

Chapter 1 Prototype of an electronic system for innovation in the papillomavirus test registration process

Capítulo 1 Prototipo de un sistema electrónico para la innovación en el proceso de registro de la prueba de Papilomavirus

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Abstract

The present work aims to show the results of the effectiveness of the prototype of an electronic system for innovation in the registration process of the Papillomavirus test. This is a technological innovation project, carried out in a University Health Center in which 32 records of patients who underwent test during the project execution period were included. The system was implemented by all the nurses who work in the Women's Care Module. Three dimensions were evaluated: structure (official indicators), process (registration) and results (staff satisfaction with the management of the system). Thus, the electronic system meet the structure indicators established by Official Mexican Standards. The percentage of completeness of the records was high in three sections: entry into the system, identification of the unit and HPV molecular biology. Most of the staff are satisfied with the handling of the electronic system, so it can be concluded that the prototype of the electronic system was effective in recording the information. Its design and implementation will make the work of health personnel more efficient.

Information technology, Papillomavirus, Nursing records, Nursing process, Uterine cervical neoplasms

Resumen

Objetivo: mostrar los resultados de la efectividad del prototipo de un sistema electrónico para la innovación en el proceso de registro de la prueba de Papilomavirus. Metodología: Se trata de un proyecto de innovación tecnológica, realizado en un Centro de Salud Universitario en el que se incluyeron 32 registros de pacientes que se realizaron dicha prueba en el periodo de ejecución del proyecto. El sistema fue implementado por la totalidad de enfermeras que trabajan en el Módulo de Atención a la Mujer. Se evaluaron tres dimensiones: estructura (indicadores oficiales), proceso (registro) y resultados (satisfacción del personal con el manejo del sistema). Contribución: el sistema electrónico cumple con los indicadores de estructura establecidos por Normas Oficiales Mexicanas. El porcentaje de completitud de los registros fue alto en tres apartados: ingreso al sistema, identificación de la unidad y biología molecular del VPH. La mayoría del personal está satisfecho con el manejo del sistema electrónico, por lo que puede concluirse que el prototipo fue eficaz para registrar la información. Su diseño e implementación permitirá hacer más eficiente el trabajo del personal de salud.

Tecnología de la información, Papilomavirus, Registros de enfermería, Procesos de enfermería, Neoplasia de cuello uterino

1.1 Introduction

Sexually transmitted infections (STIs) have a major impact on sexual and reproductive health worldwide and are considered to be among the five leading causes of medical care in adults; every day, more than one million people contract such an infection. Human Papillomavirus (HPV) infection is one of the most common STIs and the World Health Organization (WHO) estimates that more than 290 million women worldwide are infected with the virus. Annually, high-risk oncogenic HPV causes 528 thousand cases of cervical cancer and 266 thousand deaths (World Health Organization, 2019). In Mexico, in week 53, in the month of December 2020, 32 new cases of malignant cervical tumor were diagnosed, 15, 929 of mild and moderate cervical dysplasia and 2, 231 of severe cervical dysplasia, the states that registered the highest rate were Jalisco, Veracruz, and Oaxaca; the accumulated volume of cases was 2,246, (Secretary of Health, 2020). In relation to the latter, the decrease in service provision as a result of the SARS-CoV2 pandemic should be considered.

Persistent infection with high-risk HPV (types 16 and 18) is the necessary cause of the disease; these types are present in more than 70% of all cases of cervical cancer (General Directorate of Health Information, 2019). Thus, since 2009, molecular HPV testing was implemented in Mexico as a strategy of the Timely Detection of Cervical Cancer (DOCACU) program to increase the effectiveness of cervical cancer screening and as one of the means of primary detection in women aged 35 to 65 years (Apud, 2013).

One of the lines of action to improve the DOCACU program is the development of Health Information Systems, which aim to increase the quality of care and processes, through new technologies that contribute to the efficiency of procedures, clinical records and early diagnosis (Pan American Health Organization, 2016; Apud, 2012; Diario Oficial de la Federación, 2007). Health personnel, specifically nurses, are involved in the timely detection of cervical cancer by taking the HPV identification test. However, problems have been reported in the legibility, accuracy and completeness of the data (Gutiérrez-Enríquez *et al.*, 2017), which hinders both administrative processes and patient care, as well as the delivery of timely results. For this reason, it is necessary to design and implement new systems that make the activities performed by service providers more efficient and help increase the quality of the health program. For this reason, an electronic system was designed to register the HPV or Papilomavirus test result request and report form, through a technological innovation process project, with the purpose of systematizing the information, having a database and reliable reports of the users, reducing waiting times and improving the follow-up and location of the patients in case of finding positive cases, which require immediate localization. Based on the above, the objective of this study is to show the results of the effectiveness of the prototype of an electronic system for innovation in the Papilomavirus test registration process.

1.2 Methodology

Technological innovation project, carried out in a university health center in San Luis Potosi, S.L.P. Mexico. It started in phase 1 and ended in phase 5 according to NASA's "Technology Readiness Level" technology maturation stages (NASA, 2017). According to the National Council of Science and Technology of Mexico (CONACYT), it is a technological development project, which is defined as the systematic use of knowledge and research directed towards the production of materials, devices, systems or methods including the design, development, improvement of prototypes, processes, products, services or organizational models (CONACYT, 2019).

PHP (Hypertext Pre-processor) an open source language, specially designed for web development, was used to program the software. For access, a unique key and password were provided to each user, who entered the system through a web page. Because the prototype was in the testing phase, an internal test of the system components was performed, so that its application would be similar to its final application in more advanced phases according to the TRL methodology, for which reason only 32 records of patients who were scheduled for HPV testing during the study period were used. Four professionals who make up the entire staff of the Women's Module, whose function at the health center is to perform this type of test, participated using the prototype. Personnel who were not directly involved in the Timely Detection of Cervical Cancer (DOCACU) program were excluded.

Three instruments were applied for data collection that evaluated three fundamental aspects of the system: a) structure, with a checklist, including interoperability, processing, interpretation, confidentiality and security of the electronic records; b) process, with an observation guide to verify the recording of data in the electronic system carried out by health personnel; it is based on the instructions for filling out the format: "high-risk human papillomavirus (HR-HPV) test result request and report" issued and used by the Secretary of Health of San Luis Potosi, Mexico; and c) result, with a survey of satisfaction with the system, in which questions were asked with Likert-type answers: (1) not satisfied, (2) not very satisfied, (3) regularly satisfied, (4) satisfied and (5) very satisfied. For the analysis of the health personnel's satisfaction with the use of the system, three dimensions were established: structure, process and result, as shown in Table 1.1.

Table 1.1 Criteria evaluated in the satisfaction of users with the use of the electronic system

Dimension	Evaluated system criteria
Structure	Completeness of the system Ease of access Immediate availability Data security Clear screens Allows integration Accuracy in recording
Process	Ease of data entry Menu: easy to use Menu: fulfills functions Speed Ease of operation Updating of records Does not accept missing data
Result	Usefulness as an administrative tool Adaptability to staff needs Usefulness to improve quality (service) Time saving Legibility of the record Completeness of the record Accuracy of the record

Source: Own elaboration

The electronic records system was divided into 5 sections for analysis: system login (user and password), patient identification (CURP: Unique Population Registry Code, name, entity of birth, municipality of birth, age, usual residence, local phone, cell phone, email and affiliation), alternate contact data (name, address, entity, municipality, local phone and cell phone), unit identification (institution, entity/delegation, jurisdiction, municipality and medical unit) and molecular biology for HPV detection (type of test, first time or subsequent, date of previous study, date taken, reason for detection, sample to be sent to the laboratory, name and RFC of the sample taker).

Data processing was carried out with the IBM® SPSS® Statistics 22 statistical package, which was used to organize the data. The project was approved by the Academic Committee of the Faculty of Nursing and Nutrition of the Autonomous University of San Luis Potosí and the University Health Center. The participating professionals signed a letter of informed consent and the confidentiality of the data was guaranteed.

1.2 Results

Table 1.2 shows, in terms of structure, that the electronic system complies with most of the guidelines established to guarantee the processing, confidentiality, interpretation, security and use of standards and catalogs of electronic health record information, complying with the guidelines of the Mexican Official Standards: NOM 024 SSA3-2010 based on electronic health record information systems. However, it does not comply with the indicators for requesting diagnostic aids and communication support, since due to the stage it is in, it does not yet have interoperability with the laboratory in charge of analyzing the samples.

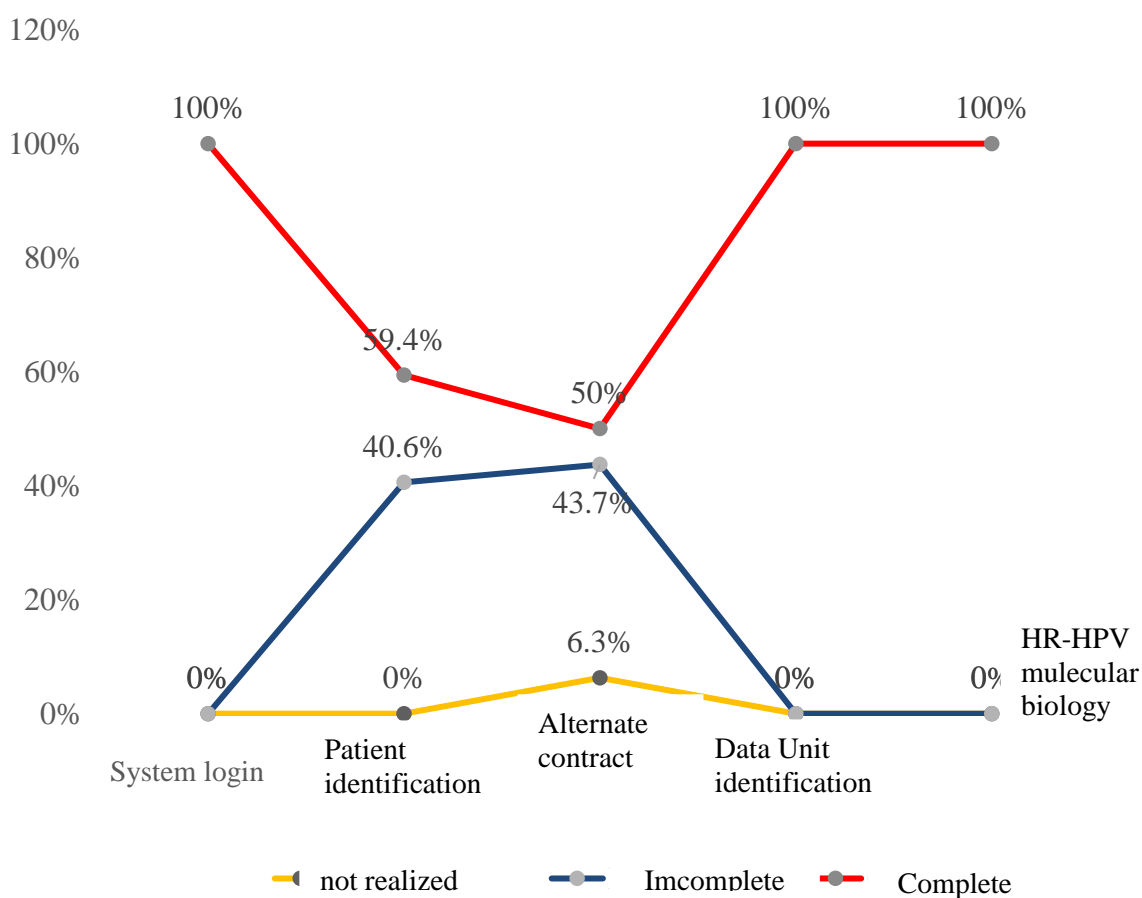
As can be seen in Figure 1.1, the results of the registration process, in the section on entry into the system, the percentage of compliance was 100%. In the patient identification section, 40.6% of the data were incomplete and 59.4% were complete. In relation to the alternate contact data, 6.3% of records were not made, 50% were incomplete and 43.7% were complete. Regarding unit identification and molecular biology for HPV screening, 100% were complete. On the other hand, the results of health personnel satisfaction with the use of the electronic capture system showed that the majority of participating health personnel expressed satisfaction in each dimension: structure (54.2%), process (53.6%) and outcome (64.3) as shown in Figure 1.2.

Table 1.2 Characteristics of the electronic system based on the indicators of the Mexican Official Standard

Indicator	Observations	Compliance
Infrastructure	Computer equipment, printing and internet connectivity.	Completes
Security	Access through username and password	Completes
Authentication	Identifies users and each health professional. Authenticates users before allowing access.	Cumple
Request for diagnostic assistants	Allows registration of results. Present past and current results. Identifies the person responsible for generating results.	Does not complete
Clinical communication support	Maintains communication with laboratory. Sends request to recipient (laboratory). Receives notification of request received.	Does not complete
Clinical information management and review	Creates electronic single request form. Displays patient identification (screen). Uniquely identifies healthcare staff.	Completes
Demographic data management	Stores established identification and demographic data.	Completes
Record and update medical history	Validates filling with the minimum information, displays and classifies data chronologically.	Completes
Patient directory	Has a directory (patients) that allows their identification and location.	Completes
Report generation	Generates request records and daily reports for printing.	Completes

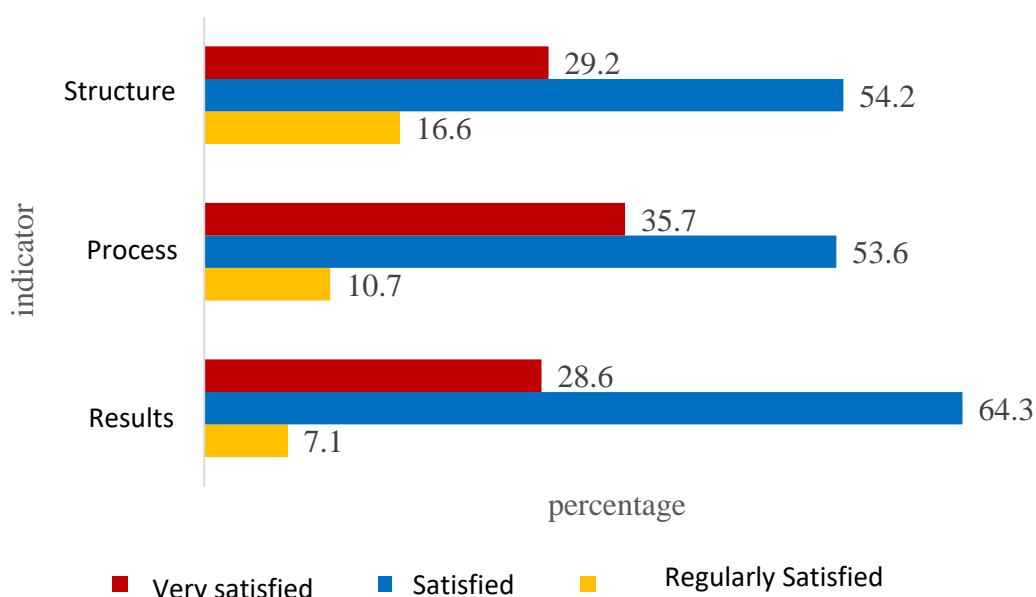
Source: Instrument for the evaluation of the structure of the Electronic System based on Norma Oficial Mexicana-024-SSA3-2012, Electronic registry information systems for health. Health information exchange.

Figure 1.1 Evaluation of the capture process of the prototype of the electronic system for recording HPV test data, according to the official format of the Mexican Ministry of Health



Source: Instrument for the evaluation of the structure of the Electronic System based on Norma Oficial Mexicana-024SSA3-2012, Electronic registry information systems for health. Health information exchange

Figure 1.2 Health personnel satisfaction with the use of the electronic system: structure, process and outcome



Source: Instrument for the evaluation of the structure of the Electronic System based on Norma Oficial Mexicana-024SSA3-2012, Electronic registry information systems for health. Health information exchange.

Table 1.3 shows that the majority of health personnel (75%) are satisfied with the structure indicators, the sections that stand out in this area being: "ease of access, clear screens and allows integration". The service providers are also most satisfied in the process indicator and the most outstanding items are: "easy to use menu, speed and does not accept missing data". In the outcome indicators, most of the staff (75%) are satisfied and the most outstanding items were: "usefulness as an administrative tool, adaptability to staff needs, usefulness to improve quality, readability, completeness and accuracy in the record".

Table 1.3 Satisfaction of health professionals with the use of the electronic system for recording data from the HPV request and results reporting sheet based on the dimensions of structure, process, and outcome

Criteria	Level of satisfaction		
	Regularly Satisfied %	Satisfied %	Very Satisfied %
Structure			
System completeness	25 (1)	50 (2)	25 (1)
Ease of access	25 (1)	75 (3)	0
Immediate availability	25 (1)	50 (2)	25 (1)
Data security	25 (1)	50 (2)	25 (1)
Clear screens	0	25 (1)	75 (3)
Allows integration	0	75 (3)	25 (1)
Process			
Ease of data entry	25 (1)	50 (2)	25 (1)
Menu: easy to use	0	75 (3)	25 (1)
Menu: fulfills functions	25 (1)	50 (2)	25 (1)
Speed	0	75 (3)	25 (1)
Ease of operation	0	50 (2)	50 (2)
Updating of records	25 (1)	50 (2)	25 (1)
Does not accept missing data	0	25 (1)	75 (3)
Result			
Usefulness as an administrative tool	25 (1)	75 (3)	0
Adaptability to staff needs	0	75 (3)	25 (1)
Usefulness to improve quality (service)	0	75 (3)	25 (1)
Time savings	0	75 (3)	25 (1)
Legibility of the record	0	50 (2)	50 (2)
Completeness of the record	0	25 (1)	75 (3)
Accuracy of the record	25 (1)	75 (3)	0
	0	75 (3)	25 (1)

Source: Instrument for evaluation of the outcome (satisfaction) of the electronic system

1.4 Discussion

The evaluation of the information system was carried out through three main indicators: structure, process and result, which were analyzed to verify its functioning and effectiveness in relation to the quality of the records for HPV sampling. The structure complies with most of the criteria established by the national agencies that regulate electronic health record information systems (Official Journal of the Federation, 2012), however, being a prototype in stage 1, according to the "Technology Readiness Level" methodology (NASA, 2017), there are some applications that need to be developed such as the request for diagnostic aids and clinical communication support, where information flows are maintained between health personnel directly related to a clinical event, such as sending the HPV test request to the recipient (laboratory), notifications of request received and generation of results reports (Official Journal of the Federation, 2012), it is expected that a next phase, the system will meet these indicators.

This development and its structure provides a reference for the design of medical information exchange systems between health institutions, since it is important to adopt intelligent algorithms that support the management of large volumes of data and the diversity of standards, terminologies and vocabularies to convert electronic health systems into intelligent entities capable of assisting in decision-making (Ojeda-Carreno et al., 2017). On the other hand, the ergonomics of the systems (organization, content, interface and technical) and usability (quality or characteristic of a product), allow for a detailed evaluation of their use and application, through the established criteria of the regulatory bodies (Almeida *et al.*, 2016).

In relation to the evaluation of the process indicator of the electronic system, an improvement is identified in the HPV test data registry, since it is a tool that allows having quality information, which in addition to being used for capturing patient data and generating daily reports, can be used for inter-institutional information exchange and health personnel can immediately consult information related to DOCACU program users. The above is related to the results of a study on health information systems, which concluded that electronic information systems are tools that collaborate in the fulfillment of institutional objectives, in addition, the authors mention that, in order to have a high quality clinical information platform, the primary capture of data should be as expressive as possible (Pinheiro et al., 2016). Thus, the use of information technologies allows the collection, systematization, structuring and storage of valuable information in the health sector (Oliveira et al., 2016).

The records of HPV tests performed in the electronic system are legible and accurate, however, there were some variations in completeness, with greater frequency in the fields corresponding to the following: e-mail, another telephone and another address, due to the fact that the users did not provide these data to the health personnel, which are of great importance for their location; this lack of information is not attributable to the electronic system, but to the patients who attend the screening, since the system is programmed to be filled out in a mandatory manner, therefore, it is necessary that the decision makers of the health institutions implement the necessary measures so that the patients have the complete identification data before the test is performed.

Regarding the results of the electronic system, the health professionals who participated expressed satisfaction in the three dimensions: structure, process and outcome, similar to what was obtained in a study on the success of information systems, where it was concluded, that user satisfaction is due to the way the system is structured and its operational quality, responding favorably to electronic health record systems (Yu and Qian, 2018). The health professionals who participated in this study also pointed out, in general, the difficulties in following up cases and locating users who require treatment, which coincides with a study on the expectations and level of satisfaction of users of the DOCACU program in Mexico, which concludes that having a quality program can achieve greater attachment on the part of program users, since they also perceive limitations with the follow-up of care (Gutiérrez-Enríquez *et al.*, 2016).

The migration of records from a manual system to an electronic one provides numerous advantages, since the use of information technology can considerably improve the quality of programs and services, as has happened in other contexts where the implementation of new technologies is the best solution to obtain effective results, since a large volume of information is handled (Orduña, 2014). One of the advantages of having an electronic system is the possibility of concentrating user data in an accessible, easy-to-use site that optimizes resources. The participants in this study stated that they were very satisfied with the use of the new work tool; however, a slight resistance to the transition from paper to electronic formats and to the use of new technologies was observed; this result is similar to that found by some authors in studies on barriers in the implementation of electronic health record systems, where the main problems were the following: user resistance, lack of training and education, and concern about data security (Gesulga *et al.*, 2017).

On the other hand, other authors conclude that the incorporation of electronic tools in the work of the nursing professional, promote and assist in decision making to improve quality, therefore, health care providers have the ability to positively influence the quality of care, through the successful implementation of this type of information tools (Walker, 2016; Wani and Malhotra, 2018). Likewise, the strategy for adoption is crucial in the success of these innovations, as hasty implementation can result in lack of acceptance by users of the systems.

One of the main challenges of this prototype is to increase the training period for health personnel, as well as a provide direct accompaniment, with the aim of ensuring user acceptance and obtain a good implementation over time, as pointed out by researchers on the subject, where they mention that to ensure successful acceptance; it is necessary to track the long-term effects, since as the staff becomes familiar with the system, the workflow improves (Baumann et-al., 2018; Dos Santos and Marin, 2018), likewise, they mention that coping with complexity in the implementation of new systems requires greater horizontal communication and collaboration (Sidek and Martins, 2017), as information technologies have a strong effect on organizational change and productivity (Ben-Assuli, 2015).

1.5 Conclusions

The electronic system had a positive impact on the records performed by health personnel based on the three indicators evaluated: structure, process, and outcome. The benefits expressed by the participants with the use of the platform were the following: ease of use and access, attractive and user-friendly system, good information management and decreased time spent on records, however, it is recommended to continue with the development of the system and implement it in other work scenarios, with the purpose of reaching the commercialization phase.

1.6 References

Baumann, L. A., Baker, J., Elshaug, A. G. (2018). The impact of electronic health record systems on clinical documentation times: A systematic review. *Health Policy*, 122(8), 827-836. doi: <https://doi.org/10.1016/j.healthpol.2018.05.014>

Ben-Assuli, O. (2015). Electronic health records, adoption, quality of care, legal and privacy issues and their implementation in emergency departments. *Health Policy*, 119, 287-297, doi: <https://doi.org/10.1016/j.healthpol.2014.11.014>

CONACYT (2019). National Council of Science and Technology: technological development and innovation, Mexico [Internet]. Retrieved from: <https://www.conacyt.gob.mx/index.php/el-conacyt/desarrollo-tecnologico-e-innovacion>

Official Journal of the Federation (2007). Mexican Official Standard NOM014-SSA2-1994. For the prevention, detection, diagnosis, treatment, control and epidemiological surveillance of cervical cancer. Retrieved from: <http://www.salud.gob.mx/unidades/cdi/nom/m014ssa294.pdf>.

Official Journal of the Federation (2012). Mexican Official Standard NOM-024-SSA3-2012. Electronic registry information systems for health. Health information exchange, Mexico. Retrieved from: http://dof.gob.mx/nota_detalle.php?codigo=5280847&fecha=30/11/2012.

General Directorate of Health Information (2013). Specific Action Program: prevention and control of cancer in women. Programa Sectorial de Salud 2013-2018. Mexico. Retrieved from: <https://www.gob.mx/salud/acciones-y-programas/cancer-de-cuello-uterino-prevencion-y-deteccion-oportuna>

General Directorate of Health Information (2013). Programa de Acción Específico: prevención y control de cáncer en la mujer. Programa Sectorial de Salud 2013-2018. México. Recuperado de: http://cneqsr.salud.gob.mx/contenidos/descargas/cama/PrevencionyControldelCancerdeLaMujer_2013_2018.pdf

Dos Santos, M.C, Marín, H.F. (2018). Analysis of the use of a computer system by hospital managers. *Acta Paulista de Enfermagem*, 31(1),1-6. <http://dx.doi.org/10.1590/1982-0194201800002>

Gesulga, J.M, Berjame, A, Sheen Moquiala, K., Galido, A. (2017). Barriers to electronic health record system implementation and information systems resources: A Structured Review. . *Procedia Computer Science*, 124, 544-551. doi: <https://doi.org/10.1016/j.procs.2017.12.188>

Gutiérrez-Enríquez, S.O., Gaytán-Hernández, D., Martínez-Martínez, R.A., Gallegos-García, V., Terán-Figueroa, Y. (2016). User expectations and perspectives with the cervical cancer screening program. , *Open Journal of Nursing*, 6, 565-572. doi: <http://dx.doi.org/10.4236/ojn.2016.68060>

Gutiérrez-Enríquez, S.O., Terán-Figueroa, Y., Monreal-Delgado, L., Nieva-de-Jesús, R., Gaytán-Hernández, D. (2017). Quality of records in a timely cervical cancer screening program. *Rev MÉD.UIS*, 30(3), 59-65. doi: <http://dx.doi.org/10.18273/revmed.v30n3-2017006>

Márquez de Oliveira, R., Freitas Duarte, A., Alves D., Ferreira Furegato, A.R. (2016).

Desarrollo de la app TabacoQuest for the computerization of smoking data collection in psychiatric nursing. *Revista Latino-Americana de Enfermagem*, 24: e2726, doi: <http://dx.doi.org/10.1590/1518-8345.0661.2726>

NASA. (2017). Level of technological readiness: National Aeronautics and Space Administration Retrieved from: https://www.nasa.gov/directorates/heo/scan/engineering/technology/txt_accordion1.html

Ojeda-Carreno, D., Cosio-León, M., Nieto-Hipólito J.I. (2017). Relevant tools to address interoperability issues in heterogeneous electronic health record systems: An exploratory investigation. *Revista Mexicana de Ingeniería Biomédica*, 38 (1), 25-37. doi: <http://dx.doi.org/10.17488/rmib.38.1.2>.

Orduña Ortégón, Y. P. (2014). Advances in the construction of a health information system in Colombia. *Science and Technology for Eye and Vision Health*, 12(2),73-86. doi: <https://doi.org/10.19052/sv.3297>

Santos Pinheiro, A.L., Santos Andrade, K.T., de Oliveira Silva, D., Machado Zacharias, F.C., Sousa Gomide, M.F., Carvalho Pinto, I. (2016). Health management: the use of information systems and knowledge sharing for the decision-making process. *Texto & Contexto de Enfermagem*, 25(3), e3440015. doi: <http://dx.doi.org/10.1590/0104-07072016003440015>

Ministry of Health (2020). Boletín Epidemiológico Sistema Nacional de Vigilancia Epidemiológica Sistema Único de Información. Mexico: Dirección General de Epidemiología,; Recovered. de: <https://www.gob.mx/cms/uploads/attachment/file/483154/sem30.pdf>

Sidek, Y.H., Martins, J.T. (2017). Perceived critical success factors in the implementation of an electronic health record system in the context of a dental clinic: An organizational management perspective. . *International Journal of Medical Informatics*, 107, 88-100. doi: <https://doi.org/10.1016/j.ijmedinf.2017.08.007> .

- Wagner de Almedia, S.R., Marcon del Sasso, G.T., Carvahlo Barra, D.C. (2016). Computerized nursing process in the Intensive Care Unit: ergonomics and usability. *Revista Escola de Enfermagem USP*, 50(6), 998-1004. doi: <http://dx.doi.org/10.1590/s0080-623420160000700017>
- Walker-Czyz, A. (2016). The impact of an integrated electronic adoption of health records on the quality of nursing care. *Journal of Nursing Administration*, 46(7-8),366-372. doi: 10.1097/NNA.0000000000000360
- Wani, D., Malhotra, M. (2018). Does meaningful use of electronic medical records improve patient outcomes? *Journal of Operations Management*, 60,1-18. doi: <https://doi.org/10.1016/j.jom.2018.06.003>
- World Health Organization (2019). Fact sheets: sexually transmitted infections (STIs). Retrieved de: [https://www.who.int/news-room/fact-sheets/detail/sexually-transmitted-infections-\(stis\)](https://www.who.int/news-room/fact-sheets/detail/sexually-transmitted-infections-(stis))
- World Health Organization/ Pan American Health Organization (2012). Strengthening health information systems: HIS component in the umbrella project. de la OPS/USAID. Washington, EUA. Retrieved from: https://www.paho.org/hq/index.php?option=com_content&view=article&id=5549:2011-strengthening-health-information-systems-usaid&Itemid=3978&lang=en
- World Health Organization/ Pan American Health Organization PAHO (2016). Mainstreaming HPV testing in health systems: manual for program managers. 2nd ed. Washington, DC, USA. Retrieved from: <https://www.paho.org/hq/dmdocuments/2016/manual-VPH-English---FINAL-version.pdf>
- Yu, P., Qian, S. (2018). Development of a theoretical model and questionnaire survey instrument to measure the success of electronic health records in elderly residential care, *PLoS ONE*, 13(1),1-18, doi: <https://doi.org/10.1371/journal.pone.0190749>