● Original article

# DIFFUSION OF THE TECHNOLOGICAL INNOVATION e-SUS AB: ACCEPTANCE OR REJECTION?*

Talita Ingrid Magalhães Silva[1], Ricardo Bezerra Cavalcante[2], Hugo Ricardo Moreira da Silva[3], Regina Consolação Santos[4], Eliete Albano de Azevedo Guimarães[5], Marta Macedo Kerr Pinheiro[6]

**Objective:** analyze the diffusion of the technological innovation "e-SUS AB strategy" in a Family health team in the West of Minas Gerais. **Method:** single case study with a qualitative approach in the light of the Innovation Diffusion Theory and the Technology Acceptance Model. The data collection included an interview and direct observation of a team's daily work. The data were systemized in the software Atlas ti and analyzed through Content Analysis. **Results:** the innovation supports the care planning because it makes individualized data available and improves the daily work. Nevertheless, its diffusion has predominantly produced a work overload and other difficulties that limit its acceptance by the health professionals. **Conclusion:** the diffusion of the e-SUS AB strategy as a technological innovation has presented situations that strengthen its acceptance, but situations that can lead to its rejection were predominant.
**DESCRIPTORS:** Health information systems; Diffusion of innovation; Medical informatics; Information technology; Primary health care.

## DIFUSÃO DA INOVAÇÃO TECNOLÓGICA e-SUS AB: ACEITAÇÃO OU REJEIÇÃO?

**Objetivo:** analisar a difusão da inovação tecnológica "estratégia e-SUS AB" em uma equipe de saúde da família do oeste de Minas Gerais. **Método:** estudo de caso único de abordagem qualitativa à luz da Teoria da Difusão da Inovação e do Modelo de Aceitação de Tecnologia. A coleta de dados compreendeu entrevista e observação direta do cotidiano de trabalho de uma equipe. Os dados foram sistematizados no software Atlas ti e analisados através da Análise de Conteúdo. **Resultados:** a inovação proporciona suporte no planejamento da assistência por dispor de dados individualizados, além de aprimorar o cotidiano de trabalho. Entretanto, sua difusão tem gerado, predominantemente, sobrecarga de trabalho e outras dificuldades que se conformam como limitadores de sua aceitação pelos profissionais de saúde. **Conclusão:** a difusão da estratégia e-SUS AB como uma inovação tecnológica tem apresentado situações potencializadoras de sua aceitação, porém predominaram situações que podem conduzir à sua rejeição.
**DESCRITORES:** Sistema de informação em saúde; Difusão de inovações; Informática em saúde; Tecnologia da informação; Atenção primária em saúde.

## DIFUSIÓN DE LA INNOVACIÓN TECNOLÓGICA e-SUS AB: ACEPTACIÓN O RECHAZO?*

**Objetivo:** analizar la difusión de la innovación tecnológica "estrategia e-SUS AB" en un equipo de salud de la familia del oeste de Minas Gerais. **Método:** estudio de caso único con enfoque cualitativo a la luz de la Teoría de Difusión de Innovaciones y del Modelo de Aceptación de Tecnología. Para recolectar los datos se llevaron a cabo entrevista y observación directa del trabajo cotidiano de un equipo. Los datos fueron sistematizados en el software Atlas ti y analizados a través del Análisis de Contenido. **Resultados:** la innovación provee apoyo en la planificación de la atención por disponer de datos individualizados, además de perfeccionar el trabajo cotidiano. Sin embargo, su difusión ha generado predominantemente sobrecarga de trabajo y otras dificultades que representan limitadores de su aceptación por los profesionales de salud. **Conclusión:** la difusión de la estrategia e-SUS AB como una innovación tecnológica ha presentado situaciones que potencializan su aceptación, pero predominaron situaciones que pueden llevar a su rechazo.
**DESCRITORES:** Sistemas de información en salud; Difusión de innovaciones; Informática médica; Tecnología de la información; Atención primaria de salud.

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[1]RN. PhD in Nursing at Universidade Federal de Minas Gerais. Lecturer at Universidade Federal de Minas Gerais. Belo Horizonte, MG, Brazil.
[2]RN. Post-doctoral degree in Information Science. Lecturer at Universidade Federal de São João Del Rei. Divinópolis, MG, Brazil.
[3]Nursing Undergraduate. FAPEMIG/UFSJ grante. Universidade Federal de São João Del Rei. Divinópolis, MG, Brazil.
[4]RN. M.Sc. in Sciences. Lecturer at Universidade Federal de São João Del Rei. Divinópolis, MG, Brazil.
[5]RN. Post-doctoral degree in Health Sciences. Lecturer at Universidade Federal de São João Del Rei. Divinópolis, MG, Brazil.
[6]Researcher. Post-doctoral degree in Information and Communication Science from Paul Sabatier University/IUT/Toulouse III. Lecturer at Universidade FUMEC and Collaborating Professor, Graduate Program in Information Science at Universidade Federal de Minas Gerais. Belo Horizonte, MG, Brazil.

**Corresponding author:**
Regina Consolação dos Santos.
Universidade Federal de São João Del Rei.
Rua Sebastião Gonçalves Coelho, 400, CEP 35.501-296. Divinópolis, MG, Brazil.

## ● INTRODUCTION

In Brazil, the acknowledged importance of information for decision-making processes has fostered the development and implementation of several health information systems.[1] Such systems are the combination of components that equip the information collection, processing, analysis, and dissemination process, strengthening information management in health services.[1] For almost two decades, however, the Primary Care Information System (SIAB) was used to organize and guide the information flow and to optimize information management in Primary Health Care in Brazil.[2]

In search of an innovative alternative, in 2011, the Federal Health Department (MS), through the Department of Primary Care (DAB), proposed the e-SUS Primary Care strategy (e-SUS AB).[3] The e-SUS AB strategy proposes the computerization of Primary Health Care through two software systems: the Simplified Data Registry (CDS) and the Citizen's Electronic History (PEC), aiming to restructure the registration of information throughout the national territory.

The e-SUS AB strategy entails structural changes in the set of ideas and in the practices of health service professionals and users, characterizing an innovation. Innovation is generated when an individual or group perceives any idea, practice or objective as "new", which happens in the implementation period of the innovation. In that sense, the individual process of acceptance or not of innovation is fundamental.[4]

The adoption of an innovation directly derives from the way it is demonstrated to its future adopters and can be accepted or rejected.[4] It should be kept in mind that the e-SUS AB strategy is in the phase of implantation throughout the Brazilian territory and needs to be evaluated.[3,5] This study aimed to analyze the diffusion of the technological innovation "e-SUS AB strategy" in a family health team in Western Minas Gerais.

## ● METHOD

A single case study with a holistic and qualitative approach was undertaken. The choice of the case study is justified because it permits the investigation of a complex social phenomenon, which maintains the holistic and significant characteristics of real-life events, such as organizational and administrative processes.

In this sense, the e-SUS AB strategy corresponds to a complex phenomenon of organizational and administrative processes, due to the initial phase of implementation and use of its software systems. Thus, the diffusion of the innovation strategy e-SUS AB was defined as the unit of analysis.

As a theoretical framework, the Innovation Diffusion Theory was used, in which diffusion is conceived as a special type of communication, in which an innovation/change is the central theme. The diffusion of an innovation comprises the process in which an innovation is communicated through certain channels of communication, for a certain period, among the members of a social system.

In addition, we also use the Technology Acceptance Model[8], in the belief that the acceptance of a technology is linked to the subject's perception of two fundamental dimensions, which are perceived easy use and perceived utility. Table 1 details the theoretical models, dimensions, elements, and attributes of the Innovation Diffusion Theory and the Technology Acceptance Model, in addition to the sources of evidence used.

**Chart 1 –** Sources of evidence in the light of the theoretical frameworks of the Innovation Diffusion Theory and the Technology Acceptance Model, small-sized city, Western health Region, Minas Gerais, Brazil, 2016

| Dimensions | Attributes | Sources of evidence |
|---|---|---|
| INNOVATION DIFFUSION THEORY (IDT) | | |
| Innovation Element | Relative Advantage: Perception that the use of the innovation offers advantages. | Interview |
| | Compatibility: Innovation compatible with the values, experiences, and beliefs practiced. | Interview Observation |
| | Complexity: Perceptions on the difficulty to use the innovation. | Interview Observation |
| | Experimentation: Period to test the innovation. | Interview |
| | Observability: Perceived outcomes of the innovation. | Observation Interview |
| Communication Channel | Means in which the messages circulate among individuals, considering the nature of the message exchange. | Observation Interview |
| Time | The time dimension between the contact with the innovation and the decision to accept or reject. | Interview |
| Social System | Members or units of a social system can be individual, informal groups or organizations. | Interview Observation |
| TECHNOLOGY ACCEPTANCE MODEL | | |
| Perceived easy use | Perception that the use of the technology demands neither effort nor difficulty. | Observation Interview |
| Perceived utility | Perception that the use of the technology improves the performance. | Observation Interview |

A city located in the West of Minas Gerais was defined as the study scenario, with a population of 46,482 inhabitants, 100% covered by the Family Health Strategy. The choice of that city was justified by the need to analyze the diffusion of innovation in a small city (<50,000 inhabitants), in the initial process of implementing the e-SUS AB strategy, and by the researchers' easy access.

A family health team from the city was randomly drafted. All 14 possible participants of that team were included. The data collection period occurred between March and July 2016. The participants were coded with the letter I, followed by the sequential interview number, as I01.

For the data collection, we used the open interview and direct observation, guided by an observation script and recorded in a field diary as Observation Notes (ON). The interviews lasted 50 minutes on average and the observation was carried out during five days of a typical workweek. In Chart 2, the observation questions and items present in the data collection tools are described.

**Chart 2 –** Research questions and aspects observed in the data collection, according to the Diffusion of Innovation Theory and the Technology Acceptance Model, small-sized city, Western Health Region, Minas Gerais, Brazil, 2016. (continues)

| Dimensions | Observation questions/items |
|---|---|
| Innovation Observability Perceived Utility | Tell me about the e-SUS AB at your Family health service? Observable influences on the work. Benefits of using e-SUS AB. Utility of software in work process. Presence of computers at workstations. Use/presence of forms, notebooks or other paper registration external to e-SUS AB. |
| Communication Channels | Tell me about the information sources you had or have access to about e-SUS AB. Communication channels about e-SUS AB. Presence or knowledge of Manuals issued by the Ministry of Health. Information and records on past training. |

| Experimentation Time | Describe what the implementation process of e-SUS AB has been from the start until now. |
|---|---|
| Relative Advantage | How do you assess the e-SUS AB in relation to the system you used earlier? Use of e-SUS AB and computer to register the work routine. Volume of documents and forms used in workstations (reception, consultation, and procedure rooms). |
| Compatibility | Tell me about the fitness of e-SUS AB to your professional needs. Response to professionals' needs. Service facilities, as well as internet connection, computers and printers. Work scale of professionals. |
| Complexity | Tell me about the instruments used in e-SUS AB (forms, software, manuals, etc.). Difficulties to use the system and other instruments (CDS/e-SUS AB forms). |
| Perceived Easy Use | Difficulty or facility of professional to use e-SUS AB. Difficulty of facility to use computers and printers. |
| Social System | Group formation and interaction among professional based on e-SUS AB. Memoranda and letters from municipal, state or federal entities. Interpersonal relationships. |

The data were systematized through the software Atlas ti and analyzed by means of Thematic-Categorical Content Analysis.[9] The data analysis permitted the clipping and coding of the registration units, according to the principles of completeness, representativeness, homogeneity, and pertinence.[9]

The study received approval from the Research Ethics Committee of the Federal University of São João Del Rei, under opinion No. 1.247.996/2015.

● **RESULTS**

The study involved 14 participants, being one physician, one nurse, one dentist, two nursing technicians, two oral health technicians, five community health agents (CHA), an administrative assistant, and a nutritionist. Most participants were female, ranging from 34 to 51 years of age, with an average age of 42 years.

In relation to the length of experience, the doctor and nurse had the longest experience with 15 and 12 years, respectively. Considering the entire team, the average length of experience was six years. Of the total number of participants, seven held a secondary education degree, three an undergraduate degree and four held a *lato sensu* specialization degree. Among the participants, five were public servants who were admitted to the municipal government and had an average of five years of experience.

**The innovation e-SUS AB and its attributes**

In this first category, in relation to the relative advantage attribute, the participants compared earlier systems the city had used and e-SUS AB.

[...] *e-SUS is more complete.* [...] *The SIAB did not have that much data to transmit, it was only age, date of birth, it did not ask for the SUS card, it did not ask for the mother's name. This one asks for the birth date, SUS card, CPF, RG, address* [...]. (I2)

Some collection instruments from earlier systems are still used though, as those data are not present in the software systems of the e-SUS AB strategy. The observed scene highlights this situation.

Health workers carried paperboards with printed forms of the e-SUS, besides form A from the abolished SIAB. For the daily work routine of the CHA, the e-SUS forms are yet another activity. (ON)

Some participants perceived improvements in some processes in the daily work routine compared to the previous system.

[...] *The forms that were done manually, where I got to close off the month, when we used the SIAB, counting square by square, medical appointments, dates, and everything. When we did not have time to close off the day, we ended up closing off at the end of the month* [...]. (I5)

The participants also talked about the incompatibility of the innovation with regard to the infrastructure provided and the work process of the family health team.

[...] *Sometimes the system is down a lot, it takes time, you spend a long time here, in front of the computer, waiting. There are times that are more difficult. At the end of the month, sometimes the internet happens to be slower and it delays our work at the service* [...]. (I4)

The low connectivity and the insufficient number of computers were also recalled as being incompatible with the work demands.

[...] *Imagine, I am here attending, as a technician, checking his pressure, doing my job, I came here to put it in the computer, I was ready and it would go down there in the doctor's room. It would be all right, it would be very good if it worked, if the doctor had a computer, because there is none there, there are few computers at the service.* [...]. (I3)

In relation to the complexity attribute, the lack of knowledge about how to operate the innovation in order to extract information and the lack of understanding about some of the available codes was recognized.

[...] *I do not understand those procedure codes ... there's a lot of programming language in e-SUS that I do not understand. Diagnostic codes, and other things that I am still unable to understand, and nobody explained it to me* [...]. (I6)

[...] *needed a report of hypertensive, diabetic patients and I cannot get it [...] Because until now they have not been able to inform us how to extract these reports from the system. How are you going to program your activities and make appointments?* (I8)

The experimentation of the innovation was an attribute the participants perceived and was linked to the sudden and constant changes in the data collection tools.

[...] *with the change of the forms, it was a great shock because everything came very fast and a lot of forms, changing the forms, every day a new form, when we thought we knew everything about the form, another came up* [...]. (I14)

Regarding the attribute of observability, some participants perceived positive effects of the innovation, such as the registration of the production, a fundamental step for the transfer of financial resources to the city. Another application of the software is to monitor priority groups:

[...] *in e-SUS, you can see [...] how many appointments I have done, how many groups I have done, how many people I have attended. This is important ... to reach goals for the financial transfer ... I can monitor and better plan the care* [...]. (I6)

On the other hand, other interviewees translate these effects as negative influences of the innovation on the care, due to the administrative overload the technological innovation causes, besides the rework.

[...] *I am kind of lost in my job [...] I overload my administrative part with the system and I am leaving much to be desired in the care ... the doctor does not type [...] how can I delegate the typing of a form that includes the CID?* [...]. (I12)

At the service, plenty of printed material related to the e-SUS AB strategy could be observed, which had accumulated for later typing. (ON)

**The communication channels involved in the innovation diffusion**

People were recalled as the main communication channels contributing to the diffusion of innovation, mainly as from the moment when they developed technological skills, which occurs through the interaction among professionals in the daily work.

[...] *Here one taught the other, one learned and was teaching others ... we still have many doubts* [...]. (I7)

To solve doubts and help in times when the system presents problems, the computer technician stood out in the professionals' statements:

[...] *we would call the technician or he would come and instruct us. He taught us to work and to move. If today the system crashes, we have to call him and he has to come here to be able to see* [...]. (I14)

On the other hand, the operating manuals of the system are unknown or are not available for professionals to consult in case of doubts:

[...] *There are no manuals available, I do not know. The help we have is one helping the other and the computer technician* [...]. (I10)

**Influences of the social system and time on the diffusion of innovation**

The professionals reported that the process of implementing the innovation took place within a short period of time, after the change of the municipal manager.

[...] *it came like this, all of a sudden. The new mayor started and already changed, we have already been doing the registrations by the computer* [...]. (I1)

In another report, the time and part of the implementation conditions were specified

[...] *I think about 40 to 50 days. It was not a long time, because they soon did the training and sent things, without any structure* [...]. (I11)

In addition to the short implementation time, the professionals emphasized that the process of implementing innovation has taken place top-down, from higher levels, and this has contributed to causing deficiencies in the process.

[...] *we know that everything that comes from the top downwards gets lost, things, so it arrives, and when it comes to us, it arrives with some shortcomings* [...]. (I8)

Another interviewee emphasized the way in which the implantation has been happening, in a sudden and unsystematized manner and as a result of pressure.

[...] *the implementation is taking place quickly. What I can tell you is this: there came an order, it seems that from Brasilia, that I had to implement the e-SUS and then the secretariat got in a very position, troubled and called all the medical and nursing professionals to take a training for e-SUS* [...]. (I11)

In one scene observed, it could be verified that some professionals are resistant to the implementation, but are moved by the imposition of higher levels. They feel insecure about the situation and have many doubts.

I observe great resistance by the professionals to implement e-SUS. I perceive insecurity and fear arising from doubts related to the software and its use. (ON)

In Chart 3, the elements/attributes and perceptions about the easy use and utility are summarized, strengthening the acceptance or rejection of the innovation and SUS-AB in its diffusion process, verified in this study.

**Chart 3 –** Perception of Primary Health Care professionals about elements that strengthen the rejection and acceptance of the innovation e-SUS AB, small-sized city, Western Health Region, Minas Gerais, Brazil, 2016

| Elements/ Attributes | Perceptions on the easy use and utility strengthening the rejection of e-SUS AB | Perceptions on the easy use and utility strengthening the acceptance of e-SUS AB |
|---|---|---|
| Complexity | Difficulty to extract reports<br>Lack of understanding of some codes | — |
| Observability | Administrative burden caused by technological innovation, besides rework | Support from care planning system |
| Compatibility | Low connectivity and small number of computers | — |
| Relative Advantage | Some collection tools from earlier systems are still used | More complete data<br>Improvements in some processes |
| Experimentation | Sudden and constant changes in the data collection tools | — |
| Social System | Pressure from higher levels towards implementation | — |
| Communication channel | Lack of knowledge on innovation manuals | People as communication channels. |
| Time | Sudden and non-systemized implementation istematizada | — |

*(leftmost column label, vertical: Attributes of the Innovation element)*

● **DISCUSSION**

The implementation of the e-SUS AB strategy has faced situations that predominantly enhance its rejection. We verified the need for administrative reorganization of the work, the need for re-registration of the population and the manual completion of several forms. The difficulty of extracting reports and misunderstandings about the codes used in the software systems were acknowledged. In addition, sudden and constant changes in the tools used for data collection made it difficult to access the information.

The scenario causes a burden and rework in the professionals' daily life, elements that tend to weaken the acceptance of a technological innovation.[4,8] In this context, the e-SUS AB strategy, despite being recognized as an innovation by the respondents, becomes incompatible with the demands of an a priori established work process.

Thus, the incompatibility and the complexity attributed to innovation end up developing the perception in the professionals that the technology being implemented is an instrument of the work process which, in addition to the others, represents an overload with negative repercussions for the care. Thus, the perceived utility of the innovation for the work process and its easy use is impaired.[8]

In Brazilian and international studies, the incompatibility of information systems in relation to the health work process, as well as the complexity of its use, were factors that contributed to its failure and entailed negative repercussions for the management and care.[1-2,5,10-11]

The development of information technologies needs to be adapted to the information needs of their potential users, besides contributing to the management of the information that emerges from the work process.[12-13] To be widely adopted as an innovative technology, the technology needs to equip people in order to qualify the flow of information, the planning and assertive decision making. Otherwise, it tends to be rejected.[4,8]

Such rejection can be characterized as its non-use by the professionals, becoming an obsolete technology. But it can also be characterized by its underutilization, when the professionals do not use the technology properly, generating information that is unreliable and has little applicability in the work process.[14]

Several studies have demonstrated the underutilization of information systems for planning purposes, mainly local planning.[2,12-14] In addition, care management has also been impaired when inappropriate information systems are used, resulting in negative effects on the safety of patients, families, and communities.[11,15]

Underutilization cannot be repeated with the software systems of the e-SUS AB strategy, as their main premise is to provide information management for local planning and decision making.[3,5] The use of the software systems of the e-SUS AB strategy is expected to favor the systematization of data, from the collection to the analysis of the information, equipping the organization of the work and the management of care.[3,5] For this to happen, however, the innovation needs to be institutionalized in order to maximize its use as a crucial element of the work process.

The necessary institutionalization is not only what is established in the regulations, because that is already present in the case of the e-SUS AB strategy.[3] It is necessary to go beyond: the professionals need to recognize the technological innovation as necessary, useful and applicable to the work process characteristic of primary health care. The professionals should share the utility of the software, evidencing its use in everyday activities as part of the work process.

In countries where computerization has been taking place in the context of primary health care, the use of information technology has favored the work process and the acceptance among health professionals.[16-17]

Thus, people need to be taken into account in the diffusion of innovations. Above all, there is a need to develop meanings that represent positive perceptions about innovation among individuals.[4,8,10,15] In this sense, it is necessary to involve health professionals in the process of implementing the e-SUS AB strategy.

In the findings of this study, the participants' lack of knowledge about the main means to communicate the innovation was evidenced, made available by the government to support the implementation of the innovation. Thus, it is necessary to broaden and diversify the communication channels, in addition to making them accessible.[3,4,8]

The preparation and planning that precede the innovation diffusion process are of fundamental importance because they correspond to how the potential users will find out about the innovation, initiating the process of diffusion and adoption.[4,15] In the scenario studied, however, the implementation process of the e-SUS AB strategy is perceived as sudden and top-down.

People are a sensitive factor of success in the implementation and adoption of health information technologies.[10,15,18] Some studies show that the involvement of health professionals in the development and evaluation of technologies, besides their training to use the technologies, contribute to the achievement of favorable meanings for the adoption of the technology.[10,15,18] Those studies even suggest the presence of health professionals in the information technology teams responsible for the implementation. The involvement of people in the process of implementing technological innovations in the context of health also contributes to the reduction of resistance.[10,15,18]

The respondents also perceived the diffusion of the e-SUS AB innovation as a requirement of higher-level managers, linked to financial transfers, reinforcing its recognition as a discrepant element of the work process. In this sense, the use of software systems is reduced to the need to meet the requirements of data input to be sent to the municipal, state and federal spheres, so there is no need to discuss, analyze or use them. This situation tends to directly influence the way the technology is perceived and used, as well as the reliability of the data produced.[2,12-14]

In this context, the data put into the software systems can be underreported or overreported, based on the criterion of a priori established goals, but without actually representing the veracity of the facts. These findings have already been verified in other Brazilian studies related to health information systems.[2,14,19]

It is necessary to break with this informational model with regard to information systems of national scope, already verified in other studies, in which the health professionals collect meaningless data, aimed at feeding the management spheres, centralizing information and making local decision making difficult.[1,14,20]

The e-SUS AB strategy emerges from this need to integrate information from the points of the healthcare network, but also from the need to manage information aimed at transforming the local reality.[3, 21-22]

Thus, health professionals and managers from all points of the healthcare network need to be encouraged and qualified to use the available technologies to organize work and manage local services, not only to send data to higher levels with a view to funding transfers. This significantly reduces the potential to transform the reality the technological innovations can provide.[14,20,23]

A limitation of this study is its capacity for generalization, but its results may guide other investigations that aim for a deeper understanding about the diffusion of technologies in health services and their repercussions on the relationships between professionals and patients.

● **CONCLUSION**

In this study, we aimed to analyze the diffusion of the e-SUS AB strategy innovation in a family health team of a city in the West of Minas Gerais. We have verified that the diffusion of the e-SUS AB strategy, as a technological innovation, has presented situations that enhance its acceptance, but predominantly situations that become challenging, as they enhance its rejection. Those situations need to be overcome in order to qualify and put the diffusion of technological innovation into practice.

It is believed that other investigations can be designed to analyze the dissemination of the citizen's electronic history in the e-SUS AB strategy, its influences on daily work, its acceptance by the professionals, its effects on patient safety, care management, and the work process.

● **ACKNOWLEDGMENT**

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