Proposal for the development and implementation of a Software for Monitoring Patients with Tuberculosis in Primary Care in the Pandemic: A Critical Analysis

Ernani Mendes da Fonseca Junior[4], Francisco José Mendes dos Reis[1,2,3], Igor Domingos de Souza[1,2,3], Alessandro Carvalho da Fonseca[2,3], Hugo Vieira Ramos[2] and Eliza Miranda Ramos[1, 2,3 *]

[1]Group of Spectroscopy and Bioinformatics Applied to Biodiversity and Health, School of Medicine, Postgraduation Program in Health and Development in the Midwest Region, Faculty of Medicine, Federal

[2]University of Mato Grosso do Sul, Campo Grande, Mato Grosso do Sul, Brazil;

[3]Postgraduation Program in Health and Development in the Midwest Region, Faculty of Medicine, Federal University of Mato Grosso do Sul, Campo Grande, Mato Grosso do Sul, Brazil;

[4]Estácio de Sa University, Campo Grande, Mato Grosso do Sul, Brazil.

RESUME

Health in Brazil through technological innovations, whether under conditions of equipment availability has been using new techniques of care and care in primary care in diseases communicable with tuberculosis. The aim of this study was to evaluate the national and international scientific production on the knowledge about the process of monitoring tuberculosis patients in Brazilian primary care by software applied by a health professional. The methodology used in this study was the systematic review with a critical analysis in the elaboration for a software and was developed in six stages. As a result, 03 articles were obtained for the construction of this systematic review and the critical analysis in the follow-up of tuberculosis patients in primary care in Brazil. Among the models used, it was noticed that the cascading model, linear or classic and prototyping were the most used for software for care support and educational software.

Keywords: Tuberculosis, software, software validation, primary care, COVID-19, Brazil.

INTRODUCTION

Technological advances from 2000 to 2020 marked a new phase in the global health sector. It is possible to observe the influence of technological innovation with health 4.0 implanted in the world and recently recognized in Brazil [8,14].

Health in Brazil through technological innovations, whether under conditions of equipment availability has been using new techniques of care and care in primary care in diseases communicable with tuberculosis in different fields or specialties mainly with assistive technology [3,4,6].

Technology in health in Brazil has been affecting clinical knowledge with the use of epidemiology and assistive technology, in this case, tuberculosis in the pandemic period, with the dimensional use of the culture of the health and disease process and the models of work organization and management [7,9,10]. Thus, the insertion of technologies in information technology as software in the field of public health is considered as a driver of technological progress [9].

It is believed that the process of caring for tuberculosis patients in the pandemic period in COVID-19 can achieve levels of excellence through the support of technological resources in computers currently available in Brazilian territory [13].

Resources are integral elements in the context of monitoring patients with tuberculosis during the pandemic period and as a support tool for obtaining data, as well as for the generation of new information and knowledge [14].

Informatics in public health policies in Brazil has been relevant to the work process of health professionals at different levels of activity in the public health system [16].

The use of software applicable to the monitoring of tuberculosis patients in primary care is a challenge faced in several parts of the world, as it is capable of allowing the recovery of data from information related to clinical or epidemiological decision-making, a fundamental requirement for evidence-based practice in Brazil [18]. Moreover, currently, in Brazil, positive aspects have been evidenced in the use of care software for the collection, recording, storage, manipulation and recovery of data of patients under the responsibilities of health professionals [18,20].

Using software in the monitoring of tuberculosis patients in periods of pandemic brings easy access to data, enables administrative instrumentation and correct decision-making [21].

For the creation and use of software in the monitoring of tuberculosis patients in COVID-19, it is essential for the health professional to appropriate and have defined the software development processes [22].

This appropriation should thus avoid the low quality of the final product, because dissatisfied customer brings high maintenance cost [23]. Thus, for the development of a software for monitoring tuberculosis patients in the pandemic period it is necessary to use a technological arsenal and it is known that there are different models of software process, but some activities are fundamental, independent of the chosen model [23,24].

Moreover, the fundamental activities for the development of the software are software specification, design and implementation, validation and evolution. The software specification defines its functionality and restrictions on its operations in monitoring tuberculosis patients during the pandemic period [23].

The implementation defines the production of the software that meets the specification, validation seeks to ensure that the software satisfies the patient in data collection and the evolution allows the software to meet the specific needs in the collection of data of patients with tuberculosis in the pandemic period [25].

The use of information systems in computer technology has become difficult because it requires greater technical training, both in relation to knowledge in the monitoring technique by the health professional and the information and data programming technology and data analysis [23,25].

However, it is relevant to identify the methodological aspects adopted in the construction of software applicable to the monitoring of tuberculosis patients in the period of COVID-19 and the limitations and suggestions of the authors in order to support future software development research in this area [22].

In view of the above, this study will be prepared a systematic review of critical analysis of data on the development of software used in the pandemic period for patients undergoing tuberculosis monitoring in Brazil in primary care [23].

Thus, this study aims to evaluate national and international scientific production on knowledge about the process of monitoring tuberculosis patients in Brazilian primary care by software applied by health professionals.

METHODOLOGY

The methodology used in this study was the systematic review developed in six stages:

In the first stage, it is the elaboration of guide questions; in the second stage, the search for sampling was performed in the literature, in the third stage data collection was performed, in the fourth stage critical analysis of the included studies was performed, in the fifth stage the results were discussed and in the sixth stage a systematic review was constructed with the critical analysis of the collected data.

The search for the articles included in this systematic review occurred in 2019, from January to March 2021 in the databases: Latin-American and Caribbean Literature on Health Sciences (LILACS); Cumulative Index to Nursing and Allied Health Literature (CINAHL); PUBMED/MEDLINE; SCOPUS and Cochrane.

For the selection of sampling in the databases, the article was established as an inclusion criterion to bring the description in the software development process in tuberculosis monitoring and be disseminated in the English or Portuguese.

Thus, dissertations, theses, reports, news, letters to the editor and those that were repeated in the databases were excluded.

In this systematic review, the following descriptors or key words belonging to the descriptors in Health Sciences (Dec's) were used in the Virtual Health Library and the Medical Subject Headings (Mesh) of the National Library of Medicine: tuberculosis, COVID-19, monitoring; Software and Software Validation. In CINAHL, the descriptors Tuberculosis and software or software validation were used and 24 results were obtained.

Of these, one, ten were not available online and 11 studies were unrelated to the theme.

In PubMed, the selected descriptors were tuberculosis, care and software, totaling 25 studies, of which 25 were available in full online. However, there was a repeated article, 19 were not related to the theme, and a study was selected.

In LILACS, the descriptors tuberculosis, monitoring and software or software validation were cross-referenced, and 57 results were found. Of these, one repeated, six were not available online and 48 did not answer the guide question. Thus, a study was selected.

In the SCOPUS and Cochrane database, the descriptors used were tuberculosis, software, and software validation. In SCOPUS, 259 studies were initially found. However, when refining for primary care and Brazil, only 78 results were found. It was noticed that, of these, three were repeated, six were not available online, and 69 did not answer the guide question. Therefore, no study was selected in SCOPUS.

In Cochrane, 155 results were obtained, but none of the studies answered the purpose of this research.

For the selection of publications, initially, title and abstract were read to confirm whether they contemplated the main question of this investigation and whether they would meet the inclusion and exclusion criteria.

For the collection of information, we used an adapted script involving the following questions: publication title, author, year, and type of study, methodological framework, and software process model, methodological steps, and software purpose, professionals involved in software construction, methodological limitations of the study, authors' recommendations and level of evidence.

To perform the evaluation of quality in the evidence of clinical studies, a method was used, namely, the Down & Black instrument (1998).

Three reviewers who worked independently (EMR) participated in the study. To ensure the quality of the articles, a sensitivity analysis of the studies was performed by random exclusion of one study at a time and this result was evaluated to ensure that the results were not correlated with the large number or to a study with extreme results.

The organization and discussion of the results was carried out descriptively, supported by the literature of the theme under study, in the areas of informatics and public policies for the use of assistive technology in Brazil.

Figure 01 - Flowchart of the selection process for studies included in the systematic review

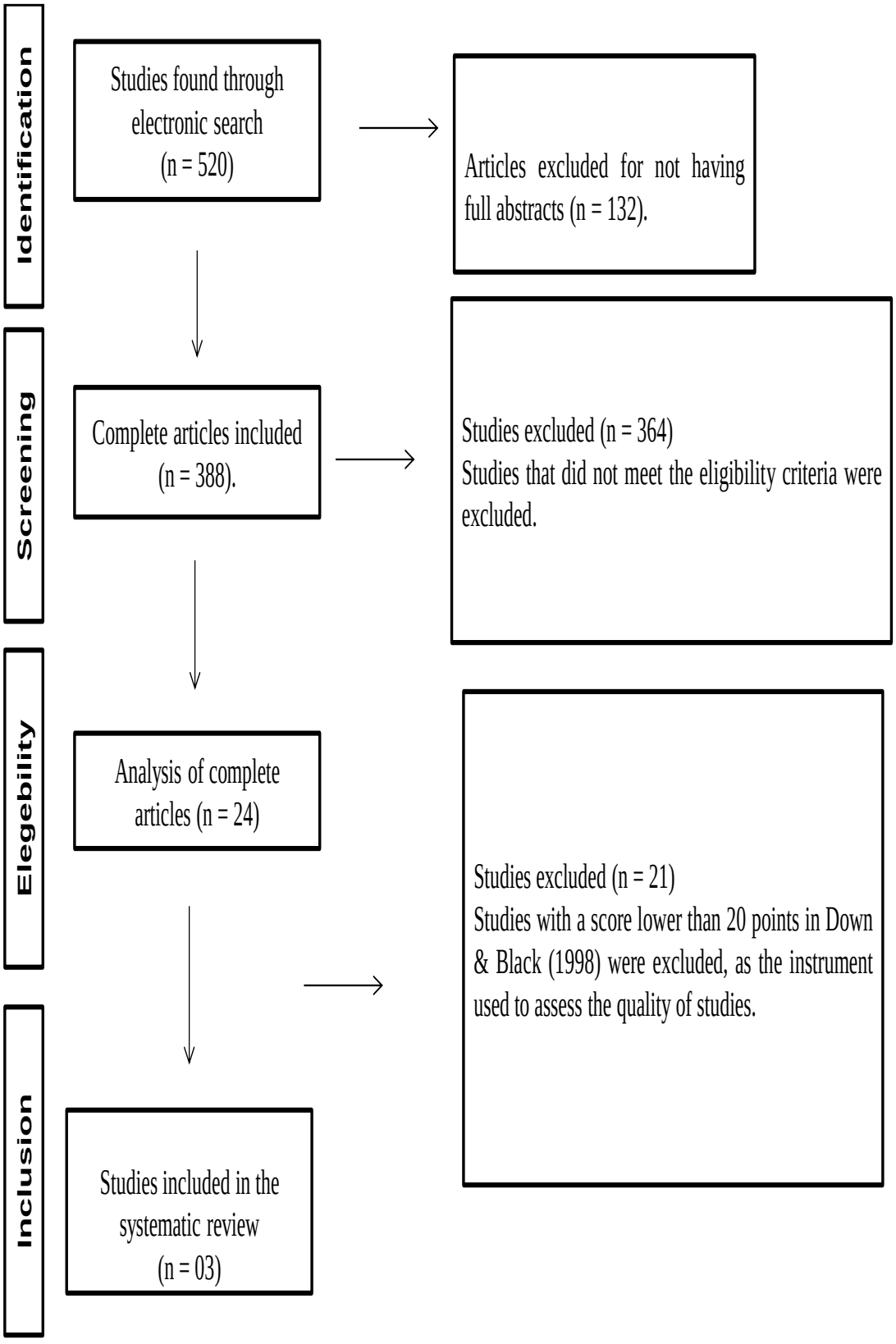
Identification
Studies found through electronic search (n = 520)
Articles excluded for not having full abstracts (n = 132).
Screening
Complete articles included (n = 388).
Studies excluded (n = 364)
Studies that did not meet the eligibility criteria were excluded.
Elegebility
Analysis of complete articles (n = 24)
Studies excluded (n = 21)
Studies with a score lower than 20 points in Down & Black (1998) were excluded, as the instrument used to assess the quality of studies.
Inclusion
Studies included in the systematic review (n = 03)

Table 01 - Identification and classification of the methodological quality risk of the included studies according to Down and Black (1998).

Article Identification	Reporting (0 – 10)	External validity (0-03)	Internal validity – bias (0 – 07)	Confusion - bias of selection (0-06)	Power (0 – 5)	Total score
Kamaiaji Castor, Fabio Batista Mota, Roseli Monteiro da Silva1, Bernardo Pereira Cabral, Ethel Leonor Maciel, Isabela Neves de Almeida, Denise Arakaki-Sanchez, Kleydson Bonfim Andrade, Vadim Testov, Irina Vasilyeva, Yanlin Zhao6, Hui Zhang, Manjula Singh, Raghuram Rao, Srikanth Tripathy, Glenda Gray, Nesri Padayatchi1, Niresh Bhagwandin, Soumya Swaminathan, Tereza Kasaeva1, Afrânio Kritski1. (2020)	10	03	04	03	00	20
Heloisa Silveira Paro Pedro, Andréa Gobetti Vieira Coelho, Isabela Mazuco Mansur, Ana Carolina Chiou, Maria Izabel Ferreira Pereira, Naiara Cristina Ule Belotti1, Manuela Galloy Sanches Ismael, Maria Rita de Cássia Oliveira Cury, Susilene	10	03	04	03	00	20

Maria Tonelli Nardi1, Érica Chimara. (2021)						
Ya-Dong Zhang, Hai-Feng Huo_and Hong Xiang. (2019)	10	03	05	03	00	21

SOURCE: SARA, H. D.; BLACK, N. The feasibility of creating a checklist for the assessment of the methodological quality both of randomised and non-randomised studies of health care interventions. J Epidemiol Community Health. v.52. p.377–384. 1998.

RESULTS AND DISCUSSION

The valorization of the use of Software in the care of tuberculosis patients in the pandemic period

The constant use of information technology (TI) is defined as an ordered set of scientific, technical, empirical and intuitive knowledge that is capable of being used in both the development and production and use of goods and services that are able to assist the care of individuals [01,04].

The SUS uses information technology (TI) in the Brazilian health sector as a way to assist in daily processes, either with diagnostic technology or with the use of biotechnology that has become dynamic and rapid in Brazilian public health [10].

The Brazilian public health system uses data technology in the health area mainly in the diagnosis using precise and less evasive equipment, equipment that can bring laboratory results connected with computer software capable of reducing the percentage of error, for example, the Brazilian single health system has used telemedicine with remote surgical interventions , the gene sequencing of SARS-CoV-2 was done in thirty-one days due to the use of specific software and when compared to HIV a 14-year delay is observed for genic a reading of the HIV virus without the aid of software [25].

The use of software in the Brazilian public health network is a logical sequence of algorithms, that is, it is a program that is executed through a computer that will result in the storage or transmission of information or printing of reports called software [19,25].

The development of monitoring software for tuberculosis patients are programs developed in order to meet a need, therefore, a logical structure that performs functions within the computational system developed by programmers who use programming languages according to the need of the patient with tuberculosis in the pandemic period for its elaboration [10,19].

This software to be developed is not physical but logical and can store both on processors and on Hard Disks among others and thus facilitate its proper transport [12].

In Brazil, there has been a veto of access to new technologies due to the high cost in the short term, however, state-of-the-art technologies and state-of-the-art equipment bring benefits in the economy of public health spending, for example, the reduction of costs in the medium and long term and stands out in this study what is invested today in information technology will be paid for by the savings made in future expenses [20].

The Brazilian health system lives in constant change and therefore, it is necessary that this software to be developed follow the changes imposed by the environment in which it is inserted [10,21].

This software must be inserted as built-in intelligence, with customer-oriented visuals, and SUS user, modular and complex network [8,12,19].

Thus, in this context, the Brazilian public health system should increasingly seek technology that saves not only money, but time of the health professional, by offering quick solutions to the problems presented and that makes the organization more optimized, with the purpose of meeting the patient's need for the Brazilian health system specialized in the treatment of tuberculosis [01,08,13,19,21].

The construction of this software will aim at a specific point that the need for tuberculosis patients to be differentiated according to the signs and symptoms of each patient during the treatment period [10,11].

Therefore, the prototype of this software will be aware of the standards and requirement of the Ministry of Health, since most of the medical bills billed in Brazil are sent via coded file and need to meet the specifications of the recipients, so that when receiving the file does not find corrupted or rejected data [10,12,16,19].

Information technology in the health area has been an ally in the fight to prevent the worsening of patients from diseases such as tuberculosis [12,14,19].

Currently, software is part of the daily life of great health professionals in the Public SUS network [10,11,12,14].

The software will be used in activities and decision making as an instrument to support the health professional [10,11]. The main function of information technology in the SUS network is the search for strategies and articulations through data collected in order to find solutions to problems both at the management level to tuberculosis and clinical treatment [2,13].

The elaboration of these prototypes already brings data information about the management of treatment in patients with tuberculosis essential to treatment, however, during this process in the primary result already possible to visualize possible failures related to the quality and veracity of the data used to feed the system, because it may occur due to the lack of training of health professionals in the Brazilian public network who will use the software in the major problems faced to the patient in treatment for tuberculosis during the pandemic period [10,12,13].

The system used will be included in the business Intelligence (BI) possible to use in all organization processes, by containing all the information that can help in the decision making by integrating the information in a way that will bring solutions to align the treatment of tuberculosis patients with the best quality of life, that is, this software will integrate, organize and show the probable correct decision to be executed by the health professional [9,10,11,14].

This software will use information provided by the patient and thus reduce the reduction of recurrent errors, such as with the electronic medical record which the health professional can observe what were the drugs prescribed to the patient, schedule, dosage and so it will be possible to perform the check of doses administered on the day and prevent the patient from being without medication, that is, medicated [10].

This software will be a set of clinical database generated by patient care in the Brazilian public health system, with identification of signs and symptoms, test results, vaccinations, surgeries or recent medications among other important aspects [11,13].

Therefore, with the information collected in a practical way, any of the health professionals will have access to the patient's history and it will be possible to develop a software with multimedia characteristics such as images in real time, signs of aggravation and physiological, informative texts for the purpose of an electronic data control [14].

Development of the software stages of tuberculosis patients in Brazilian primary care

For the construction of the software prototype, three articles were used for using software and it was noted that the three could be used to support health professionals in primary care in the care of tuberculosis patients [10].

Thus, they can help in the elaboration of the defining characteristics for the construction of the data regarding the necessary care, the automation of medical and nursing diagnoses and nursing interventions. Two were educational software that was characterized as hypermedia for use in the teaching of health professionals for the care of patients with tuberculosis in the epidemiological profile [12,14].

Only one article obtained the purpose of conducting the constructive administrative path of the software mainly in the dynamics of the progression of tuberculosis of the patient in the pandemic period [11,13].

The three articles included for the development of this software brought as methodological references software process models and thus, it was possible to verify the prototyping and cascading model in a linear or classical way [10,13].

It is possible to verify that this software will have an educational role, the computer-aided instruction model (CAI) will be the most used and will be combined with the following theoretical references: Bernardo (1996), Paulo Freire, Price (1991), Falkembach (2005) and Gagné (1980) [9,11,14].

Only one study included in this systematic review of critical analysis for theoretical elaboration in the construction of the software adopted a process model considered more agile in its development according to the evolution of recent knowledge and trend in data sciences [12].

Only one study described the software evaluation stage that is considered essential for the evolution and construction of software and consequently the quality of the final product elaborated [14,17].

In relation to the limitations of the studies included in this systematic review, it is possible to verify the difficulty related to the political will of the health service for the development of software projects to the Brazilian population, the feeding of data that requires exhaustive typing and the costly cost of this type of research that can intimidate initiatives of creation in the area of primary care for patients with tuberculosis in periods of high stress as in the COVID-19 pandemic [11,13,14].

However, the development of this software in general produces a foundation for the care of tuberculosis patients in periods of difficult access as in the COVID-19 pandemic and reduces the time spent by the health professional in bureaucratic work and thus enables the health professional; doctor or nurse a greater dedication in direct care and the development of these software can be makes an educational and innovative tool capable of potentiating the educational process in the treatment and conduct of tuberculosis [7,9,10].

The three studies included in this critical analysis by systematic review assist in the identification of the software, and showed that this software should be a set of activities, actions and tasks necessary for its development with a critical view on quality [11,14].

Moreover, traditional approaches, such as the linear or classical cascade model and prototyping specifically in software with patient care follow-up as in the case of tuberculosis should be used [14,15,17].

The analysis of these studies included in the construction of this critical analysis demonstrated the presence of similarities when addressed the methodologies and systems of classification of the signs and symptoms of tuberculosis used in the construction of information systems in primary care [14,15,16].

Thus, it was possible to determine in the cascade modeling that each phase should not be started before the previous phase has been completed and the phase transition period must present one or more approved documents [14].

After the approval of the documents the implementation phase must be initiated, the requirements will be frozen and may not undergo methodological changes [17].

This phase of premature freezing of the requirements will be able to prevent the system from reaching the patient's goal [11].

It is a model used in projects where the requirements are well elaborated. This prototyping process for the construction of this software is constituted in several interactive cycles based on initially pre-established requirements. Initially, a critical evaluation of the prototype will be carried out if the initial requirements were considered [14,15]. This software aims to reduce the time required to develop patient documentation and train healthcare professionals [17,18].

The disadvantage of this software can be highlighted with the modeling started in advance, without having a sufficiently focused attention to the analysis of a current and desired situation, in the recognition of the problem and formulation of the problem that will be as less important as the resolution of the problem itself [19,21].

The studies included in this systematic review of critical analysis showed that health professionals do not know how to appropriate agile methodologies for software construction. Only one study adopted the unified process that framed to be used in this software profile [19,20,21].

The Computer Assisted Instruction (CAI) model was preferably used in educational hypermedia software only in one article included in this systematic review of critical analysis [11,12,14].

This model recommends the following stages: 1. Initial planning; 2. Planning and development of instructional content and three. Evaluation and review [25,26].

The CAI type programs can be classified into the categories: exercise and practice; tutorial and simulation; as well as problem solving [24].

The CAI has been revealed as an adequate methodology in the production of educational hypermedia in the area of health in primary care [20,22]. The use of new educational technologies has contributed to the paradigm shift in the training of professionals in health institutions and, thus, in the promotion of qualified nursing care [21,23].

Regarding the methodological stages, it was found that most studies did not present data on the evaluation of the software, which hinders their evolution. It is understood that after the systems have been deployed, they must be reevaluated to remain useful [19,21].

After the software is put into use and deployed, new requirements will emerge and existing requirements will change [11,19].

Parts of the software can be modified to correct errors discovered during its operation, to adapt them to a new platform, and to improve its performance [05,17,21].

The development of software, therefore, does not stop when a system is delivered for operation, but continues throughout the life cycle of the system applied to patients with tuberculosis in primary care [12,13,19].

They understood that the software developed for the monitoring of patients with tuberculosis in primary care might not meet all the quality criteria recommended by specialists in the field. Therefore, recent initiatives by health professionals, especially nurses, which seek to identify the necessary requirements for the construction of software, are valid [17,18,19].

CONCLUSION

Among the models used, they noticed that the cascade model, linear or classic and prototyping were the most used for software for assistance support purposes and for educational software.

In this systematic review of critical analysis, a small number of studies were obtained that did not allow to portray the current panorama of software development studies for monitoring tuberculosis patients in care in Brazil, mainly due to the lack of detail in the articles.

Therefore, the urgency to develop new studies with this theme they emphasized, as well as providing the reader with information capable of contributing to the replication or understanding of what was exposed.

As the incorporation of this technological resource in the health sector is increasing and in the monitoring of patients and with an increasing tendency to use assistive technologies in Brazil.

REFERENCES

1. Ayday E, Fekri F. An interative algorithm for trust management and adversary detection for delay tolerant networks. *IEEE Trans. Mob. Comput*. v.11, n.9, p.1514–1531. 2012.

2. Curtis D, Shih E, Waterman J. Physiological signal monitoring in the waiting areas of an emergency room. *In: Proceedings of body networks workshop*. v.2, p.5 –8. 2008.

3. Lorenzetti J, Trindade LL, Pires DEP, Ramos FRS. Technology, technological innovation and health: a necessary reflection. Text Context Nursing [Internet]. 2012 Apr [cited 2013 July 30];21 (2):432-9. Available from: http://www.scielo.br/pdf/tce/v21n2/en_a23v21n2.pdf

4. Peres HHC, Marin HF. Informática em Enfermagem e Telenfermagem: desafios e avanços na formação e no cuidado [editorial]. J Health Inform [Internet]. 2012 Jan [cited 2013 July 29]; 4(1):I Available from: http://www.jhi-sbis.saude.ws/ojs-jhi/index.php/jhi-sbis/article/viewFile/194/110

5. Lima AFC, Melo TO. Nurses' perception regarding the implementation of computer-based clinical nursing documentation. Rev Esc Enferm USP [Internet]. 2012 [cited 2013 Aug 01]; 46(1): 170-177 Available from: http://www.scielo.br/pdf/reeusp/v46n1/en_v46n1a24.pdf

6. Souza MT, Silva MD, Carvalho R. Integrative review: what is it? How to do it? Einstein [Internet]. 2010; 8(1): 102-106. Available from: http://apps.einstein.br/revista/arquivos/PDF/1134-Einsteinv8n1p102-106.pdf

7. Eric Lepage MD, Bernadette Guillemet RN, Patrick Durepaire, Marc Dupont, Kin Veyer RN. Promoting Measure of nursing care workload through computerization AMIA [Internet]. 1995 [cited 2013 July 28];615-619 Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2579167/pdf/procascamc00009 0644.pdf

8. Chambers MG, Ed DC, Connor SL, McGonigle M, Ed MC, Diver MG. Multimedia Software to help caregivers cope. Journal of the American Medical Informatics Association [Internet]. 2003. 10(5):504-511 Available from: http://171.67.114.118/content/10/5/504.full.pdf+html

9. Lopes MVO, Silva VM, Araújo TL. Desenvolvimento lógico-matemático do *software* "ND". Rev Latino-am Enfermagem [Internet]. 2004;12(1):92-100. Available from: http://www.scielo.br/pdf/rlae/v12n1/v12n1a13.pdf

10. Goés FSN. Desenvolvimento e Avaliação de Objeto Virtual de Aprendizagem Interativo sobre o Diagnóstico em Enfermagem aplicado ao Recém-nascido Pré-Termo [Tese de Doutorado]. São Paulo: Escola de Enfermagem de Ribeirão Preto Universidade de São Paulo; 2010 [cited 2013 July 28]. Available from: http://www.teses.usp.br/teses/disponiveis/22/22133/tde-04082010-095024/en.php

11. Santos SR. Computers in nursing: development of free software application with care and management. Rev Esc Enferm USP [Internet]. 2010

12. ;44(2):294-300. Available from: http://www.scielo.br/pdf/reeusp/v44n2/en_08.pdf

13. Sperandio DJ, Évora YDM. Nursing care planning: proposal for a software prototype. Rev Latino-am Enfermagem [Internet]. 2005 [cited 2013 July 25];13(6):937-43. Available from: http://dx.doi.org/10.1590/S0104-11692005000600004/

14. Fernandes MGO, Barbosa VL, Naganuma M. Nursing physical examination of the full-term neonate: self-instructional software. Rev Latino-am Enfermagem [Internet]. 2006 [cited 2013 July 25] 14(2): 243-50. Available from: http://dx.doi.org/10.1590/S0104-11692006000200014

15. Martins ACF. Desenvolvimento e avaliação de um software de controle de atendimentos e apoio à decisão, para diagnóstico diferencial de disfunções do trato urinário inferior, baseado em lógica fuzzy. [Dissertação de Mestrado] São Paulo: Universidade Estadual de Campinas [Internet]. 2011. Available from: http://www.bibliotecadigital.unicamp.br/document/?code=000807126

16. Freitas LV, Teles LMR, Lima TM, Vieira NFC, Barbosa RCM, Pinheiro AKB, Damasceno AKC. Physical examination during prenatal care: construction and validation of educational hypermedia for nursing. Acta Paul Enferm [Internet]. 2012 [cited 2013 July 25] 25 (4): 581-588. Available from: http://www.scielo.br/pdf/ape/v25n4/16.pdf

17. Xelegati R. Desenvolvimento de ambiente virtual de aprendizagem sobre eventos adversos nos serviços de enfermagem [Dissertação de Mestrado] São Paulo: Universidade de São Paulo [Internet]. 2010. Available from: http://www.scielo.br/pdf/rlae/v19n5/pt_16.pdf

18. Pereira IM. Dimensionamento Informatizado de Profissionais de Enfermagem (DIPE): avaliação de um software [Dissertação de Mestrado] São Paulo: Escola de Enfermagem da Universidade de São Paulo [Internet]. 2011. Available from: http://www.teses.usp.br/teses/disponiveis/7/7140/tde-20062011-160947/pt-br.php

19. Medeiros SB, Pereira CDF, Assis YMS, Santos VEP. Desenvolvimento de Softwares em Programas Brasileiros De Pós-Graduação em Enfermagem: Pesquisa Documental Revista Brasileira de Inovação Tecnológica em Saúde [Internet]. 2012 [cited 2013 Aug 30];2(4):19-28. Available from: http://ufrn.emnuvens.com.br/reb/article/view/3302/2726

20. Schwonke CRGB, Filho WDL, Lunardi VL, Santos SSC, Barlem ELD. Phylosophical perspectives about the use of tecnology in critical care nursing. Rev bras enferm. [Internet]. 2011 [cited 2013 Aug 30];64(1):189-92. Available from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S003471672011000100028&lng=en&nrm=iso&tlng=en

21. Nietsche EA, Lima MGR, Rodrigues MG, Teixeira JA, Oliveira BNB, Motta CA, Gribler CS, Gribler VM, Lucas DDI, Farias MKF. Innovative technologies of nursing care. Rev Enferm UFSM [Internet]. 2012 Jan/Apr [cited 2013 Aug 31];2(1):182-189. Available from: http://cascavel.cpd.ufsm.br/revistas/ojs2.2.2/index.php/reufsm/article/view/3591/3144

22. Fuly PSC, Leite JL, Stipp MAC, Erdmann AL, Souza CQS. Interconnections between the systematization of nursing care and software engineering: theory based on data. Online braz j nurs [Internet]. 2013. 12(1):49-61. Available from: http://www.objnursing.uff.br/index.php/nursing/article/view/4099

23. Melo ECA, Enders BC. Construção de sistemas de informação para o processo de enfermagem: uma revisão integrative J. Health Inform [Internet]. 2013. 5(1):23-29. Available from: file:///Users/andreamoreira/Downloads/233-1017-1-PB%20(1).pdf

24. Sganderla MA, Lacerda GS. Melhorando a gerência e a construção de Software com Metodologias Ágeis [Internet]. 2008.Available from: http://docplayer.com.br/7969861- Melhorando-a-gerencia-e-a-construcao-de-software-com-metodologias-ageis.html

25. Silva DES, Souza IT, Camargo T. Metodologias ágeis para o desenvolvimento de software: aplicação e o uso da metodologia scrum em contraste ao modelo tradicional de gerenciamento de projetos. Computação Aplicada [Internet]. 2013. 2(1): 39-46. Available from: http://www.revistas.ung.br/index.php/computacaoaplicada/article/viewFile/1408/1194

26. Miranda LN, Freitas DA, Vasconcelos E. Desarrollo del Sistema Eletrónico de la Documentación Clínica de Enfermeria estructurado en diagnósticos, resultados e intervenciones. J Nurs UFPE on line [Internet]. 2014. 8(3):4178-82. Available from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0080-62342009000600002.