as informações. **Conclusão**: A implantação da nova estratégia para atenção primária em quase 100% do território brasileiro vem sendo um sucesso devido a uma série de fatores. No entanto, os esforços devem ser mantidos para garantir o sucesso de sua implementação.

Descriptores: Atención Primaria de Salud; Salud Pública; Registros Electrónicos de Salud; Sistemas de Información en Salud; Brasil

RESUMEN

Objetivos: Presentar las principales acciones del gobierno brasileño que llevaron a la implementación exitosa de la estrategia de informatización de atención primaria, e-SUS APS, en todo el país, así como las dificultades para implementar un sistema nacional de información de salud (NHIS). **Métodos:** Informe sobre la experiencia de implementar un NHIS en Atención Primaria brasileña, identificando las acciones tomadas por el gobierno para mitigar riesgos y superar sus dificultades. **Resultados:** La estrategia de atención primaria de e-SUS (e-SUS APS) inició la reestructuración del sistema de información de salud a nivel nacional. Esta acción se centró en el manejo efectivo de la información, considerada esencial para aumentar la calidad de la atención. Esta estrategia fue construida con el objetivo de crear diferentes realidades de infraestructura tecnológica y permitir que todas las ciudades se interconecten con un NHIS en todo el país. Desde que se implementó el e-SUS APS, el gobierno ha recibido más de 3 mil millones de registros de atención primaria de salud (APS) de todas las regiones del país. Hoy, incluso las ciudades con infraestructura tecnológica débil pueden transmitir sus datos a NHIS, que administra toda la información. **Conclusión:** La implementación de la nueva estrategia de atención primaria en casi 100% del territorio brasileño ha sido un éxito debido a una serie de factores. Sin embargo, se deben mantener los esfuerzos para garantizar el éxito de su implementación.

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INTRODUCTION

Brazil is the largest country in the South American region, with more than 200 million people and 5,570 cities[1]. As with other developing countries, public health has always been a huge challenge. In attempt to increase the overall quality of health care and reduce differences in the health care provided to various population groups, the Brazilian Unified Health System (SUS) was created under the Brazilian Constitution in 1988[2]. In 1990, the construction of the National Health Information System (NHIS) in Brazil was begun. Since then, there have been several serious efforts aiming at establishing a fully-integrated Health Informatization system (HIS), but unfortunately none were effectively implemented in all Brazilian regions[3]. In 2004, the National Health Information and Informatics Policy (PNIIS) was created, and in 2009 the Brazilian Ministry of Health established the Health Informatics Information Committee (CIINFO/MS), with normative, directive and supervisory functions regarding health informatics activities intended to replace or revise old concepts and move forward on the construction of a solution to the Brazilian reality. Establishing an effective NHIS is an absolute necessity to support and direct rational public health policy in every city and region of a country[4-5].

The challenge of NHIS implementation is not exclusive to Brazil[6-8]. Research notes that deploying NHIS in developing countries often results in one of these types of failure[3,9]: first and most commonly, total failure (project cancellation); second, partial failure (partial implementation of the NHIS, with time and costs being extrapolated); third, sustainably failure (system abandonment over time; and finally, replication failure (the project pilot is successful but replicating it elsewhere is not). Taking all of these lessons into consideration, in 2013, the Brazilian Government began the implementation of the e-SUS APS (informatization of Primary Care) strategy[10], which was intended to overcome a series of barriers that were considered to be the main reasons for the unsuccessful implementation of NHIS in developing countries. Today, the e-SUS APS strategy allows the Brazilian Government to grasp the reality of national health care by receiving approximately 1.5 million Electronic Health Records (EHRs) per day. This has transformed the Brazilian strategy into one of the biggest public primary care informatic systems in the world.

Thus, this work aims to present the main actions taken by the Brazilian government that led to the successful implementation of this strategy and point out the challenges that were ultimately overcome, resulting in a remarkable improvement in the health of the Brazilian population.

METHODS

This is an experience report of the difficulties and barriers to the implementation of a National Health Information System and of the actions taken by the Brazilian government to mitigate the risks related to the failure to implement an NHIS.

Studies that dealt with the experience and difficulties with the implementation of national health information systems were analyzed, in a national and international context. Articles that present the reasons that lead or not to the effective implementation of a health information system were also analyzed. Based on the implementation success and failure reasons analyzed, it was possible to draw a comparison with the current strategy established by the Ministry of Health, pointing out what actions were taken to avoid errors that in the past hindered the effective implementation of other health systems.

Data on the implementation of e-SUS APS in the national context were sought to support a reflection on the success of the implementation of the strategy.

RESULTS AND DISCUSSION

The implementation of an NHIS is a challenge for most developing countries, presenting several barriers that need to be overcome to achieve a successful performance[4], among them are:

- Collaboration and political support[8,11-12]: the adoption of health information systems tends to be faster when policies for care management are established, encouraging the creation of a corporation, rather than individual providers[13].

- Complexity of the local environment and analysis of the socio-technical phenomenon[8,14-15]: it is important for a Health Information System (HIS) to be adaptable to different organizational particularities, but if the difference from the local work model is too disruptive, this can have a negative impact on the adoption of the system[16]. Another challenge is the need to consider the specific necessities from different health environments and professionals[17].

- Need for financial support[3,8]: the end of the support provided by sponsors for the implementation of HIS, often leads to the abandonment of initiatives[14,18-19]. Therefore, it is important to ensure that the informatization strategy demands resources that can be maintained in the long term.

- Lack of interoperability standards[8,14-15]: the establishment of interoperability standards[20-21] and terminologies that allow semantic interoperability[17] is a fundamental factor for the success of HIS, since they allow its support and expansion[20,22].

Overcoming these barriers was an even greater challenge, in Brazil, as the strategy needed to accommodate the individual characteristics of the many and varied Brazilian municipalities. Thus, some initiatives to develop a NHIS have been initiated over the past few decades, none of them, however, has been successfully implemented[3,10]. Challenges to establish an NHIS, however, is not a Brazil exclusivity. In an attempt to be successful, many countries have been investing large sums of money, which are at risk of being wasted if the implementation of the system is not effective[8]. In this context, it became imperative to understand why failures occur and prevent them from occurring. Thus, the Brazilian Ministry of Health has defined a new strategy to computerize and integrate primary health care data across the whole country.

In 2013, the ordinance GM/MS nº 1.412, from the federal government, instituted the use of the Primary Health Care Information System (SISAB), as the Primary Care

information system in force with purpose of financing and adhering to the programs and strategies of the National Primary Care Policy, replacing the Primary Care Information System (SIAB). As SISAB centralizes the Primary Care data, it allows managers to access reports on sanitary and health situation at the national, regional, municipal, or healthcare team level. SISAB is operationalized through the e-SUS APS strategy, whose objective is to reorganize the collection of information from Primary Care, qualifying the data collected by health care professionals, improving the conditions of infrastructure and working processes of health units[23-24].

The e-SUS APS strategy has systems that capture the data that will be sent to SISAB, being two EHRs and three applications for mobile devices[25]. These systems allow data recording from different Primary Care units, including Primary Care teams, Family Health Support Centers (Nasf), Street Clinic (CnR), Prison Health Care, Home Care (AD), and from programs such as Health in Schools (PSE) and Health Academy. The ordinance GM/MS nº 1.412, also fixed a deadline for municipalities to begin submitting more detailed production data using the e-SUS APS strategy[23-24], with an adequacy period of two years, in which municipalities should adopt one of the systems provided free of charge by the government.

The e-SUS APS strategy has policies that aim to overcome the barriers and challenges present in the implementation of an NHIS. Firstly, the adoption of the strategy is encouraged through a specific transfer of funds to the municipalities that implement it. Other measures were adopted to promote the effective implementation of the strategy:

a) Reduction of implementation costs for municipalities: two EHR systems, e-SUS APS CDS (Simplified Data Collection System) and e-SUS APS PEC (Citizen's Electronic Medical Record System), and three mobile applications were developed funded by the federal government and distributed freely to the municipalities. So far, to effectively develop and implement the e-SUS APS strategy, the government has invested (through 2020) less than US$18 million, about US$0.08 cents per capita[1]. On the other hand, the municipalities are responsible for hardware and software implantation expenses.

b) Definition of a minimum data set: specifications for the data sets to be sent to NHIS have been established by the Ministry of Health. Publishing a relevant data dictionary enables other third-party systems to integrate with NHIS.

c) Inclusion of a network of local actors: involving local actors is a key factor for identifying deviations from the original strategy goals and thus broadening the adoption of user groups from different contexts[26]. A tripartite intermanagers commission (CIT)[27], composed by representatives of the Ministry of Health (Primary Care Secretary of Health) and the secretaries of health of states and municipalities is responsible for mediating and supporting decision making in the operational processes of implementation of the e-SUS APS strategy countrywide.

d) Definition of six implementation approaches: considering the various contexts of Brazilian municipalities, which have different information and communication technology infrastructures, six implementation models were defined to meet to the needs of the municipalities with limited internet connection, as well as municipalities with good quality connections and computers in all health facilities.

Other main operational and technical differences between the early attempts to informatize primary care in Brazil and current efforts of the e-SUS APS strategy are summarized in Table 1.

The implementation of the e-SUS APS strategy is considered successful, having been continued by different governments since its inception. It has now been in effect for eight years, consolidating itself as a fundamental element of the informatization of health data in Brazil. During the first year of implementation, 1,094,364 primary health care (PHC) records were sent to the NHIS, SISAB. In 2019, the number grew to 377,176,484 records, representing an increase of more than 34,000 % in eight years. Since 2013, 59,446 primary care units have registered and sent more than 1.7 billion PHC records to NHIS[28].

It is important to note that the large volume of data sent to SISAB does not represent the successful implementation of the strategy only in few regions of the country, as in 2020, the e-SUS APS strategy has already received data from 5535 municipalities (representing 99.37% of the Brazilian municipalities). At the end of the first year of implementation of the e-SUS APS strategy (at July 2014), 1822 municipalities sent data, representing an increase of 203%. Besides the adoption of this strategy at the municipalities, there is an increase in engagement by health units, which already totalize more than 40,000 units sending data to SISAB (an increase of 302% when compared with the 9,927 units at July 2014). This shows the capillarity of the strategy nationwide.

In addition to consolidating the e-SUS APS strategy, the electronic medical record system (PEC) provided free of charge by the government, has been increasing its use in relation to the Simplified Data Collection Model (CDS) and the use of third party systems, as presented in Figure 1 and Figure 2. At the end of the first year of implementation, 90% of the municipalities used the CDS system, only 8.3% used the PEC and 1.8% used third-party systems. Currently, regarding data collection systems, 38% use CDS, 40% use PEC, and 22% use third party systems. These data show how the municipalities have evolved their physical and organizational structures, no longer using the simplified data collection tool, and switching to electronic medical record systems.

Other advantages observed in the implementation of the e-SUS APS strategy were the possibility of making records individually, since this allows monitoring of the citizen's history and professional production and minimizing the possibility of fraud and duplication[29-31].

Despite the advances, some challenges in consolidating

[1] The amounts invested in the development of the data collection systems of the e-SUS AB strategy are available at http://dpc.proad.ufsc.br/. The sums were converted to dollars and divided by the size of the Brazilian population.

Table 1 - Operational and technical characteristics before and after e-SUS APS strategy implementation

Main characteristics	Before e-SUS APS implementation	Current e-SUS APS implementation
Record	Consolidated	Individualized
Reports	Aggregated and consolidated by team	Aggregated by individual, team, health regions, municipality, state and national
Territory Tracking	By families	By residence, family nucleus and individuals
Collective Activities and Meetings	Registration restricted to fields "Group Service - Health Education", "Collective Procedures" and "Meetings"	Record by activity type, meeting theme, target audience, and types of health practices/topics. Consolidated or individualized
Management Reports	Limited to consolidated data	Dynamic reports: graph, percent, averages, and rates
Indicators	Provided based on the health situation of the territory	Provided from the health situation of the territory, care and monitoring of individuals on the territory
Information Technology	Does not allow communication with other systems	Allows interoperability with other health systems in use in the municipality
Data Acquisition System	Through consolidated tokens	Through records with individualized registration or Electronic Record

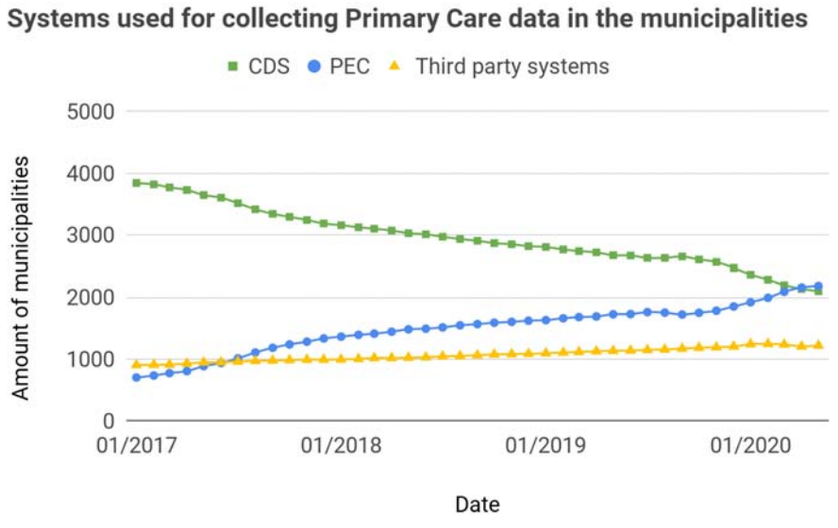

Figure 1 - Number of municipalities by type of systems used for collecting primary care data.

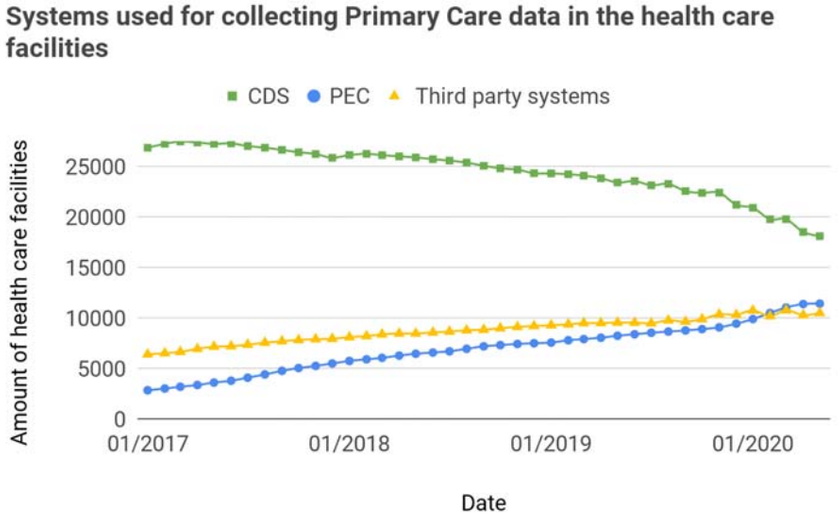

Figure 2 - Number of health care units by type of systems used for collecting primary care data.

the strategy remain[32-34] deficiency in the structure of health units, lack of staff training, resistance to using the system, and staff overload.

To further extend the adoption and effective use of its EHR systems, the Ministry of Health continues to update the e-SUS APS strategy. Thus, different approaches are being adopted, such as offering an online training course on PEC and CDS for primary care professionals,

expanding the operational technical support service, defining new policies for funds transfer that motivate the adoption of the strategy in more health units, and continuing the evolution of the PEC and CDS systems.

CONCLUSION

This experience report showed that the national implementation of the Brazilian Electronic Primary Care Strategy (e-SUS APS) was a success for a combination of reasons. The most important are: 1) political agents understanding that public health policies must be prioritized over other political demands; 2) construction of six different scenarios of implementation, allowing distinct cities in Brazil to connect to the e-SUS APS strategy; 3) the active participation of health professionals and representatives of the citizens in the decision making processes of the CIT commission; they effectively supported and validated all decisions of government technical employees, culminating in the effective implementation of the largest public primary care informatic system in the world.

Despite the barriers that have been overcome so far, consolidating and expanding the use of a national health system in primary care is a constant challenge. Thus, it requires continuous actions to motivate the adoption of the strategy, as well as the continuous evolution of the systems and updating of the health strategy informatization.

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REFERENCES

1- Instituto Brasileiro de Geografia e Estatística. [Internet]. Brasil: Censo Demográfico; 2010. [citado 2019 Dec 01]. Disponível em: https://censo2010.ibge.gov.br/
2- Brasil. Presidência da República. Casa Civil. Constituição da República Federativa do Brasil de 1988. Brasília (DF); 1988. Disponível em: http://www.planalto.gov.br/ccivil_03/constituicao/constituicao.htm
3- Fornazin MA. Informatização da saúde no Brasil: uma análise multi-paper inspirada na teoria ator-rede [tese]. Rio de Janeiro: Fundação Getúlio Vargas; 2015.
4- Panhuis WG, Paul P, Emerson C, Grefenstette J, Wilder R, Herbst AJ, et al. A systematic review of barriers to data sharing in public health. BMC Public Health. 2014 Nov;14(1):1-9.
5- Organização Pan-Americana de Saúde. Plano de ação para o fortalecimento dos sistemas de informação para a saúde 2019-2023 [internet]. Washington: Organização Mundial da Saúde; 2019 Ago [cited 2019 Oct]. Available from: https://iris.paho.org/bitstream/handle/10665.2/51617/CD57-9-p.pdf?sequence=3&isAllowed=y
6- Ngwakongnwi E, Atanga MBS, Quan H. Challenges to implementing a National Health Information System in Cameroon: perspectives of stakeholders. J Public Health Afr. 2014 Mar;5(1):322.
7- Jamoom EW, Patel V, Furukawa MF, King J. EHR adopters vs. non-adopters: impacts of, barriers to, and federal initiatives for EHR adoption. Healthc (Amst). 2014 Mar;2(1):33-9.
8- Fragidis LL, Chatzoglou PD. Development of nationwide electronic health record (ÍEHR): an international survey. Health Policy Techn. 2017; 6(2):124-33.
9- Heeks R, Mundy D, Salazar A. Why health care information systems succeed or fail. SSRN Elec J [Internet]. 1999 Jun [cited 2020 Jul 14]. Available from: https://www.researchgate.net/publication/339989141_Why_Health_Care_Information_Systems_Succeed_or_Fail
10- Gaete RAC, Leite TA. Estratégia e-SUS atenção básica: o processo de reestruturação do sistema de informação da atenção básica. In: Anais XIV Congresso Brasileiro de Informática em Saúde; 2014 Dez. 07-10; Santos (SP). [Internet] [acesso 2020 jul 14]. Disponível em: shorturl.at/jyDH0
11- Khandelwal A. E-health Governance Model and Strategy in India. J Heal Man [Internet]. 2006 Apr. [cited 2020 Jul 14]. Available from: https://doi.org/10.1177/097206340500800111
12- Millery M, Kukafka R. Health information technology and quality of health care: strategies for reducing disparities in Underresourced Settings. Medical Care Research and Review [Internet]. 2010 Oct [Acesso 2020 Jul 14]. Available from: https://doi.org/10.1177/1077558710373769
13- Fonkych K, Taylor R. The state and pattern of health information technology adoption. 1th ed. Saint Monica: Rand Corporation; 2005.
14- Bath PA. Health informatics: current issues and challenges. J Inform Sci. 2008 Jun; 34(4):501-18.
15- Ludwick D, Manca D, Doucette J. Primary care physicians' experiences with electronic medical records: implementation experience in community, urban, hospital, and academic family medicine. Can Fam Physician. 2010 Jan; 56(1):40-7.
16- Roberts A. Standard generalised markup language for electronic patient records. Health Inform J. 1998; Jun;4(2):249-55.
17- Hayrinen K, Saranto K, Nykanen P. Definition, structure, content, use and impacts of electronic health records: a review of the research literature. Int J Med Inf. 2008; 77(5): 291-304.
18- Kimaro HC, Nhampossa JL. Challenges of sustainability of health information systems in developing countries: comparative case studies of Mozambique and Tanzania. J Health Inform Develop Countries. 2007 Dez;1(1):10.
19- Anderson JG. Social, ethical and legal barriers to e-health. Int J Med Inform. 2007 May-Jun;76(5-6):480-3.
20- Braa J, Mohammed W, Hanseth O, Heywood A, Shaw V. Developing health information systems in developing countries: the flexible standards strategy. MIS Quarterly. 2007 Jun; 31(2):381-402.
21- Vasconcellos MM, Moraes IHS, Cavalcante MTL. Health policy and potential for the use of information technologies. Saúde Debate. 2002 Mai-Ago; 26(61):219-35.
22- Akhlaq A, McKinstry B, Muhammad KB, Sheikh A. Barriers and facilitators to health information exchange in low- and middle-income country settings: a systematic review. Health Policy Plan. 2016;31(9):1310-25.
23- Ministério da Saúde (BR). Gabinete do Ministro. Portaria nº 1.412, de 10 de julho de 2013: Institui o Sistema de Informação em Saúde para a Atenção Básica [Internet]. 2013 Jul [cited 2020 Jul 14]. Available from: https://bvsms.saude.gov.br/bvs/saudelegis/gm/2013/prt1412_10_07_2013.html
24- Conselho Nacional de Secretários de Saúde – CONASS. Nota Técnica 07/13: Estratégia e-SUS na Atenção Básica e Sistema de Informação em Saúde da Atenção Básica – SISAB [Internet]. Apr; 2013 [cited 2020 Jul 14]. Available from: https://www.conass.org.br/biblioteca/wp-content/uploads/2013/01/NT-07-2013-e-SUS-e-SISAB.pdf
25- e-SUS Atenção Primária [Internet]. Brasília: Secretaria de Atenção Primária à Saúde. [cited 2020 Jul 14]. Available from: https://aps.saude.gov.br/ape/esus/download
26- Nguyen T, Nyella E. Health information systems implementation in developing countries: a translation process. In: Proceeding of the MCIS 2010; 2010 Set 12-14; Tel-Aviv.

[Internet] [citado 2020 jul 14]. Disponível em: shorturl.at/bdvD4

27- Ministério da Saúde (BR). Estratégia e-Saúde para o Brasil [Internet]. Brasília: Ministério da Saúde; 2017. Available from: https://saudedigital.saude.gov.br/wp-content/uploads/2020/02/Estrategia-e-saude-para-o-Brasil_CIT_20170604.pdf

28- Ministério da Saúde (BR). sisab.saude.gov.br [Internet]. Brasília: Ministério da Saúde (DF); 2020 [cited 2019 Dec 01].Disponível em: sisab.saude.gov.br

29- Thum MA, Baldisserotto J, Celeste RK. e-SUS AB use and factors associated with recording primary care procedures and consultations in Brazilian municipalities [Internet]. Cad. Saúde Pública. 2019 [citado 2020 Jul 14];35(2):e00029418. Available from: https://www.scielo.br/scielo.php?script=sci_arttext&pid=S0102-311X2019000205003&lng=en#B7

30- Estratégia e-Saúde para o Brasil [Internet]. Brasília: Ministério da Saúde; 2017 [acesso 2020 Jul 14]. Available from: https://saudedigital.saude.gov.br/wp-content/uploads/2020/02/Estrategia-e-saude-para-o-Brasil_CIT_20170604.pdf

31- Cavalcante RB, Kerr-Pinheiro MM, Guimarães EAA, Miranda RM. An overview of the definition and implementation of the Brazilian National Policy on Health Data and Information Technology [Internet]. 2015;31(5):960-70. Brasileiro [acesso 2020 Jul 14]. Available from: https://www.scielo.br/scielo.php?script=sci_arttext&pid=S0102-311X2015000500008&lng=pt&nrm=iso.

32- Zacharias FCM. Sistema de informação da Atenção Primária à Saúde no Brasil: adoção do e-SUS AB como inovação tecnológica [tese].Ribeirão Preto: Escola de Enfermagem de Ribeirão Preto. Universidade de São Paulo; 2019.

33- Silva TIM, Cavalcante RB, Santos RC, Gontijo TL, Guimarães EAA, Oliveira VC. Diffusion of the e-SUS Primary Care innovation in Family Health Teams [Internet]. Rev Bras Enferm. 2018 [acesso 2020 Jul 14]; 71(6):3121-8. Available from: https://www.scielo.br/scielo.php?script=sci_arttext&pid=S0034-71672018000602945&lng=en&tlng=en

34- Pilz C. Desafios e propostas para a informatização da Atenção Primária no Brasil na perspectiva de implantação do prontuário eletrônico do e-SUS AB [tese]. Porto Alegre: Universidade Federal do Rio Grande do Sul. Programa de Pós-Graduação em Odontologia; 2016.