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Contribution of the Information System to the Vaccination Campaign's Success against Covid-19 in Morocco

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Abstract
Because of the fatal consequences of covid-19 pandemic, the vaccination against the Covid-19 virus was the best solution in order to limit the pandemic's spread. Morocco was from the countries that instigate the vaccination operation.
So as to manage the vaccination campaign, an information system has been implemented at all vaccination centers, in urban and rural areas. The objective of our research is to evaluate the effectiveness of the information system set up, and to elucidate the role it plays in improving the performance of the vaccination campaign.
*Method***:** The study was focused on the development of the vaccination campaign process. Then, the vaccination campaign was evaluated by currying two surveys of vaccination personnel and vaccinated people at various vaccination centers in Morocco.
*Results***:** The information system played a pivotal role in the success of the vaccination campaign. It facilitated the data collection, the management and the analysis of vaccination-related data through providing a solid technological infrastructure, the information system set up enabled efficient monitoring of vaccine distribution, recording of patient data and scheduling of appointments. It also eased the coordination between the different stakeholders involved, such as healthcare professionals, authorities and vaccine recipients. Due to the information system, the campaign's progress may be monitored in real time, risk areas identified and strategies adjusted accordingly. Nevertheless, it is important to take into consideration any shortcomings and weaknesses recorded, for the sake of improving future vaccination campaigns.

Keywords
Covid-19, Vaccination campaign, Information system, Healthcare establishment, Morocco

INTRODUCTION

The Covid-19 pandemic spread worldwide and caused almost 6.88 million deaths internationally and around 16.29 deaths in Morocco alone according to the Johns Hopkins Coronavirus Resource Center (counted October 3, 2023). The Covid-19 pandemic has had significant economic and social repercussions worldwide, including unemployment, reduced incomes, disruption of supply chains and the global economy, transitions to e-learning, the onset of mental disorders, and loss of life as a result of contamination. The development of safe and effective vaccines was a crucial step towards limiting the spread of covid-19 and returning to business as usual. Morocco was among the first countries to take the initiative and begin the covid-19 vaccination campaign on January 28, 2021, in line with WHO recommendations that emphasize fair and equitable access to vaccines in order to defeat the covid-19 pandemic. In this context, Morocco has set up, for the first time, an information system with the aim of facilitating the organization of the vaccination campaign, from the scheduling of appointments to the delivery of the vaccination pass to the beneficiaries of the vaccination operation.
Hence, our problematic aim to understand the role of the information system in the performance of this campaign and how can we capitalize on this operation to set up an efficient information system to cope with possible future pandemics?

CONCEPTUAL FRAMEWORK

As part of its healthcare system's strengthening program, Morocco has established a solid national health strategy to protect the population against the risks of the Covid-19 pandemic. In this context, the information system has become a crucial element in the management of the vaccination campaign against Covid-19; in the collection, diffusion of data, planning, coordination and evaluation of vaccines on a national scale.

National health strategy

The Moroccan healthcare system has undergone a series of changes and reforms in recent years, with the aim of improving patient access to healthcare facilities and providing high quality, efficient health services without their cost causing financial difficulties for users.

Based on the health map and regional health care supply schemes, in public sector Morocco's health care supply in fixed mode is made up of four health establishment systems managed by the Ministry of Health: the primary health care establishment system, the hospital system, the integrated emergency medical care system and the public medico-social establishment system.

According to the Ministry of Health, the number of health centers making up the system of primary healthcare establishments is set to increase in both urban and rural areas from 2019 to 2021(figure 1), which proves that the Ministry is mobilizing its resources to widen the scope of access to healthcare provision, especially as health centers are the first level of establishments to receive patients. These health centers are essentially used for preventive actions, in particular vaccinations for children and pregnant women, and family planning, as well as for care and medical consultations and monitoring of chronic diseases, based on health programs.

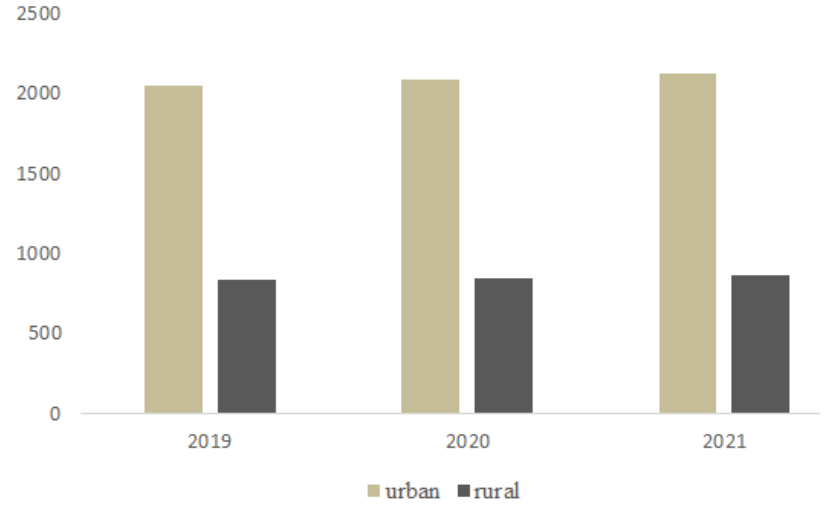

Fig. 1 Number of primary healthcare establishments according to the Ministry of Health (health in figures in 2019, 2020 and 2021 consulted on www.sante.gov.ma) [1], [2], [3] (***Source:*** Author)

Vaccination is a central pillar of national health strategy, since it plays a fundamental role in protecting and improving public health, providing essential preventive solutions for a wide range of infectious diseases. The field of vaccination is constantly evolving, due to the development of new vaccines, increased knowledge of the effects of existing vaccines, as well as changes in the epidemiology of infectious diseases and new knowledge concerning modes of transmission and pathogenesis. Morocco has achieved great progress in immunization against targeted diseases, which were in the past responsible for high mortality and morbidity among children under the age of five. The general objective of the national immunization program was to help reduce child mortality and morbidity by vaccinating against targeted diseases. To guarantee effective management of immunization programs, some health centers have set up information systems to ensure rigorous monitoring and continuous improvement of immunization coverage. Nevertheless, these information systems remain limited and can't respond to the expectations of the population and the challenges of future health crises in terms of the quality of care and the performance of the healthcare system.

Although the implementation of a hospital information system is an important step, its simple existence does not systematically guarantee optimal performance or smooth operation. Hence, it is essential to harness the full potential of all the components of an information system, based on all the processes that ensure effective management of vaccine campaigns.

Information system

When it comes to running a vaccination campaign, the information system holds the ultimate importance in ensuring that it runs properly. In fact, the information system covers the set of resources, procedures and technologies that enable the collection, processing, storage and diffusion of data and information needed to maintain effective, coordinated implementation.

According to (Reix, 2011), the information system is an "organized set of resources: hardware, software, personnel, data and procedures allowing the acquisition, processing, storage of information (in the form of data, texts, images, sounds, etc.) within and between organizations". [4]

An Information System (IS) can be defined by its objective, which is ensuring the access, storage, processing and circulation of information, enabling everyone in an organization to have access to data at the right time.
Information systems meet current needs, facilitate decision-making and prepare for the future (information observation, knowledge management).

The hospital information system is a set of interacting elements designed to gather, process and supply the information required for its activity. It facilitates the management of all a hospital's medical and administrative information, while bringing together all types of healthcare stakeholders and resources.

According to De goulet, "the Hospital Information System (HIS) is defined as a computer system designed to facilitate the management of all medical and administrative information in a hospital". [5]

The Hospital Information System is an integral part of the hospital organization, which is constantly in evolution. According to predefined rules and operating procedures, it enables information to be acquired and data to be evaluated, then processed by the informational technology or organizational tools and distributed to all the establishment's internal or external partners, working together towards a common goal, such as patient care and recovery. (EVIN, C. Circular no. 275 of January 6, 1989 on the computerization of public hospitals) [6].

The Hospital Information System aims to improve quality of care, control costs, improve communications, reduce waiting times, develop integrated patient records, support decision-making, reduce length of stay and administrative tasks, and optimize resources. In 2013, the Ministry of Health set up an information system for the National Immunization Program with the introduction of vaccine services in various health centers in Morocco.

This information system provided data and information relating to the activities of the national immunization program, and included different media, namely the child health record and the woman health record, the child immunization services register, the woman immunization services register, the daily immunization sheet, the monthly rapid immunization follow-up sheet, the vaccine management and daily temperature record register, the maternal child health booklet, the family planning booklet and the immunization equipment management register.
The information system was set up to ensure rapid exchanges between the various levels of responsibility, guaranteeing the reliability, relevance, consistency and security of the information required to monitor and evaluate the immunization program. Unfortunately, this information system has not been generalized to all healthcare centers in Morocco ("National Immunization Program: Practical Aspects of Vaccination, Training Manual", 2013) [7].

In addition, during the first attempts to set up an information system within healthcare centers, which have faced communication problems, poor interoperability, document tracking, security and data collection. This situation leads to a loss of valuable time, inefficient coordination and an inability to take informed decisions. Hence, the importance of re-establishing functional information systems that guarantee efficient, integrated and transparent management of the information needed to deliver quality care, with a perspective of confronting the various challenges and future health crises.

Covid-19 vaccination campaign

Since the discovery of the Covid-19 pandemic, everyone has had to face up to the consequences of such a health crisis, by setting up health and governmental measures to prevent the spread of the virus and monitor the evolution of the pandemic.

The Ministry of Health has mobilized the healthcare system to deal with the pandemic, in particular to ensure the detection and management of "probable cases" as well as "confirmed cases". The strategy adopted is to limit the introduction of the virus by ensuring that suspect patients are rapidly detected and classified as "probable cases", and to contain their spread within the country if necessary. The objective also aims to put in place a series of measures to isolate and treat patients classified as "confirmed cases" in health establishments qualified to treat Covid-19.

Being aware of the urgency of the situation, Morocco has adopted a proactive, multi-dimensional approach to contain the spread of the virus, protect the health of its population and deal with the pandemic.
Morocco launched a vaccination campaign against COVID-19 in order to protect people and reduce the societal and economic impact of the pandemic by minimizing deaths and contamination. The vaccination campaign began gradually, starting with those who were at high risk of contracting the disease, such as healthcare professionals aged 40 and over, public authority and royal military personnel, national education personnel aged 45 and over, and people aged 75 and over (Ministry of Health official website: santé.gov.ma, accessed on 20/5/23).
Over time, the Ministry of Health has succeeded in gradually vaccinating people aged 12 and over, with a total of 24.92 million people receiving the first dose, 23.42 million people receiving the second dose and 6.88 million people receiving the third dose according to Morocco's health watch service, counted on May 5, 2023.

The vaccines used have been selected in accordance with international standards, guaranteeing their efficacy and safety. The Ministry of Health also emphasizes the importance of maintaining preventive measures such as the use of face masks, compliance with general hygiene rules and physical distancing throughout the national vaccination campaign.
In order to successfully plan and implement this vaccination campaign, it is essential to set up an information system that takes into account the specific nature of this campaign, which has been carried out in critical conditions on an international scale, while considering several decisive elements, namely the monitoring of administered vaccines, coordination between the various stakeholders involved and timely decision-making to protect public health.

MATERIALS AND METHODS

The objective of our study is to focus on the role played by the information system in the performance of the covid-19 vaccination campaign and how it can be considered as a foundation for an effective hospital information system.

To answer our question, we first developed the process of the covid-19 vaccination campaign to highlight the critical points to be assessed in our study.

Then, we carried out a qualitative study through the elaboration of two questionnaires. The first questionnaire is intended for all staff involved in the vaccination campaign, and more specifically in recording patients' data, from the moment they are admitted to the vaccination site until they are discharged, during the administration of three vaccine doses in Morocco's vaccination centers. The second questionnaire is intended for beneficiaries of the covid-19 vaccination campaign.

Both questionnaires were validated after being tested with a group of 40 healthcare professionals and a group of 100 beneficiaries. The questionnaire for beneficiaries was administered online, while the questionnaire for vaccination campaign participants was administered at vaccination centers.

Data processing for both questionnaires was carried out using SPSS Statistical Package for Social sciences, version 21.

At the end of the study, we capitalized on the dysfunctions identified in the vaccination information system to be able to make recommendations for improving healthcare provision, by facilitating decision-making and coordination between the various stakeholders in order to improve the health of individuals and the population.

RESULTS

Elaboration of the vaccination campaign process

The covid-19 vaccination campaign represented a major logistical challenge, requiring careful planning and effective coordination. Health authorities worked closely with health professionals, public health organizations and governments to ensure vaccine availability and equitable distribution.

To assess the information system set up to manage the vaccination campaign, we created a cartography of the vaccination process, from planning the campaign to issuing the vaccination pass (Fig. 2).

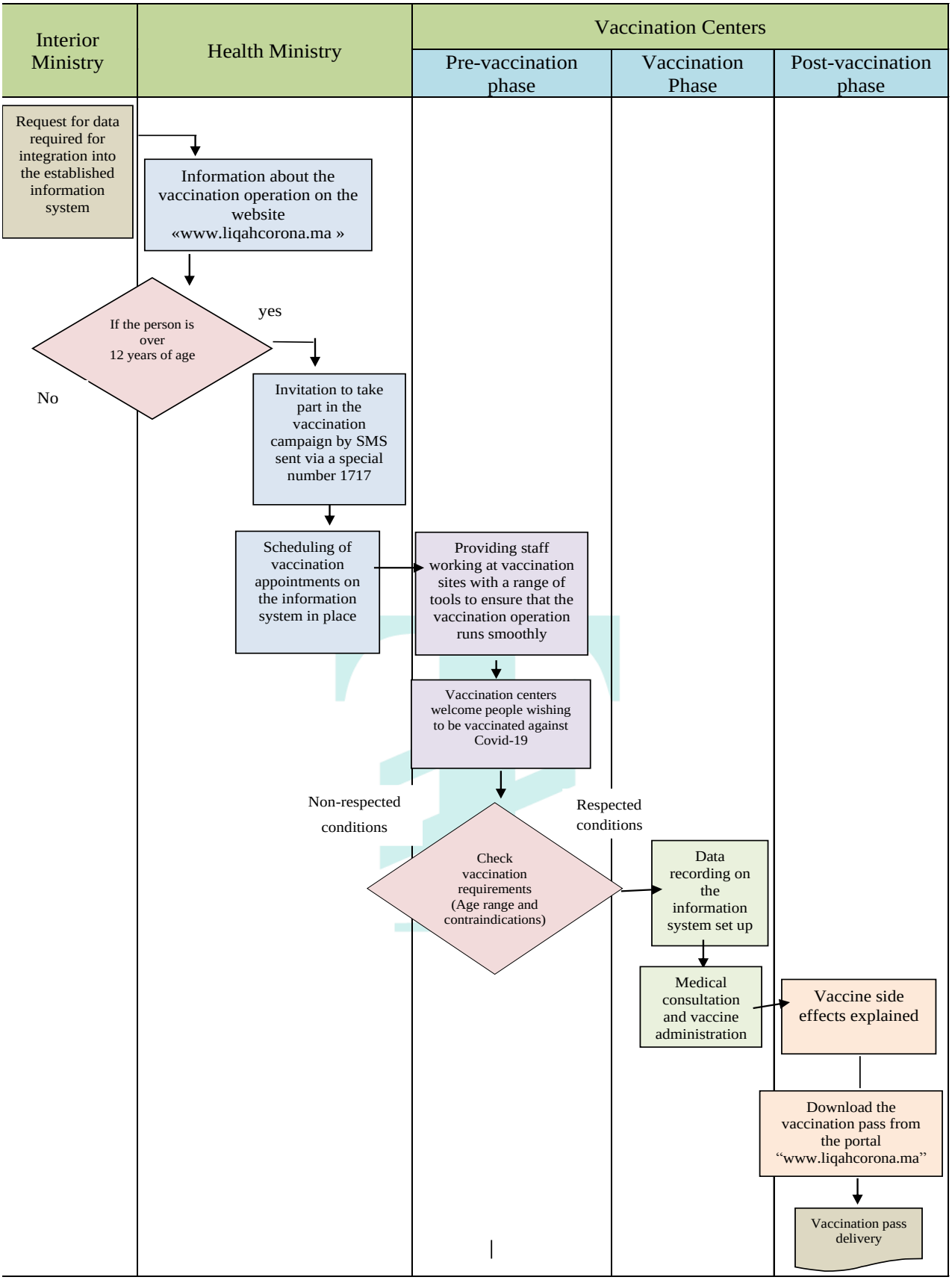

Fig. 2 Vaccination Campaign process (***Source:*** Author)

The vaccine information system in place generates a specific set of data (Fig. 3), the collection, monitoring and analysis of which require evaluation.

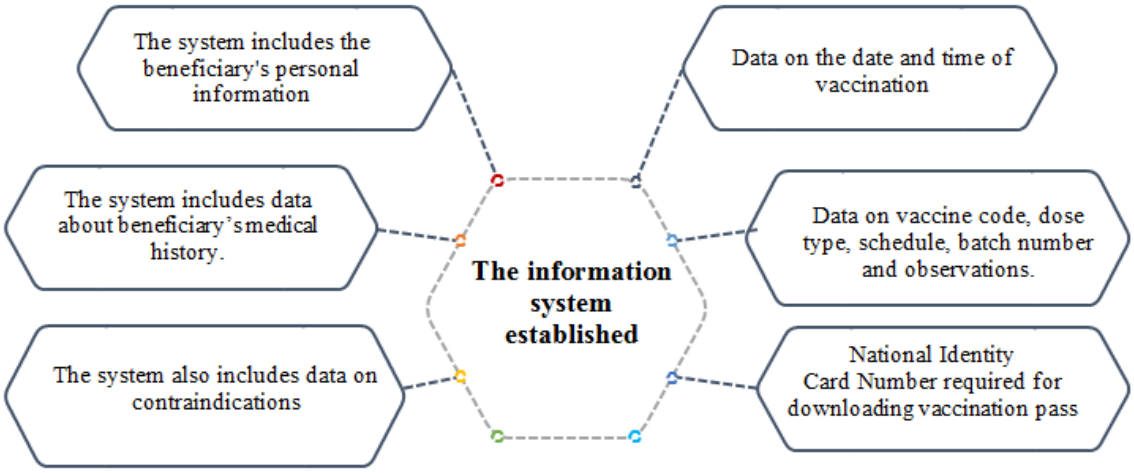

Fig. 3 Specific features of the established information system (***Source:*** Author)

Evaluation of the implemented information system

In order to evaluate the information system that managed the previously charted vaccination process, we carried out a qualitative study involving 400 staff who took part in the vaccination operation held at covid-19 vaccination centers. The operation covered all regions of Morocco, with 52.3% of interviewees from the Casablanca-Settat region and 47.7% from other regions.

57.3% of respondents were healthcare personnel working in public health centers, 17% were student trainees, 13.3% were healthcare personnel working in private clinics, 8.3% were public administration personnel and 4% were local authority personnel (prefecture, province, commune, etc.).

The first questionnaire was based on 8 main variables:

- The possibility of conducting training in the use of the platform (Oliver RL. A, 1980). [8]
- Quality of training received (Delone & Mclean, 1992-2004). [9]
- Ease of manipulating the information system (Davis, 1989). [10]
- Clarity of content (UTAUT model; Venugopal et al. 2018). [11]
- Difficulties encountered (Paré, Trudel, Forget. 2014) [12] and (Hendrikx et al.2013) [13]. This variable includes the following items: the probability of encountering difficulties in collecting information from beneficiaries, the probability of encountering difficulties in the choice of vaccine type by the recipient due to limited availability, conflicting information or personal preferences, difficulties in operating the platform and failures in the information system instituted.

The results obtained are as follows:

Training

With regard to the training of the vaccination campaign staff, it was found that 63.5% of people taking part in the vaccination campaign had not previously received training about the use of the vaccination application. This shows a lack of preparation and awareness of the system among participants. It would therefore be advisable to introduce pre-training initiatives to ensure optimal use of the application and improve participants' experience.

As for those who received training, 69.5% were not satisfied, 19.3% were somewhat satisfied, 8.5% were satisfied and 2.8% were very satisfied. It is therefore important to evaluate and reconsider training methods and content to meet participants' expectations. It could be beneficial to evaluate training courses both on the spot and after the event.

The information system's data manipulation

3.8% of participants in this study mastered the manipulation of the vaccination application and 11.8% were able to manipulate it well. On the other hand, 60.3% manipulated it moderately and 24.3% were not able to manipulate it, justifying their attitude by the failure of the information system and the inadequacy of the duration of the training.

The results indicate that it is crucial to address participants' concerns and remedy the problems identified. This could involve improving the practical application, providing additional technical support and adjusting the duration of training to ensure optimal use of the information system.

Content of the developed application

According to 85% of participants, the headings and content of the vaccination application are clear, but 23% of participants encountered difficulties in receiving information from the beneficiary. This suggests that the app provides understandable and accessible information, which is essential to ensure effective use of the application and adequate

understanding of vaccination procedures. However, it is worrying to note that almost a quarter of participants (23%) have encountered such difficulties. This raises questions about the effectiveness of communication and sharing data related to vaccination. It is essential to remedy this situation, as it is important that all concerned receive clear and timely information.

Choice of vaccine type

49% of staff had no concerns, given that beneficiaries had the freedom and possibility to choose the type of vaccine to be administered. On the other hand, 51% find it difficult to guide beneficiaries in their choice and to convince them that all the types of vaccine available in Morocco protect against covid-19, and that if a vaccine is out of stock, the beneficiary can receive another type of vaccine without fear of its safety and efficacy, which has been confirmed by positive results and clinical trials in Morocco and other countries, according to the Ministry of Health.

Vaccination application's deficiencies

With regard to the operation of the vaccination application, 35.5% of participants rarely had problems, while 54.8% frequently encountered difficulties, including internet connection problems, which occur frequently at a rate of 68.3%, as well as application bugs or crashes, application access problems, editing and recording problems, and technical failures in varying proportions, as shown in Fig. 4.

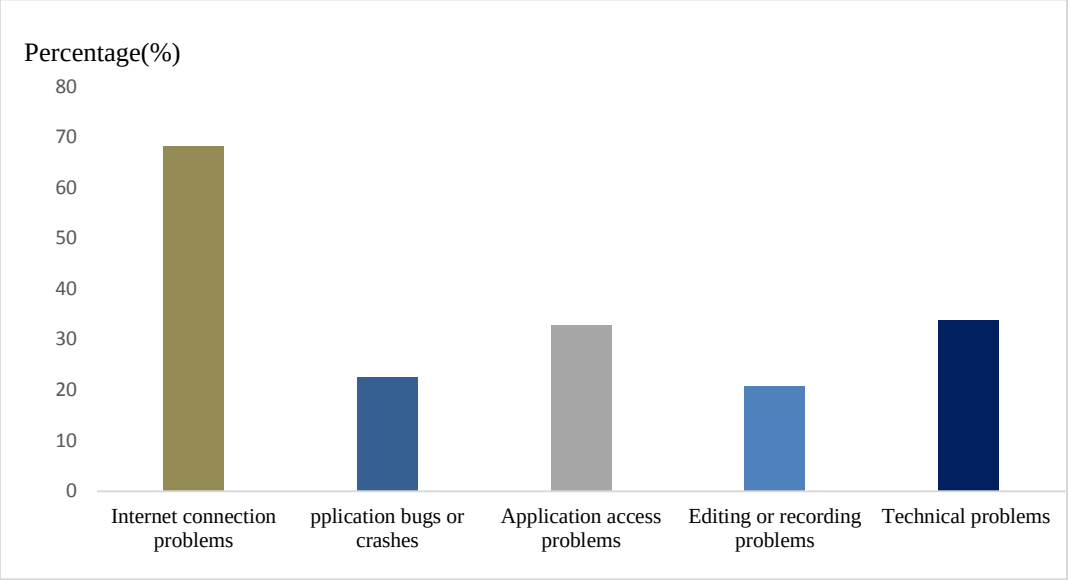

Fig. 4 Vaccination application deficiencies (%) (***Source:*** Author)

Some healthcare professionals pointed out other problems, such as the absence of the possibility of modifying or deleting information about beneficiaries in the case of a data editing error or a change of information, as well as the difficulty of data entry on a tablet compared with a computer, also a lack of supervision and support, and a lack of communication between supervisors and operators.

The evaluation of the information system introduced during the covid-19 vaccination campaign in Morocco revealed crucial aspects requiring particular consideration.

The overall level of satisfaction with the quality of training was low, underlining the need for a thorough review of training methods and content in order to meet participants' needs and expectations. The manipulation of the information system presents significant challenges, with a significant proportion of participants expressing difficulties and justifying this by gaps in the information system and insufficient training time.

Although the clarity of the application's content is widely appreciated, communication problems persist, particularly in the context of vaccine type selection. Technical failures, such as connection problems and bugs, are frequently reported, creating obstacles for operators.

Some healthcare staff highlighted additional problems such as the inability to modify erroneous information, difficulties in entering data on a tablet, and the lack of supervision and effective communication between supervisors and operators.

Overall, the evaluation highlighted substantial challenges in several aspects of the implemented vaccine information system, requiring significant improvements in training, application technology, communication and coaching to ensure the success of future vaccination campaigns.

Survey of vaccination recipients at health centers

A qualitative survey of beneficiaries who had received the covid-19 vaccine was carried out, with a questionnaire sent to 900 people from all Moroccan regions. 54% of respondents were from the Casablanca-Settat region and 46% from other regions. 67.7% of beneficiaries were aged between 39 and 12, and 32.3% were aged 40 and over.

The second questionnaire was based on 15 main variables:

- Evaluation of Morocco's vaccination awareness campaign
- Reasons for deciding to be vaccinated
- Taking the initiative to request an appointment
- Receipt of a notification message to be vaccinated
- Clarity of message content
- Proximity of vaccination center to place of residence or work
- Reception at the vaccination center
- Service provided by staff in charge of the operation at the vaccination site
- Inquiries about medical history
- Benefit of a medical consultation before vaccination
- Knowledge of the types of vaccine available at the vaccination site
- Possibility of choosing the type of vaccine administered
- Communication of health instructions or explanations in relation to taking the vaccine
- The ease of receiving the vaccination certificate or pass through the ″liqahcorona.ma application″.
- Level of satisfaction with the national vaccination operation carried out in Morocco

We will set out the results of the analysis of items specific to each variable.

Awareness and decision to vaccinate

As for Morocco's vaccination awareness campaign, 66.6% found it satisfactory. This highlights the efforts made in communication and the awareness-raising strategies implemented. However, it is important to note that 43.4% of beneficiaries indicated that they found the campaign little or not at all satisfactory. This raises concerns about the effectiveness or appropriateness of certain aspects of the campaign (Table 1).

Table 1 Evaluation of vaccination campaign by beneficiaries

Niveau de satisfaction	Pourcentage (%)
Not at all satisfying	10,1
Not very satisfying	23,3
Satisfying	49
Very satisfying	17,6

Beneficiaries' reasons for being vaccinated

In order to identify the reasons that led beneficiaries to be vaccinated against covid-19, we asked them a few questions and found that many people decided to be vaccinated against covid-19 because they were convinced of the vaccine's role against covid-19, or to be protected against this virus, or to have a vaccination pass, while a minor proportion of beneficiaries chose to be vaccinated in order to align themselves with their entourage (family, colleagues, friends, etc.), or to respond to the call from the health authorities, or after having been contaminated by the covid-19 virus.) or to respond to a call from the health authorities, or after having been contaminated by the covid-19 virus, in varying proportions, as shown in Fig. 5.

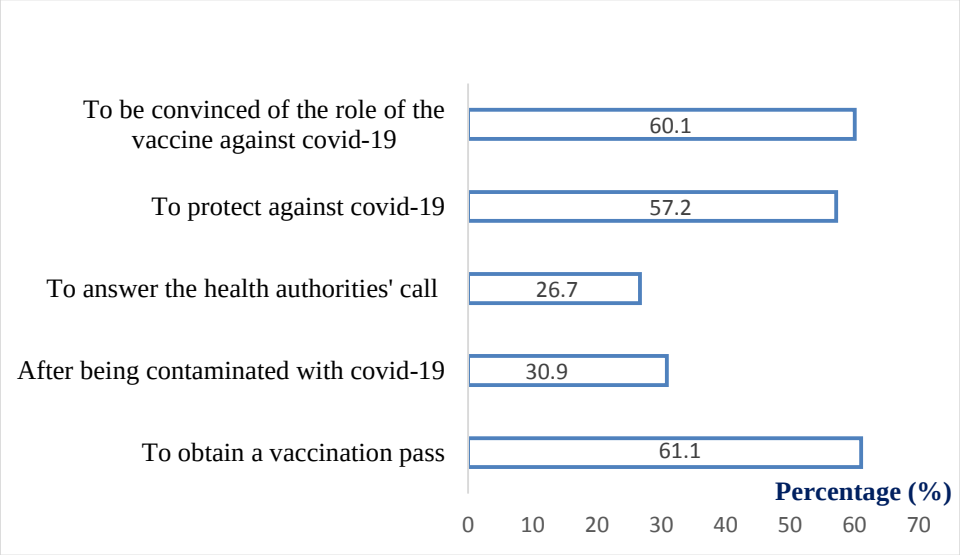

Fig. 5 Beneficiaries' reasons for being vaccinated (***Source:*** Author)

Booking appointments, clear messages and proximity of centers

According to our survey, 65.3% of beneficiaries took the initiative to request an appointment to be vaccinated, and 75.3% received a notification message to be vaccinated. 75.7% found that the content of the message received was clear.

Concerning 90% of beneficiaries, the vaccination centers are close to their place of residence and work. Overall, these results underline the importance of individual initiative, clear communication and adequate geographical accessibility in promoting high vaccination coverage. They highlight the need to maintain effective communication systems, make information understandable and continue to facilitate access to vaccination by establishing vaccination centers in locations convenient to potential beneficiaries.

Personnel welcoming and service

It was found that 74.3% of beneficiaries found the welcoming at the vaccination center satisfying, while 15.7% found it not or not at all satisfying.

Regarding the service provided by the staff in charge of the vaccination operation at the vaccination sites, 74.3% of beneficiaries found it satisfying, while 15.7% found it unsatisfying or not at all satisfying. In other words, the majority of beneficiaries had positive feedback on the reception and service provided by staff.

The vaccination operation

In terms of the vaccination process, we found that 67.4% of beneficiaries were requested about their medical history, indicating that the health authorities sought to assess pre-existing medical conditions in order to determine eligibility or to take into account any additional precautions. As a result, 84.2% of beneficiaries did not receive a medical consultation prior to vaccination. Most people did not have the opportunity to consult a doctor to discuss their vaccination and receive personalized medical advice.

We found that 57.6% of people asked about the types of vaccines available at the vaccination site. So, the majority of individuals were interested in learning more about the different vaccine types. On the other hand, 64% hadn't had the opportunity to choose the type of vaccine administered. This refers to the limited range of vaccines available.

After being vaccinated, 43.3% of beneficiaries received health instructions or explanations in relation to taking the vaccine, as well as 90% of beneficiaries easily receiving the attestation or vaccination pass through the ″liqahcorona.ma″ application, which indicates that the majority of people were able to easily obtain proof of their vaccination.

In general, beneficiaries rated the national vaccination operation carried out by Morocco as very satisfying at a percentage of 20.1%, satisfying at a percentage of 51.3%, not very satisfying at a percentage of 20.6% and not at all satisfying at a percentage of 8%. These percentages reflect beneficiaries' general opinions of the vaccination operation.

DISCUSSION

The covid-19 pandemic caused a sudden shutdown of activity in various sectors, forcing several countries to take various measures to reduce the impact of the pandemic on their economies and decrease the risk of contamination. Among the measures taken by the Moroccan government was vaccination against covid-19, which our study shows to have played an important role in controlling the covid-19 pandemic.

This is the first time that the Ministry of Health has taken the initiative of implementing an information system, which remains an innovative experience in the vaccination centers. Yet, it is apparent that there are areas for improvement to make the application developed more effective.

According to the Covid-19 vaccination campaign’s process elaborated, it is clear that the Ministry of Health deployed a range of resources to ensure the campain's management, facilitating the staff's work by setting up an information system specific to the vaccination operation, which had a positive impact on its progress.

According to our results, many healthcare professionals were unable to receive training beforehand, or were not satisfied in terms of the quality of their training, which had an impact on the way they carried out their tasks at the vaccination centers, especially when it came to data manipulation. Hence the need to review the established training program, implement corrective measures, introduce clearer and more accessible teaching aids and involve all staff in training sessions. We have also noticed that younger staff are more adept at manipulating the information system than older staff, which can be explained by their frequent use of digital tools and their familiarity with technological innovations, whereas older staff are more comfortable using traditional, conventional and manual methods. It is important to put in place measures to improve training and increase the satisfaction of all participants in order to optimize the effectiveness and acceptance of the vaccination campaign as a whole. In addition, it would be preferable to regularly evaluate the effectiveness of training programs by monitoring the mastery of the application by trained personnel. This would enable potential gaps in training to be identified and adjustments made to ensure continuous improvement.

It was found that 51% of staff found difficulties in the choice of vaccine type by the beneficiary, there is a possibility that some beneficiaries were hesitant and didn't know exactly what type of vaccine to choose especially in the period when Morocco imported different types of vaccine unlike at the start of the vaccination operation. So, it would be preferable to integrate vaccine choice into the awareness campaign conducted by the Ministry of Health through the implementation of mechanisms to ensure that information about vaccination is easily accessible to all beneficiaries. This could involve proactive communication using different communication channels to allay their concerns and help them understand that all available vaccine types offer similar protection against COVID-19. It could also involve training staff on the safety and efficacy of each vaccine type, as well as on how to convey this information in a clear and reassuring way to beneficiaries.

With regards to the operation of the vaccination application, 35.5% of participants rarely encountered problems, the majority of which were internet connection problems (68%) and other breakdowns. In general, it can be said that the information system implemented works well, but it is advisable to check and monitor the appearance of various failures in order to improve the functioning of the system set up. It is possible to create a better user experience for the vaccination application, by reducing technical problems, developing in-depth tests, optimizing the user interface, relying on proactive application maintenance, improving use experience and offering responsive support. This will help promote adoption of the application and make the vaccine campaign management process easier for users.

Overall, from the beneficiaries' point of view, Morocco's awareness campaign was satisfactory. This shows that the approach had a positive influence on beneficiaries' decision to be vaccinated against covid-19, but there are still areas to be developed to meet the expectations of all beneficiaries, with a perspective of improving the effectiveness of the vaccination campaign. It would be preferable to continue raising awareness among the population and adapt new means and methods to convince them, especially as the majority of beneficiaries justified their choice to take the vaccine was to have the vaccination pass required by the State, acknowledging that a significant number of them chose this option due to conviction and for protection against covid-19.

It's worth mentioning that the majority of beneficiaries had positive feedback on the clarity of the messages, the proximity of the vaccination site, the welcome they received, the quality of service provided by the staff, and the way in which the vaccination was carried out. This proves that vaccination centers have succeeded in providing a positive experience in the majority of cases. However, it is essential that we continue to listen actively to our customers and look for ways to constantly improve the quality of reception and service, in order to guarantee a positive experience for all vaccination customers.

Organizing the campaign as quickly as possible was a major concern for the Ministry of Health, given the seriousness of the covid-19 pandemic, the absence of a curable treatment and the speed of contamination. Hence, the need to find effective and rapid solutions to further aggravate the situation of the spread of the covid-19 pandemic in Morocco.
The management of immunization information system is an essential pillar of global public health. However, this endeavor isn't immune to challenges, particularly in terms of data security and coordination between the players involved. In this respect, several risks can occur, as follows :

- Data security: Data security in vaccination information systems is crucial to protect individuals' sensitive medical information. Risks include compromised confidentiality of medical records, unauthorized access to personal information and data loss, with potentially serious consequences for individual privacy.
- Vulnerability to cyber-attacks: Vaccination information systems are exposed to cyber-attacks, such as ransomware, phishing attacks and malware. These threats can compromise data integrity, leading to manipulation or deletion of records, putting public confidence in system security at risk.
- Complex coordination: Coordination between the various entities involved in vaccination, including health authorities, healthcare providers and government institutions, is often complex. Associated risks include delays in updating data, inconsistencies in the information collected, and difficulty in tracking vaccinations across various jurisdictions.
- Fragmentation of information: Coordination problems can lead to information fragmentation, where important data can be dispersed across the system without an integrated overview. This can impact on the ability of decision-makers to fully picture the situation and take informed decisions.
- Logistical issues: Logistical constraints, such as the availability of the necessary information technology resources and the physical logistics of vaccines, can interfere with the smooth implémentations of the system.

In fact, the information system set up had a major role in the vaccination campaign's success. It enabled efficient data management throughout the various processes involved in the vaccination operation. This highlights the fact that the information system is a key tool for ensuring the efficient implementation of health services.

CONCLUSION

The information system deployed by the Ministry of Health was a great help in collecting data from beneficiaries, and played an essential role in managing the vaccination campaign by guaranteeing the reliability and security of information and facilitating epidemiological studies linked to covid-19 vaccination in Morocco, but there are still shortcomings to be improved. It is necessary to monitor and evaluate the performance of the application implemented within vaccination centers, in order to track the execution of tasks and the various interventions of all stakeholders, by providing them with quality training and ensuring that all staff are well supported. This will have a positive impact on the service provided, and will then make it possible to meet the expectations of the beneficiaries of the vaccination campaign.

Overall, the national covid-19 vaccination campaign has achieved a certain level of success. Beneficiaries of the vaccination operation were satisfied and had good feedback on their experience, despite certain dysfunctions that we hope to improve in order to fulfill the expectations of all beneficiaries and improve the vaccination campaign’s effectiveness.

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DECLARATION OF CONFLICT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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