KESANS: International Journal of Health and Science
2808-7178 / 2808-7380
http://kesans.rifainstitute.com/index.php/kesans/index

Analysis the Effectiveness of Health Information Systems for Vaccine Intervention COVID-19 at Glenu Health Center Ermera Year 2023

Nuno Pedro Guterres Magno, Elias Pereira Moniz, Suzi Bernardina Faria Marçal, Me. Lourença da Conceição Oliveira
Faculty of Public Health, Universidade da Paz, Timor-Leste
nunomagno007@gmail.com

Article Information
Submitted: **16 June 2025**
Accepted: **20 June 2025**
Publish: **30 June 2025**

Keyword: *Health Information Systems; Interventions Infectious Diseases Vaccine; COVID-19;*

Abstract
Introduction: *Health Information Systems (HIS) play a vital role in enhancing healthcare delivery and decision-making processes. Effective implementation of the COVID-19 vaccination program is essential to control the pandemic globally. However, data from the Ministry of Health of Timor Leste reveals suboptimal vaccination coverage in Municipio Ermera, with only 78.9% receiving the first dose, 66.2% the second, and just 18.7% the third dose. These figures indicate a need for more efficient data management and health service delivery.* ***Objective:*** *This study aims to assess the effectiveness of the Health Information System in supporting COVID-19 vaccination efforts at the Glenu Ermera Health Center in 2023.* ***Method:*** *Using a quantitative cross-sectional design, data were collected from 59 healthcare workers. Analysis was performed using the Chi-Square test in SPSS version 21.* ***Result and Discussion:*** *Results showed that only 5.1% of respondents rated the HIS as effective, while 74.6% deemed it less effective. The chi-square analysis yielded a p-value of 0.013 (<0.05), indicating a significant relationship between HIS effectiveness and vaccination outcomes.* ***Conclusion:*** *In conclusion, enhancing HIS effectiveness at the Gleno Ermera Health Center requires comprehensive facility improvements, better regulations, and the development of skilled human resources.*

How to Cite — **Nuno Pedro Guterres Magno, Elias Pereira Moniz, Suzi Bernardina Faria Marçal, Me. Lourença da Conceição Oliveira/Analysis the Effectiveness of Health Information Systems for Vaccine Intervention COVID-19 at Glenu Health Center Ermera Year 2023, Vol. 4, No. 9, 2025**
DOI — https://doi.org/10.54543/kesans.v4i9.385
e-ISSN/p-ISSN — **2808-7178 / 2808-7380**
Published by — **CV Rifainstitut/KESANS: International Journal of Health and Science**

Analysis the Effectiveness of Health Information Systems for Vaccine Intervention COVID-19 at Glenu Health Center Ermera Year 2023

Introduction

Global COVID-19 vaccination programs are coordinated in large part by health information systems, Throughout the pandemic, the use of health information technology (HIT) has grown significantly, not only for telehealth services and SARS-CoV-2 education, but also for tracking vaccinations and epidemiological updates (Yehia, 2021).According to research, achieving herd immunity depends in large part on how well information technology increases people's behavioral reactions to vaccination (Liu, Wang, & Chen, 2024).

The largest vaccination campaign in human history has been carried out, with over 13 billion doses of COVID-19 vaccines distributed globally as of March 2023 (Bloomberg, 2022). According to John Hopkins University 2023, this distribution includes 222 countries and territories that span six continents and comprise roughly 99.7% of the world's population: Africa (55 countries), Asia (50 countries), Europe (50 countries), North America (34 countries), Oceania (20 countries), and South America (13 countries). (University John Hopkins, 2023).

The analysis of the COVID-19 virus distribution shows that there is a significant difference between the two groups (Liu et al., 2024). According to our world in data 2020, the prevalence of vaccinas varies greatly, ranging from 29% in India to 85% in Peru. (our world in Data, 2020). According to the 2021 global vaccination timeline projection, some nations are only anticipated to achieve the goal of vaccinating 60% of the population after 2023 (Statista, 2021). This illustrates the intricacy of vaccine distribution, which is impacted by health infrastructure, economic considerations, and the capability of each nation's health information system (Mathieu et al., 2020).

There are several ways to evaluate the efficacy of health information systems in COVID-19 vaccine interventions (National Center for Biotechnology Information 2021). According to cross-country research, vaccination coverage is positively connected with increased use of health services, having a consistent, high-quality service provider, and receiving additional preventive health services (Schaefer, 2023). It has been demonstrated that high-quality health information systems influence COVID-19 vaccination behavior and make it easier to access online health information, particularly in nations like China (Liu et al., 2024).

The creation and implementation of Health Information Systems is a creative initiative that has been undertaken in the medical field. A collection of programs and software known as Health Information Systems (HIS) has been created to handle data and information related to medical services. Health Information Systems aims to standardize processes, streamline and expedite services, and ensure that the generated data is accurate and up-to-date. It is expected that (HIS) will result in more integrated, efficient, and successful healthcare service management (Rewah, Sambiran, & Pangemanan, 2020).

Health information system Through information integration, real-time patient monitoring, and patient engagement, eHealth can accelerate decision-making and medical response. However, challenges such as data security and human resource readiness still need to be addressed to ensure the successful implementation of eHealth in improving healthcare service coordination (Wulandari & Sholihin, 2019).

The improvement of performance and decision-making in the health sector is greatly influenced by the effectiveness of health information systems. To support management processes at various levels of healthcare services, information systems must be able to provide accurate, timely, relevant, and reliable data. Because of its crucial role,

health information systems serve as tools and important components of initiatives to improve healthcare standards (Alwi, 2021).

The main component of international efforts to stop the spread of the SARS-CoV-2 virus, which causes the COVID-19 pandemic, is the introduction of COVID-19 vaccine interventions. It is expected that vaccination will provide immunity against this disease, break the transmission chain, reduce morbidity and mortality, and accelerate the development of herd immunity.

In addition to protecting those who have been vaccinated, vaccination interventions also address broader public health issues. This strategy involves several tactics, including prioritizing vaccination for vulnerable populations, distributing vaccines fairly, and educating the public to increase vaccine acceptance and trust. Therefore, to ensure comprehensive and long-term pandemic management, the implementation of efficient COVID-19 vaccine interventions is crucial (Fitriani Pramita Gurning, Laili Komariah Siagian, Ika Wiranti, Shinta Devi, & Wahyulinar Atika, 2021).

COVID-19 vaccine interventions have evolved into important efforts worldwide to combat the pandemic that has changed the global order of life. The goal of vaccination is to generate immunity against the SARS-CoV-2 virus, reduce transmission rates, decrease morbidity and mortality, and achieve herd immunity. Prioritizing vaccination for high-risk groups, ensuring equitable distribution, and educating the public to boost confidence and participation in the vaccination program are just a few tactics included in this intervention policy (Ariana, Pujiyanto, & Hikmahwati, 2021).

To address the COVID-19 pandemic, which has significantly impacted the health and socio-economic life of the community, several countries have implemented COVID-19 vaccine interventions. The goal of this policy is to protect vulnerable groups, enhance herd immunity, and reduce the number of infections and deaths caused by the SARS-CoV-2 virus. Establishing priority groups for vaccine recipients, distributing vaccines fairly and equitably, and increasing public acceptance and trust in vaccines are part of the implementation of the vaccination program. (Sutari, Idris, & Misnaniarti, 2022).

Effective collaboration between the government, healthcare workers, and community members who actively participate in receiving the vaccine is crucial for the success of the COVID-19 vaccination intervention. It is hoped that this comprehensive strategy will accelerate the recovery from the pandemic and restore normalcy (NUHA, ACHMAD, & SUPU, 2021).

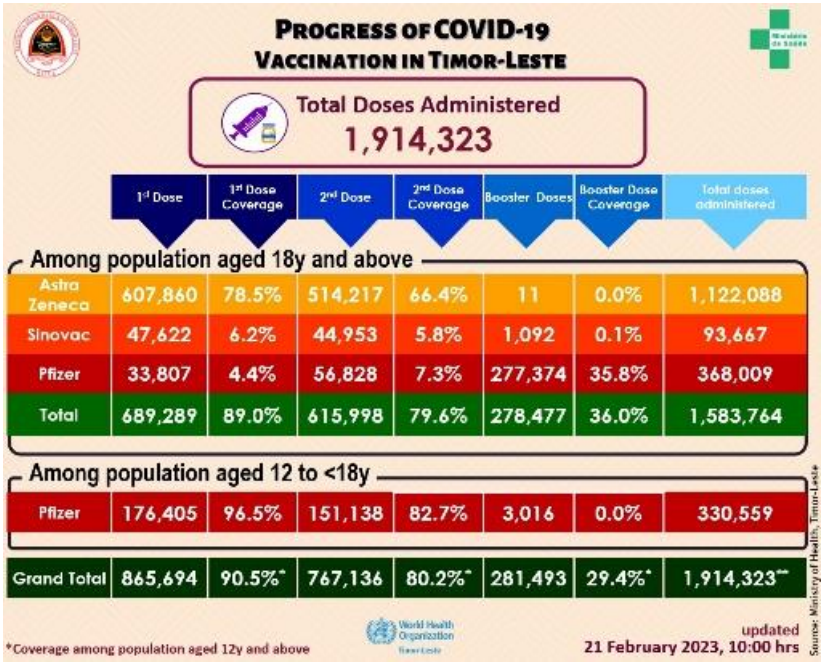


Figure 1. Data Progress of COVID-19 Vaccination in Timor-Leste

COVID-19 vaccination data in Timor-Leste reported by the Ministry of Health in collaboration with WHO in Timor-Leste shows that residents aged >18 years who received the first dose of the AstraZeneca vaccine numbered 607,860 (78.5%) and the second dose numbered 514,217 (66.4%), with a booster dose coverage of 100%, resulting in a total vaccination rate of 100%.122,088. Sinovac vaccination for the first dose was 47,622 (6.2%), the second dose was 44,953 (5.8%), and the booster dose was 1,092 (0.1%), with a total vaccination of 93,667. And for the first dose of Pfizer, there were 33,807 (4.4%), the second dose 56,828 (7.3%), and the booster dose 277,374 (35.8%), totaling 1,583,764 Pfizer vaccinations. In this section, the Pfizer vaccination for residents aged <18 to 12 years has received the first dose amounting to 176,405 (96.5%), the second dose amounting to 151,138 (82.7%), and the booster dose amounting to 3,016 (0.0%), with a total of 330,559 Pfizer vaccinations. Total cumulative vaccinations (AstraZeneca, Sinovac, and Pfizer) covering first, second, and third vaccinations amount to 1,914.3. (Word Health Organization 2023).

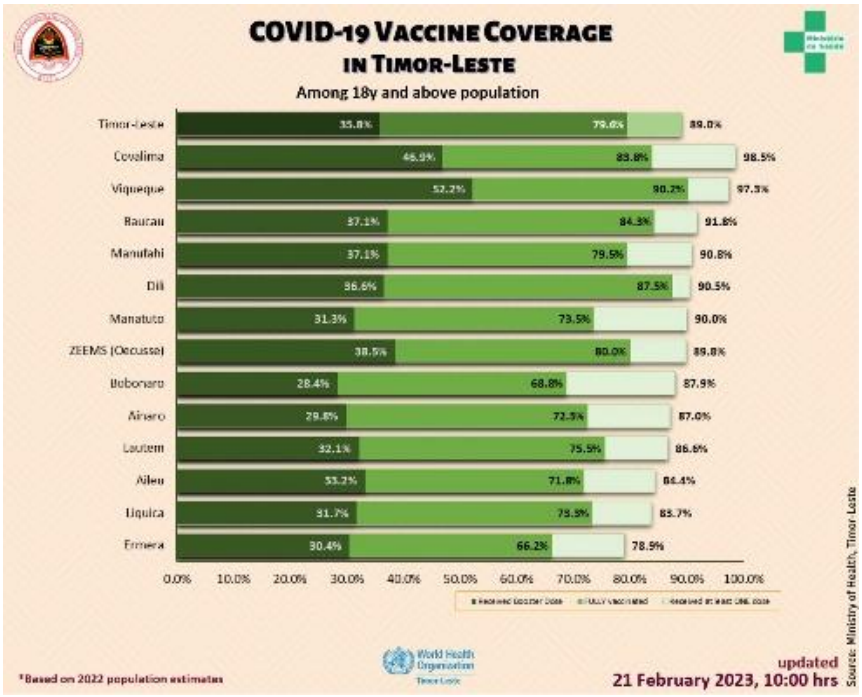


Figure 2. Data COVID-19 Vaccine Coverage in Timor-Leste

The Municipality of Ermera has a low vaccination rate due to lack of knowledge about vaccine effectiveness and unclear information from residents. The first dose of the vaccine is 78.9%, the second dose 66.2%, and booster vaccination only reaches 31.7% of the population aged 18 and above. This is lower than other municipalities like Viqueque and Covalima, where 97.3%, 79.6%, and 35.8% of the population participated in the first, second, and third doses respectively. Through the above data, the researcher wants to conduct this research to measure and find out about the effectiveness of the health information system for effective vaccine intervention in Ermera Municipality in 2023 through this quantitative research can contribute information to help program effectiveness in intervention.

Problem Identification

Based on the background, the researcher identified that the effectiveness of the health information system for the COVID-19 vaccine intervention is as follows:

1. The Effectiveness of Health Information Systems for COVID-19 Vaccine Interventions with Minority Participation at the Glenu Ermera International Health Center.
2. Most of the community lacks information about the effectiveness of the COVID-19 vaccine on the immune system.
3. Most of the public lack's knowledge about the effectiveness of the COVID-19 vaccine.
4. Municipio Ermera has the lowest vaccination participation rate compared to other Municipalities at the national level.

Problem Formulation

Based on the above identification, the researcher formulates the problem as follows:

How effective is the health information system for the COVID-19 vaccine intervention at the Glenu Ermera Health Center in 2023?

Research Objectives

1. **General Objective:** To analyze the effectiveness of the Health Information System on the COVID-19 Vaccine Intervention at the Glenu Ermera Health Center in 2023.
2. **Specific Objective:** To determine the effectiveness of the health information system for the COVID-19 vaccination intervention at the Glenu Ermera Health Center in 2023.

Problem Identification

Based on the background, the researcher identified that the effectiveness of the health information system for the COVID-19 vaccine intervention is as follows:

1. The Effectiveness of Health Information Systems for COVID-19 Vaccine Interventions with Minority Participation at the Glenu Ermera International Health Center.
2. Most of the community lacks information about the effectiveness of the COVID-19 vaccine on the immune system.
3. Most of the public lack's knowledge about the effectiveness of the COVID-19 vaccine.
4. Municipio Ermera has the lowest vaccination participation rate compared to other Municipalities at the national level.

Literature Review

One of the planned steps to combat the pandemic that significantly impacts public health is the COVID-19 vaccination intervention. The goal of the vaccination program is to reduce morbidity and mortality rates, develop herd immunity, and slow the spread of the SARS-CoV-2 virus. This policy addresses several topics, such as prioritizing groups of vaccine recipients, ensuring fair and equitable distribution, and educating the public to increase trust in the vaccine. (NUHA et al., 2021). The following are indicators to measure the effectiveness of the health information system at the Glenu Ermera Inpatient Health Center as follows:

Understanding the Program: Understanding the Program This is an important procedure to maximize how well various policies and initiatives are implemented. For example, understanding vaccination in the context of the COVID-19 pandemic requires a comprehensive awareness of the advantages and disadvantages of vaccines, in addition to public acceptance and engagement. The article "COVID-19 Vaccines: Debates, Perceptions, and Choices" claims that information obtained from social media and other sources has a significant impact on the way the public views vaccines. Public participation in vaccination programs can be increased and fear can be reduced through a comprehensive understanding of vaccines and vaccination programs. Therefore, enhancing program understanding is crucial for the effective implementation of public policy (Octafia, 2021).

Targeted: Targeted the main tactics in marketing and management are to increase the number of members and the efficiency of services. Member engagement and loyalty can be enhanced by providing relevant and appealing services based on an understanding of needs and preferences. Sustainable growth and development can be ensured by implementing this strategy along with first-class customer service and continuous innovation (Syariah, and Miftahul 2014).

Timeliness: Timeliness based on the research findings in the article "The Influence of Work Motivation, Work Discipline, and Organizational Culture on the Performance of Health Employees. One of the key components to achieving work effectiveness is punctuality in completing tasks. Time discipline, which is one of the components of work discipline, has a significant impact on employee performance (Djaman, Hasanuddin, & Rudin, 2021).

Achievement of Goals: Achievement of Goals Management of an integrated and efficient information system for healthcare services, A computerized information system that integrates patient medical records, health service information, and the business process flow of health services is necessary to provide optimal health services, according to the article "Health Facility Service Information System Health Center (Yufrizal, Renaldi, & Umbara, 2017).

One of the important tactics in the international effort to combat the SARS-CoV-2 virus pandemic is the COVID-19 vaccine. The goal of the vaccination program is to reduce morbidity and mortality due to COVID-19, curb the spread of the virus, and develop herd immunity. Prioritizing vaccine recipients, ensuring equitable and fair distribution, and educating the public to enhance knowledge and trust in vaccines are just a few important components of this policy. (Dayu, Putri, & Damayanti, 2022). The following are indicators to measure the COVID-19 vaccination intervention at the Glenu Ermera Health Center as follows:

AstraZeneca Vaccine: The University of Oxford and AstraZeneca collaborated to create the AstraZeneca vaccine, a viral vector vaccine that delivers genetic material encoding the SARS-CoV-2 spike protein through a genetically modified chimpanzee adenovirus (ChAdOx1). By generating neutralizing antibodies and T-cell responses, the vaccine creates a dual immune response that protects against COVID-19 (Voysey et al., 2021).

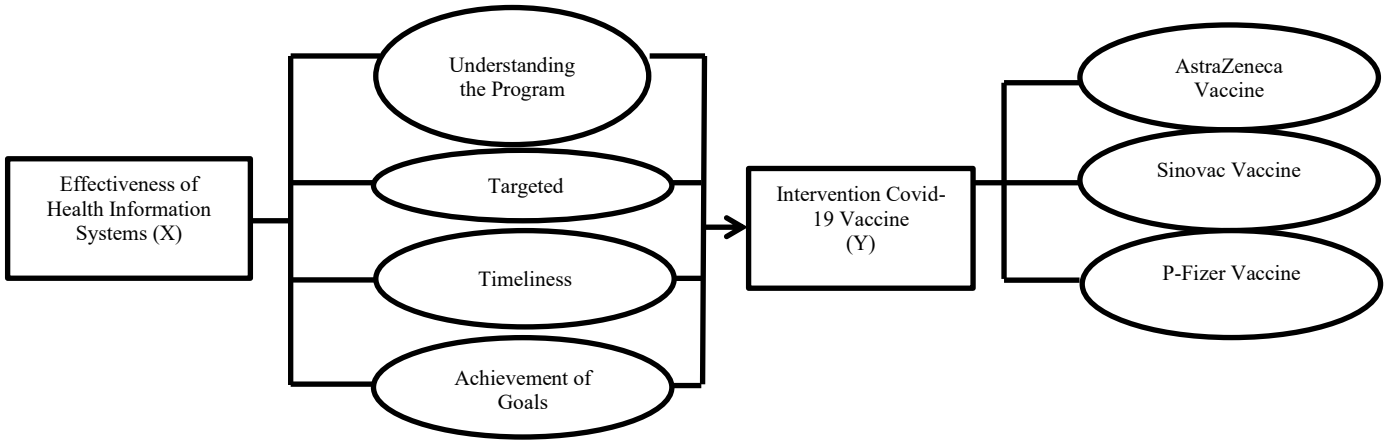
Sinovac Vaccine: The COVID-19 vaccine called CoronaVac is being developed by Sinovac Biotech Ltd. using an inactivated virus technology platform. Chemically inactivated SARS-CoV-2 particles, which cannot replicate but still can activate the immune system, are present in the vaccine. For many infectious diseases, this traditional vaccine development approach has been used for a long time (Zhang et al., 2021).

Pfizer Vaccine: The Pfizer-BioNTech vaccine, developed by BioNTech in partnership with Pfizer, is an mRNA-based vaccine. This vaccine contains mRNA molecules encapsulated in lipid nanoparticles that encode the SARS-CoV-2 spike protein. When injected, the mRNA enters the cells and provides instructions to produce the virus's spike protein, which then triggers an adaptive immune response (Polack et al., 2020)

Theoretical framework is a definition specifically used within the operational paradigm to provide explanations and discussions of the issues revealed by investigating the research conducted and obtained from the theoretical framework as follows:

Table 1

Framework Rosyadi and Casandri 2020, Modified by the researcher 2023



Method

The method used in this research is a quantitative method with a cross-sectional study approach, and the population in this study consists of 59 healthcare workers at the Glenu Ermera health center, with data analysis techniques using the Chi-Square method in SPSS software V.21.

Result and Discussion

Results of Frequency Distribution Search Based on the results of interviews with respondents; the research findings will be presented as follows:

Table 2

Frequency Distribution of Healthcare Workers by Gender

No	Gender	Frequency	Percentage
1	Men	17	28.8%
2	Women	42	71.2%
	Total	**59**	**100%**

Primary data from Health Center Glenu for the year 2023

Based on the table 2 above, there are 42 women, representing 71.2% of the total, and 17 men, representing 28.8%.

Table 3
Frequency Distribution of Healthcare Workers by Gender

No	Year	Frequency	Percentage
1	20-29	34	57.6%
2	30-39	15	25.4%
3	40-49	1	1.7%
4	50-59	4	6.8%
5	60-69	4	6.8%
6	70>	1	1.7%
Total		**59**	**100%**

Primary data from Health Center Glenu for the year 2023.

Based on table 3 above, the number of residents aged 20-29 years is 34 more with a percentage of 57.6% compared to residents aged 70 years, which is 1 with a percentage of 1.7%.

Table 4
Frequency Distribution of Healthcare Workers by Profession

No	Profession	Frequency	Percentage
1	**General Practitioner**	7	11.9%
2	**Nurse**	13	22.1%
3	**Public Health**	3	5.1%
4	**Midwife**	10	16.9%
5	**Dentists**	1	1.7%
6	**Health information system**	1	1.7%
7	**Tek. Laboratories**	4	6.8%
9	**Medical Record**	1	1.7%
8	**Farmacia**	2	3.4%
9	**Nutritionist**	2	3.4%
10	**Screening**	3	5.1%
11	**Physiotherapy**	1	1.7%
12	***Ass.Malaria, HIV, TB***	5	8.5%
14	**Staff Health Administration**	2	3.4%
15	***Focal Point RSETL***	4	6.8%
	Total	**59**	**100%**

Primary data from Health Center Glenu for the year 2023.

Based on Table 4 above, healthcare workers in the midwifery profession are more numerous, with 10 people and a percentage of 16.9%, compared to Dentists, Health information system, Physiotherapy, and Medical Records, each with 1 person and a percentage of 1.7%.

Table 5
Results of the Test of the Relationship between COVID-19 Vaccination Intervention and the Effectiveness of the Health Information System.

Chi-Square Tests	Value	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.232[a]	.013
Likelihood Ratio	5.113	.024
Linear-by-Linear Association	6.127	.013
N of Valid Cases	59	

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is .95.

b. Computed only for a 2x2 table

Primary data from Health Center Glenu for the year 2023.

A Chi-Square test was performed to ascertain whether there was a significant relationship between the COVID-19 vaccination intervention and the efficacy of the health information system, based on the findings of the crosstabulation analysis between the two variables.

The test results revealed a significance value (p-value) of 0.013 and a Pearson Chi-Square value of 6.232. Perceptions of the efficacy of the health information system and acceptance of the COVID-19 vaccination intervention are statistically significantly correlated, as indicated by the p-value <0.05.

Table 6
Below shows the frequency distribution of respondents based on the two variables Computed only for a 2x2 table

Vaccination Intervention	Not Effectiveness	Effectiveness	Total
Not Good	3 (21.4%)	11 (78.6%)	14 (100%)
Good	1 (2.2%)	44 (97.8%)	45 (100%)
Total	**4 (6.8%)**	**55 (93.2%)**	**59 (100%)**

Primary data from Health Center Glenu for the year 2023.

In addition, the Likelihood Ratio test also showed significant results wi the primary findings were further supported by the Likelihood Ratio test, which yielded significant results with a value of 5.113 and p-value = 0.024. A consistent linear trend between the two variables was indicated by the Linear-by-Linear Association test, which yielded a value of 6.127 with p = 0.013. p-value = 0.024 and a value of 5.113, confirming the primary conclusions. A consistent linear trend between the two variables was indicated by the Linear-by-Linear Association test, which yielded a value of 6.127 with p = 0.013.

Note that the minimum expected count value is 0.95, and two cells (50%) have an expected count of less than 5. The accuracy of the Chi-Square test results may be impacted by these limitations in the data distribution. With caution, the results can still be used for exploratory analysis.

According to the study's findings, the degree of acceptance of the COVID-19 vaccination intervention is significantly correlated with the public's opinion of the health information system's efficacy. The COVID-19 vaccination intervention was generally viewed favorably by most respondents who thought the health information system was

effective. On the other hand, people who believed that health information was useless were more likely to question the value or effectiveness of vaccination.

This implies that improving public acceptance of health initiatives, such as vaccination, depends in large part on having access to accurate, understandable, and trustworthy information. This study supports earlier research that highlights how crucial public health communication is in influencing public perceptions and actions regarding health interventions (Salathé, 2018; Brownstein, 2009).

For those who plan policies and carry out health programs, these findings have significant ramifications: enhancing the quality of the health information system, particularly about public information delivery, can boost the effectiveness of immunization campaigns and other health initiatives.

To ensure the quality of healthcare services in the COVID-19 vaccination intervention, it is necessary to have personnel with the capacity to utilize information systems and technology in healthcare services and to improve the quality of medical services through the evaluation of decision-making processes by providing access to medical guidance to simplify the planning of COVID-19 diagnostic procedures and treatment plans for new patients.

Related to the above research results, to ensure the effectiveness of the health information system at the Glenu Ermera Inpatient Health Center, it is necessary to enhance COVID-19 interventions such as making thorough plans and socializing the plans before implementation, as well as ensuring accurate and clear information to the public. Additionally, direct approaches to the community are needed to explain the benefits of the COVID-19 vaccine, which are to boost human immunity and combat infectious diseases like COVID-19.

Based on observations from the research results, the frequency distribution of effectiveness shows a low percentage of 6.8%, and in the intervention section, the percentage is also low at 23.7%. From these results, it can be concluded that the Glenu Ermera Health Center needs to improve the effectiveness of the information system by providing training to enhance personal knowledge to achieve effective health information system planning. Additionally, the intervention percentage of 23.7% is significantly higher than the effectiveness of the information system. Therefore, healthcare workers need to create adequate or systematic conditions to increase productivity, which will enhance facilities, training, and intervention approaches that significantly influence the COVID-19 vaccine at the Glenu Health Center.

Conclusion

Based on the results and discussion regarding the Effectiveness of Health Information System X on COVID-19 vaccine intervention Y at the Glenu Ermera Inpatient Health Center in 2023, it is concluded that out of 59 respondents who provided answers regarding the Effectiveness of the Health Information System on the COVID-19 vaccine intervention, 51% responded regarding Health Information System X on the COVID-19 vaccine intervention with 74.6%. This means that the Health Information System is good, but the implementation of the intervention is not yet satisfactory. And after conducting a chi-square test at alpha (α) 0.05, it was found that the p-value = 0.013 < 0.05 with a chi-square (X^2) value of 6.232, indicating a significant effect on the effectiveness of the health information system on the COVID-19 vaccination intervention in Gleno Ermera.

Reference

Alwi, M. K. (2021). Pengaruh Kualitas Sistem Informasi Kesehatan (SIK) Terhadap Efektivitas Fungsi Manajemen di RSUD Haji Makassar Provinsi Sulawesi Selatan Tahun 2021. *Jurnal Mitrasehat*, *XI*(Ci), 155–170.

Ariana, Emilia, Pujiyanto, & Hikmahwati. (2021). Strategi dan Tantangan dalam Meningkatkan Cakupan Vaksinasi COVID-19 untuk Herd Immunity. *Jurnal Medika Hutama*, *03*(01), 1273–1287.

Bloomberg. (2022). *More Than 12.7 Billion Shots Given: Covid-19 Vaccine Tracker*. Bloomberg Graphics.

Data, Our World in. (2020). *Coronavirus (COVID-19) Vaccinations*.

Dayu, Graceila Oktamanicka, Putri, Novita Surya, & Damayanti, Fransiska Erna. (2022). Pengalaman Masyarakat Terhadap Pemberian Vaksin COVID-19: Tinjauan Sistematis Community Experience with The Provision of The Covid-19 Vaccine: A Systematic Review. *Jurnal Ilmiah Keperawatan (Scientific Journal Of Nursing)*, *8*(4), 529–536.

Djaman, Sriwaty, Hasanuddin, Bakri, & Rudin, Rudin. (2021). Pengaruh Motivasi Kerja, Disiplin Kerja dan Budaya Organisasi terhadap Kinerja Pegawai Kesehatan Rumah Sakit Umum Daerah Tora Belo Kabupaten Sigi. *JAMIN : Jurnal Aplikasi Manajemen Dan Inovasi Bisnis*, *3*(2), 25. https://doi.org/10.47201/jamin.v3i2.74

Fitriani Pramita Gurning, Laili Komariah Siagian, Ika Wiranti, Shinta Devi, & Wahyulinar Atika. (2021). Kebijakan Pelaksanaan Vaksinasi Covid-19 Di Kota Medan Tahun 2020. *Jurnal Kesehatan*, *10*(1), 43–50. https://doi.org/10.37048/kesehatan.v10i1.326

Information, National Center for Biotechnology. (2021). *Role of Information Technology in COVID-19 Vaccination Drive: An Analysis of the COVID-19 Global Beliefs, Behaviors, and Norms Survey*. PMC.

Liu, Y., Wang, Z., & Chen, H. (2024). The impact of internet health information seeking on COVID-19 vaccination behavior in China. *BMC Public Health*, *24*, 1–12. https://doi.org/10.1186/s12889-024-17638-3

Mathieu, E., Ritchie, H., Ortiz-Ospina, E., Roser, M., Hasell, J., Appel, C., & Rodés-Guirao, L. (2020). A global database of COVID-19 vaccinations. *Nature Human Behaviour*, *5*(7), 947–953.

NUHA, AGUSYARIF REZKA, ACHMAD, NOVIANITA, & SUPU, NUR 'AIN. (2021). Analisis Model Matematika Penyebaran Covid-19 Dengan Intervensi Vaksinasi Dan Pengobatan. *Jurnal Matematika UNAND*, *10*(3), 406. https://doi.org/10.25077/jmu.10.3.406-422.2021

Octafia, Lula Asri. (2021). Vaksin Covid-19: Perdebatan, Persepsi dan Pilihan. *Emik*, *4*(2), 160–174. https://doi.org/10.46918/emik.v4i2.1134

Organization, World Health. (2023, June). *World Health Organization: Timor-Leste*. World Health Organization.

Polack, Fernando P., Thomas, Stephen J., Kitchin, Nicholas, Absalon, Judith, Gurtman, Alejandra, Lockhart, Stephen, Perez, John L., Pérez Marc, Gonzalo, Moreira, Edson D., Zerbini, Cristiano, Bailey, Ruth, Swanson, Kena A., Roychoudhury, Satrajit, Koury, Kenneth, Li, Ping, Kalina, Warren V., Cooper, David, Frenck, Robert W., Hammitt, Laura L., Türeci, Özlem, Nell, Haylene, Schaefer, Axel, Ünal, Serhat, Tresnan, Dina B., Mather, Susan, Dormitzer, Philip R., Şahin, Uğur, Jansen, Kathrin U., & Gruber, William C. (2020). Safety and Efficacy of the BNT162b2 mRNA Covid-19 Vaccine. *New England Journal of Medicine*, *383*(27), 2603–2615. https://doi.org/10.1056/nejmoa2034577

Rewah, Daniel Ridel, Sambiran, Sarah, & Pangemanan, Fanley. (2020). Efektivitas Penerapan Sistem Informasi Manajemen Puskesmas (SIMPUS) di Kita Manado (Studi Puskesmas Bahu). *EKSEKUTIF Jurnal Jurusan Ilmu Pemerintahan*, *2*(5), 1–10.

Rosyadi, & Casandri, Y. (2025, June). *Prosiding Seminar Akademik Tahunan Ilmu Ekonomi dan Studi*.

Schaefer, M. K. (2023). Health system quality and COVID-19 vaccination: a cross-sectional analysis in 14 countries. *The Lancet Global Health*, *11*(12), e1846–e1856.

Statista. (2021). *Chart: Global Vaccine Timeline Stretches Beyond 2023*.

Sutari, Sutari, Idris, Haerawati, & Misnaniarti, Misnaniarti. (2022). Implementasi kebijakan vaksinasi covid-19 di Indonesia: narrative review. *Riset Informasi Kesehatan*, *11*(1), 71. https://doi.org/10.30644/rik.v11i1.637

Tetap, Dosen, Syariah, Ekonomi, & Miftahul, Stai. (2014). *Dosen Tetap Ekonomi Syariah STAI Miftahul 'Ula (STAIM) Nganjuk 191*. 191–200.

University, Johns Hopkins. (2023). *Understanding Vaccination Progress by Country*.

Voysey, Merryn, Clemens, Sue Ann Costa, Zuidewind, Peter, et al. (2021). Safety and efficacy of the ChAdOx1 nCoV-19 vaccine (AZD1222) against SARS-CoV-2: an interim analysis of four randomised controlled trials in Brazil, South Africa, and the UK. *The Lancet*, *397*(10269), 99–111. https://doi.org/10.1016/S0140-6736(20)32661-1

Wulandari, Nia, & Sholihin, Hayat. (2019). 肖沉 1, 2, 孙莉 1, 2Δ, 曹杉杉 1, 2, 梁浩 1, 2, 程燄 1, 2. *Tjyybjb.Ac.Cn*, *27*(2), 58–66.

Yehia, B. R., & Others. (2021). Health information technology utilization and impact on COVID-19 vaccination. *American Journal of Preventive Medicine*, *61*(2), 165–169.

Yufrizal, Mochammad Riyan Nendyari, Renaldi, Faiza, & Umbara, Fajri Rakhmat. (2017). Sistem Informasi Pelayanan Fasilitas Kesehatan Tingkat 1 (Puskesmas) Terintegrasi Kota Cimahi. *Prosiding Seminar Nasional Komputer Dan Informatika (SENASKI)*, *2017*, 163–168.

Zhang, Yanjun, Zeng, Gang, Pan, Hongxing, Li, Changgui, Hu, Yaling, Chu, Kai, Han, Weixiao, Chen, Zhen, Tang, Rong, Yin, Weidong, Chen, Xin, Hu, Yuansheng, Liu, Xiaoyong, Jiang, Congbing, Li, Jingxin, Yang, Minnan, Song, Yan, Wang, Xiangxi, Gao, Qiang, & Zhu, Fengcai. (2021). Safety, tolerability, and immunogenicity of an inactivated SARS-CoV-2 vaccine in healthy adults aged 18–59 years: a randomised, double-blind, placebo-controlled, phase 1/2 clinical trial. *The Lancet Infectious Diseases*, *21*(2), 181–192. https://doi.org/10.1016/S1473-3099(20)30843-4