

# Best practices for COVID-19 Test Process in a Hospital Emergency Department

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## Abstract

Detection tests for COVID-19 are important to mitigate its spread. However, it is not yet clear what are the best practices for its realization. This paper aims to propose best practices to avoid possible failures in the points of contact of the samples collection for *Reverse Transcription Polymerase Chain Reaction* (RT-PCR) process in an emergency department of a hospital for the care of patients who are suspected or diagnosed with the new coronavirus. For this purpose, we performed a process mapping of the RT-PCR collection process using the Service Blueprint tool to identify the points of contact between the patients and the hospital staff. Thus, we identified the possible failures in these points, with the process actors, and we prioritized them according to their perception about Gravity, Urgency, and Tendency matrix. Our results show that the most critical failures are related to the information and communication between the process actors and the patients. In this way, improvements were proposed related to the standardization, information material, continued training, development of specialized teams, creation of protocols, and use of information technology.

## Keywords

Best practices in services. COVID-19. Hospital emergency. Service Blueprint.

## 1. Introduction

The second decade of the new millennium ends with a pandemic – declared by the World Health Organization – apparently begun in China, which transformed the facets of society (Qian and Fan, 2020). The new coronavirus COVID-19 affected life in general, imposing sanitary barriers and modifying many human habits in a short period. The pandemic unfolded into economic problems, but it also brought much more impact to health systems. For example, in Brazil, there is the Unified Health System (SUS) (Paiva and Teixeira, 2014), whose advent “increased access to health care for a substantial proportion of the Brazilian population, at a time when the system was becoming increasingly privatized (Paim et al., 2011, p.1778)”. With the pandemic, the reasonably organized health system suffers from an abrupt increase in demand, especially in hospitals. One of the tests used for the detection of the active virus is *Reverse Transcription Polymerase Chain Reaction* (RT-PCR). Particularly, in a study on the diagnosis of Influenza by RT-PCR in emergencies, Hansen et al. (2018) state that optimal patient management depends on the recognition of appropriate clinical symptoms by an experienced health professional and the availability of reliable diagnoses, with strong predictive values, capable of allowing management decisions to be made. The main figure of the pandemic is the patient who, as a client of the public health service, will be impacted by the new protocols of medical care for diagnosis. The improvements in the current care processes, or the inclusion of new and best practices, become fundamental approaches in crises, as they can bring numerous benefits, especially for patients and for public health.

In health service processes, the patient's point of contact with the care environment seems to be essential elements of analysis to allow better management of services in crises scenarios. For this, the Service Blueprint presents as a good analytical tool to understand the participation of patients with suspected COVID-19 infection throughout the healthcare process. The Service Blueprint is one of the most used tools to manage service operations, being also used in the health area to clarify the functions and responsibilities of each team member, reveal problem areas, seek improvements, compare observed processes, as well as analyze interactions in processes (Chen and Cheng, 2012).

The tool uses a process graph to show the service delivery process from a customer perspective and includes several important components, including customer actions, early-stage employee actions, behind-the-scenes employee actions, support processes, and physical evidence; these components are separated by an external interaction line, a visible line, and an internal interaction line (Liang and Chen, 2020).

The domain of direct interaction between the client (patient) and the service, demonstrated by Service Blueprint, reveals the points of contact where the greatest process inefficiency occurs and that can be associated with management practices to be improved. The well-known Blueprint technique can be used as a valid approach to identify points of improvement and can be applied to optimize processes in the health area from patients perspective (Fliess and Kleinaltenkamp, 2004).

## 1.1 Objectives

The aim of the study is to map the RT-PCR test process to identify possible failures in the contact points and, thus, propose best practices for its improvement. For this purpose, we analyzed the collection process for RT-PCR examination in a hospital emergency service for exclusive care of patients with suspected COVID-19 infection. RT-PCR is the only recognized method for rapidly and precisely detecting COVID-19 infection in humans (Djalante et al. 2020). Specifically, the contact points between professionals and patients were analyzed and the possible failures emerging from these interactions were verified. According to Geum, Cho and Park (2011), in any organization, failures in a system must be identified, evaluated, and improved under a well-defined structure. The main concern of fault analysis is to emphasize the prevention of problems related to proactive system treatment, rather than finding a solution after failure.

## 2. Literature Review

### 2.1 Service process

Any activity, whether related to a product or service, involves a process for it to be executed, transforming an input into an output, through activities that add value, seeking to satisfy the needs of a specific client (Gonçalves, 2000a; Paslauskis et al. 2016, 2017). Gianesi and Corrêa (1994) state that the main difference between products and services is due to the participation of the user who, when it comes to services, experiences the creation process. In this context, Santos (2000) establishes great importance of user participation in the service process, highlighting process management to improve the services delivery to customers. Lovelock (1995) states in his study that improvement is only possible with a deep understanding of the process, constituting an indispensable factor in the services management, since the interaction between the user and the company, known as "moments of truth", can generate a high complexity and lead, consequently, to negative results. In health services, especially in hospital environments, these dimensions take particularly important proportions since it involves compromising the patients' health especially in the context of the current COVID-19 pandemic, since the high transmissibility of the virus can compromise society safety.

From this context, mapping processes is a fundamental strategic measure for the organization, allowing a clearer understanding of the tasks, their interrelations, and their impacts. According to Pinho (2006), the detailed view of the process, whose focus is the understanding of the relationships between the various activities that compose it, allows the organization to better identify the failures that may occur during its execution. For fault diagnosis to occur effectively and efficiently, Hunt (1996) recommends the use of process mapping techniques.

It is important to emphasize that in the processes there are failures. Failures in health services, according to patients' perception, are beyond the diagnostic process or a technical failure that may occur. Donabedian (1985) and Engelbrecht (2007) affirm that the health professional's behavior can also generate failures, mainly due to the emotional fragility and insecurity that patients and family members find when seeking hospital services. Bucknall (2010) and Spath (2011) suggest that part of the hospital's mistakes come from flaws in the process, understanding that a failure can trigger several successive events. In this sense, it becomes relevant to use tools that allow the mapping of processes and visualization of interactions in the service.

### 2.2 Service Blueprint to Services Process Mapping

The process performance and/or the provision of services may depend on the customer interactions that generate difficulties in managing service processes efficiently and effectively, considering that customer contributions can only be influenced by the provider to a certain extent (Fliess and Kleinaltenkamp, 2004). In this way, the Service Blueprint, coined by Shostack (1982), becomes of great value for the service processes management, because its objective is to

map processes. Otherwise, Service Blueprint differentiate front-office activities from the back-office activities and concentrate this information in a flowchart (Go and Kim, 2018), allowing the best visualization of the customers participation in the service process (Bitner et al. 2008).

In this sense, Service Blueprint allows the company to explore the problems inherent in-service management (Shostack, 1984). Thus, it has a positive impact by enabling a detailed process analysis (Lee et al. 2005) and the identification and recording of actions and interactions of the process in and around the customer-company interface (Sampson, 2012).

### **3. Methods**

#### **3.1 Mapping the Covid-19 RT-PCR Collection Process**

First, a literature study was conducted on the main issues to be addressed. After that, we defined the hospital emergency as the study site, because there are a lot of opportunities to improve service interaction between patients and health teams (Brei, 2004). Finally, information collection was initiated to map the process and understand the points of interaction of the team with patients, also called contact points (Gersch et al. 2011). For this, the Service Blueprint tool was used, which was applied to map the RT-PCR collection process performed in patients with suspected COVID-19. Mapping was made possible by observing the process.

#### **3.2 Fault survey and GUT Matrix**

To perform a survey of the failures that could occur in the contact points, a semi-structured interview was conducted, in which we sought to raise the opinion of the actors in the process (Gil, 2010). This interview was conducted with emergency nurses (4), physicians (2) and members of the Hospital Infection Control Service (3) who had some interaction with the patient in the RT-PCR collection process. Thus, 9 interviews were conducted. After this initial questionnaire, the relevance of the failures pointed out was validated with a specialist (hospital work nurse). Thus, it was possible to identify the existence of 12 possible failures in the analyzed process.

Based on this, the failures validated by the specialist were listed and we elaborated a questionnaire with closed multiple-choice questions, to evaluate the criticality of the failures pointed out according to the opinion of the process team, we obtained a response rate of 68% (19/28). To elaborate this questionnaire, the criteria of the GUT Matrix (Kepner and Tregoe, 1981), which assesses the Gravity (G), Urgency (U) and Tendency (T) of a failure or problem, were used. In this sense, gravity corresponds to the damage on the result, the urgency investigates the pressure of time to solve the problem, and the tendency deals with the growth potential of the problem over time (Oliveira et al. 2016). To evaluate the consistency of the questionnaire applied, we used Cronbach's Alpha (Hair et al, 2005). Following Hair et al. (2005), Cronbach's Alpha must be greater than 0.7, and, in this study, the value of Cronbach's Alpha is 0.88, showing the instrument reliability. Thus, the values collected were also used to elaborate the GUT Matrix and generated a Priority Number for the implementation of improvements to mitigate priority failures.

#### **3.3 Proposition of best practices**

Once the prioritization was carried out, we sought to identify the documents and protocols of the hospital best practices related to the most critical failures. Then, an action plan was elaborated through the 5W1H tool that is a checklist that facilitates the understanding of what should be done for the implementation of actions in a clear and objective way to guide the steps for achieving the results (Peinado and Graeml, 2007). This checklist is composed of What, Who, Where, When, Why and How actions that should be implemented.

### **4. Results and Discussion**

#### **4.1 GUT matrix prioritization**

Based on the data, it was possible to establish a prioritization of the failures found with the use of GUT matrix. Therefore, allowing decision-making to be done in a more strategic and smarter way, reducing impacts by error or lack of prioritization. In addition, the result helps in the resources allocation, which could make effective decisions, avoiding resource waste. The results are consolidated in Table 1.

**Table 1: GUT matrix**

<b>Fault</b>	<b>Gravit</b>	<b>Urgency</b>	<b>Tendency</b>	<b>G*U*T</b>	<b>Priorization</b>
Lack of confirmation of patient identification	4,95	5,00	4,79	118,48	1
Lack of hospital return on test result	4,68	4,68	4,58	100,47	2
Unable to communicate the test result to the patient	4,74	4,68	4,53	100,43	3
Error in passing guidance on waiting for test results	4,63	4,53	4,32	90,48	4
Patient denies performing the test	4,37	4,61	4,42	89,05	5
Patient does not understand the reason for the test	4,32	4,58	4,37	86,33	6
Collection performed outside the period for the test	4,21	4,42	4,32	80,34	7
Failure to perform patient release	4,16	4,47	4,26	79,30	8
Patient does not collaborate at the time of test collection	3,89	4,68	4,16	75,86	9
Lack of guidance on possible discomfort when performing PCR collection	3,89	4,58	3,95	70,40	10
Lack of clarification of how the test result will be informed	3,84	4,47	4,05	69,66	11
Lack of understanding of the patient about the information passed on about the test	3,89	4,05	4,28	67,52	12

Source: authors.

From these findings, we found that the main failures attributed by the front-office are related to information and communication between the actors and the patients. For example, failure with the highest score (118.48) is related to "Lack of confirmation of patient identification", which is related to how to communicate with the patient. The main actor involved is the physician, so the communication between the physician and patient should be clear and accurate. Roter et al. (1988) explore different categories of physicians talk, one of them is called "information seeking", in which the physicians ask for information about the patients. This type of communication is important in the patient-physician relationship to mitigate some problems, including the first prioritized fault.

The second failure is "Lack of hospital return on test result", in which COVID-19 nurses are the key actors. The failure is related to the patient's guidance to wait for the result, since the hospital should return the patient's result. Therefore, the nurse should create a protocol about how the test return will be done and improve communication skills, explaining how and when the result delivery will occur.

The third failure is "Unable to communicate the test result to the patient", which is considered a communication failure. The main actor is the team of the Hospital Infection Control Service. The information misunderstood by patients and family members directly interferes with their perception of the disease, which may lead to lack of confidence in the team and in the health institution, because there is a positive and significant effect between satisfaction and staff communication skills (Clever et al., 2008). Better, when communications abilities increase, patient and family satisfaction also increase.

Regarding the fourth failure, there is the "Error in passing guidance on waiting for test results" whose main actor is the nurse of the emergency COVID wing. Not passing on or passing on incorrect information about the result waiting period could also cause the spread of the virus. Without the necessary care and without a result perspective, patients could go to the streets and/or not take proper precautions indoors.

In the fifth position is the failure related to the "Patient denies performing the test". Even though it was in fifth position, the interviews indicate that it is one of the main flaws since it is closely related to the spread of the virus if the patient is asymptomatic and does not perform the test. Qian et al. (2020) explain the high importance of the prevention of the

infection by asymptomatic patients, because there are different clinical manifestations of COVID-19. Furthermore, this action could reduce infections because the cases are increasing. For instance, According to Worldometer (2021) data, 87,199,708 total confirmed cases, 1,882,986 confirmed deaths and 1,083,816 recovered throughout the world as of January 06, 2021. If we compare with data from May 02, 2020, in eight months more than 1.6 million people died, unfortunately.

The sixth failure was the "Patient does not understand the reason for the test", whose main actor is the nurse of emergency COVID wing. This failure could bring fear to the patient, since the patient may not understand the reason why he would have to take the test and his family members did not, which generates discomfort in performing the examination, which may result in a possible denial of the test performance. It is important to mention that testing strategies differ between some countries, for instance, in French Polynesia, they are testing only symptomatic people (World Health Organization, 2020).

In the seventh position of the GUT matrix, is the failure "Collection performed outside the period for the test", in which the nurse of the emergency COVID wing is the main actor of this process. Patients with 1 or 2 days of symptoms may result in false negatives, causing spread of the virus. One main action to mitigate this problem is for all negative-testing individuals to be isolated for seven days to reduce virus transmission (Davis et al., 2020).

In the eighth position is the failure "Failure to perform patient release" in which the physician is the main actor in this process. This failure is important since the patient should receive clear and objective guidance on the risks of the disease.

The ninth failure, called "Patient does not collaborate at the time of test collection" the nurse of emergency COVID wing is a key part of the success of this process. This step is important for the process, since if the patient does not collaborate with the collection of the material, the swab may not reach the correct location, bringing, for example, wrong diagnoses, such as false negatives, because it does not have enough material for the identification of the virus. Indeed, swab tests can reach more than 20% in false negative tests (Casella, 2020). Furthermore, RT-PCR test is not sufficient to exclude COVID-19 false negative results (Zitek, 2020).

In the tenth position, there is the failure "Lack of guidance on possible discomfort when performing PCR collection", in which the physician is the main actor of this process. With this lack of guidance on the collection by the physician, the patient may end up coughing or sneezing, which can hinder the collection and, according to the specialist may imply the non-performance of the test.

In the eleventh failure, "Lack of clarification of how the test result will be informed", the physician is also the main actor. This failure, pointed out as the main flaw by the specialist, has great impact, since the patient has no idea when and how he will have access to the result of his RT-PCR Test, as well as how he will have to behave in this period. So, physicians and patients should talk about how social distancing is important in this period and how it could save lives.

In the last position is the failure "Lack of understanding of the patient about the information passed on about the test", with the COVID-19 emergency nurse as the main actor. Many patients are humble and illiterate, making it difficult to fully comprehend the information about the test. In this way, it is important to inform and detail the procedure and ask if the patient has any doubts.

#### **4.2 Proposition of best practices (5W1H)**

To organize the proposition of best practices to mitigate the effects of possible process failures, we developed an implementation plan through the 5W1H tool (Table 2).

Regarding the failures pointed out, we found that the hospital did not have any protocol that could avoid the failures related to the patient's poor orientation regarding the procedure and the non-confirmation of patient identification data. Therefore, we propose a standardization of the patient care process using a checklist that contains the necessary information to be explained and confirmed with the patient. With this, we understand the necessary information will be passed on to the patient correctly, and the verbal confirmation of the patient's identification will be confirmed. Regarding the physician's inappropriate conduct when releasing the patient, we also propose the use of the checklist to ensure that the conduct is standardized in all care. We developed this best practice based on the literature. In the surgical environment, when the health team implemented a surgical checklist, it improved team communication (Cabral et al., 2016).

Furthermore, even though surgical checklists are important to team communication improvement, checklists also play an important role in patient safety and patient care (Papaconstantinou et al., 2013). Therefore, we decided that checklists are the best practices to improve the communication between patients and the health team. For others' faults, we suggest the use of checklists. For instance, when the "Collection performed outside the period for the test", the patient could receive a false negative result. So, we suggest standardization of the patient care process to perform the

procedure correctly. In this sense, we suggest the preparation of a checklist containing the information that must be collected before performing the test. This checklist must be checked before it is put into practice.

Considering “Lack of clarification of how the test result will be informed” fault, we proposed the creation of a systematic (checklist) and explanatory folder containing precautions guidelines and informing the procedure to wait until the contact of the Health Department with the result, minimizing the spread of the virus and seeking to inform the patient, family members and society effectively. The folder to be developed focuses on social inclusion, since figures will be inserted so that illiterate people can understand it.

In regard of “Patient does not understand the reason for the test” fault, the way in which the doctor passes the information to the patient or the patient’s family could cause doubts, since, in some cases, a technical and formal language is used, not consistent with the reality of most of the population seeking the hospital emergency. Based on this, we proposed the creation of a continuing training program, containing specialists in languages (Portuguese teacher, psychologist, theater teacher). In addition, simulations environments could be created, then the physicians and the health team could develop and practice communicative skills, resulting in clearer communication and avoiding the dissemination of wrong information and even reducing the spread of the virus.

“Patient denies performing the test” could lead to the spread of the virus due to a lack of accurate diagnosis. Considering this problem, we proposed the creation of a competent team of psychologists, social workers and other professionals, who would be triggered by the doctor or another professional as soon as they verify the patient's denial in performing the examination. This team will be responsible for raising the patient's awareness and should respond quickly when triggered, promoting the effectiveness of the action. This action could help to reduce population contagion.

The fault “Error in passing guidance on waiting for test results” is related to patient and public health, because the unfollowed guidelines have a greater impact on other people's contamination, as social isolation may not be respected until the diagnosis is received. As it can have a negative impact on public health, waiting for results could cause uncertainty for the patient (feeling of abandonment), according to the interview. In this case, we proposed the physical and digital folder development that will be made available to the patient. Or, otherwise, prescribe the guidance information, automatically, in the Care Bulletin, which is the document that accompanies the patient when there is medical discharge and that contains the record of patient information throughout the care process. Furthermore, we proposed complementary strategies using information technologies. Patients could access their results in a system to reduce the communications failures between hospital and patient, especially in cases that could cause more impact on public health (positive cases). Hospitals could also use automated messaging by SMS, WhatsApp, and Telegram, for instance to send the test results to the patients. On the other hand, these systems should include data security, because there are some laws regarding medical confidentiality. So, this action should be well planned and structured. From the patient's perspective, information about the results occurs in an active way (patient contacts the hospital), or passive way (hospital contacts the patient). Therefore, we understand that the availability of the test result by digital means could reduce the possibilities of errors during the waiting of the test results.

On one hand, “Unable to communicate the test result to the patient” or their family could be summarized in a communication failure. On the other, the inadequate provision of information to the patient may lead to a perception of mistrust about team conduct, which may influence the clinical outcome for treatment. Therefore, we understand that this failure is related to the training of the available human resource, especially in the front-office, in which there is difficulty in adopting a standard conduct in the form of action for the transmission of information about test results. Thus, we proposed the standardization of conduct in the transfer of information. Finally, the discussion with professionals about recognized best practices, the formal establishment of a way of acting with the preparation of procedures/protocols and the training of the entire team are essential elements to improve communication.

When “Patient denies performing the test”, we suggest the creation of a continuing training program to ensure professionals execute the protocols correctly, creating a schedule of periodic updating of protocols for professionals in the sector. In addition, regarding “Lack of guidance on possible discomfort when performing PCR collection”, we recommend the development of a protocol, raising the possibility of sedation of patients who have a problem performing the test.

<b>Fault</b>	<b>What</b>	<b>Why</b>	<b>Where</b>	<b>Who</b>	<b>When</b>	<b>How</b>
<b>Lack of confirmation of patient identification</b>	Standardize the patient care process.	To verbally confirm the information with the patient	Patient care doctor's office	Responsible for the COVID emergency wing and physician	Short-term	Collect with emergency physicians all information about the procedure and identifications that are necessary to perform the procedures; Collect with physicians the ideal chronological order for the transfer of information about the procedure and confirmation of identifications; Elaborate, approve, disseminate, and distribute a checklist in the form of a physical and virtual folder of the main forms of contamination, and containment measures and important information of the tests (interpretation and response time of the results) to patients and family members with visual and written information that ensure social inclusion.
<b>Lack of hospital return on test result</b>	Use of information technology to automate the delivery of test results. If positive, the hospital should contact for new guidance.	To ensure that the test results reach the right patient, reducing communication failures	Direct contact with the patient through electronic devices (phone, smartphone, laptop)	IT team, Nurses and Hospital Infection Control Service	Mid-term	Create, validate, and implement a project for integrating laboratory systems with connection to other systems for further automation of the test results delivery process
<b>Unable to communicate the test result to the patient</b>	Use of physical and virtual folders	To record relevant information in physical and virtual means that can be consulted by the patient	Physician's Office or Reception Areas or Other Online Media	Responsible for the COVID emergency wing and Hospital Infection Control Service	Short-term	Elaborate, approve, disseminate, and distribute a checklist in the form of a physical and virtual folder of the main forms of contamination, and containment measures and important information of the tests (interpretation and response time of the results) to patients and family members with visual and written information that ensure social inclusion.
<b>Error in passing guidance on waiting for test results</b>	Use of physical and virtual folders	To record relevant information in physical and virtual means that can be consulted by the patient	Physician's Office or Reception Areas or Other Online Media	Responsible for the COVID emergency wing and Nurse	Short-term	Check and update recommendations with competent bodies (Ministry of Health and Health Departments)
<b>Patient denies performing the test</b>	Create a competent team psychologist/social worker) to understand the reason for the withdrawal and try to get the patient to take the test	To reduce or prevent population contagion	Inpatient Unit (Room)	Responsible for the COVID emergency wing	Short-term	Create, train, and promote a team with psychologists and social workers to explain the details of the test and its importance.
<b>Patient does not understand the</b>	Create a continuing training program on care protocols with	For patients to understand the reason for the test	Covid Sector and Service Units	COVID emergency officer of the hospital and nurse	Mid-term	Create, develop, implement, and validate a health team training center with communication specialists to understand the patient's test reasons.

<b>reason for the test</b>	explanations about the test and its importance	with a standard care protocol specially developed for this purpose				Elaborate, approve, disseminate, and distribute a checklist in the form of a physical and virtual folder of the main forms of contamination, and containment measures and important information of the tests (interpretation and response time of the results) to patients and family members with visual and written information that ensure social inclusion.
<b>Collection performed outside the period for the test</b>	Standardize the patient care process	Ensure that tests are performed in the reporting period, generating more reliable results	Physician's office	COVID emergency officer of the hospital and nurse	Short-term	Collect with emergency physicians all information about the procedure and identifications that are necessary to perform the procedures. Collect with physicians the ideal chronological order for the transfer of information about the procedure and confirmation of identifications.
<b>Failure to perform patient release</b>	Standardize the patient care process	To ensure the right physician conduction	Physician's office	COVID emergency officer of the hospital and physician	Short-term	Elaborate, approve, disseminate, and distribute a folder-shaped checklist of the main forms of contamination, containment measures and important test information (interpretation and response time of results) to patients and their families with visual and written information that ensure social inclusion.
<b>Patient does not collaborate at the time of test collection</b>	Create a protocol for the collection of patients who have difficulty undergoing the test	To ensure that the collection is done correctly and that the patient feels comfortable to perform the test.	Service Units.	COVID emergency officer of the hospital and nurse	Short-term	Develop, test and validate a sedation protocol for patients who have a problem performing the test.
<b>Lack of guidance on possible discomfort when performing PCR collection</b>	Standardize the patient care process	To ensure that all necessary information is passed on to the patient about the test collection procedure	Physician's office	COVID emergency officer of the hospital and physician	Short-term	Collect with emergency physicians all information about the procedure and identifications that are necessary to perform the procedures;
<b>Lack of clarification of how the test result will be informed</b>	Create systematics to inform the patient (checklist) and make a folder with guidelines for further contact of the Health Department	To decrease the likelihood that the patient will discontinue the virus to the population if patient is contaminated with the virus,	Physician's office	COVID emergency officer of the hospital and physician (infectologist)	Short-term	Elaborate, approve, disseminate, and distribute a folder-shaped checklist of the main forms of contamination, containment measures and important test information (interpretation and response time of results) to patients and their families with visual and written information that ensure social inclusion.
<b>Lack of understanding of the patient about the information passed on about the test</b>	Standardize the patient care process	To standardize patient and family orientation behaviors, minimizing the communication failures	COVID Service Units	COVID emergency officer of the hospital and nurse	Short-term	



## 6. Conclusion

We analyzed the process of RT-PCR collection in an emergency room of a hospital that treats patients suspected and/or affected by COVID-19. As a contribution, we explored the use of Service Blueprint as a process mapping tool. This choice facilitated the understanding of the process and the analysis of contact points in a hospital context, enabling the identification of failures in these points. One point to highlight is that none of the interviewed pointed out that a possible contamination during the process. A justification for this may be that professionals assume this risk as inherent to the profession in view of the current crisis scenario presented by the pandemic, making it difficult to understand it as something feasible to avoid. In addition to Service Blueprint, we applied other quality tools: GUT Matrix for prioritizing failures and the 5W1H tool for the proposition of best practices. However, GUT Matrix was used differently than usual because we sought different perspectives from several actors instead of focusing on a few perspectives.

As practical contributions, we highlight the best practices associated with each of the failures. We understand that it is important to develop standards to mitigate problems, especially in crisis scenarios such as the one created by the new coronavirus. Thus, we understand that our greatest contribution is the implementation plan, which can be applied by hospitals in short and mid terms.

As limitations of the study, we highlight the crisis scenario itself, which prevented all authors from observing the RT-PCR process. In addition, our study was limited to the collection of information with only one of the health team perspective. Therefore, for future research, we could collect information about the customers perspectives (patients). We propose the best practices focus on the hospital profile, but it may vary according to hospital size, technological level, and hospital type (public, or private). Future studies could assess whether there are the same failures in different hospitals, identify their best practices, and how this influences the number of potential failures.

## Biographies

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