



Article

Web-Based Clinical Teleconsultation for Mothers and Children at RSIA Muhammadiyah, Probolinggo City

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Abstract: Health services at RSIA Muhammadiyah Probolinggo City are currently provided face-to-face to patients who come directly to the hospital. This approach often leads to long queues in several polyclinics, resulting in discomfort and prolonged waiting times for patients. One solution to this problem is to utilize information technology through a website-based teleconsultation system for maternal and child health services. This research applied a research and development (R&D) approach using the waterfall development model. Data collection techniques included interviews, documentation review, and direct observation of existing services. The system design and development stages were carried out sequentially, covering analysis, design, implementation, testing, and deployment of the website-based teleconsultation platform. The resulting system is a web-based clinical teleconsultation application designed for maternal and child health services at RSIA Muhammadiyah Probolinggo City. The system provides features to support online consultations, including real-time chat and video consultations via Google Meet, to facilitate interaction between patients and healthcare professionals without requiring in-person visits. The development of this teleconsultation system is expected to improve the quality of online healthcare services at RSIA Muhammadiyah Probolinggo City. The use of teleconsultation can reduce patient queues, shorten waiting times, and enhance comfort for patients while also expanding access to maternal and child health services.

Keywords: Teleconsultation, Online Consultation, Hospital

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1. Introduction

In this era of rapid technological advancement, innovations in technology continue to drive progress in various fields [15]. Technological sophistication plays a vital role in creating greater ease and convenience for users. It also significantly contributes to improving healthcare services for the community [3]. RSIA Muhammadiyah Kota Probolinggo is one of the hospitals in Probolinggo City that specializes in maternal and child healthcare. The hospital operates three main outpatient clinics: pediatrics, obstetrics and gynecology (obgyn), and general practice. The number of patient visits has continued to increase weekly across all clinics, particularly in the pediatrics and obgyn clinics. Outpatient visit data for May 2023 at RSIA Muhammadiyah Kota Probolinggo is presented in Table 1.

Table 1. Outpatient Visit Data for May 2023

Week	Day	Number of Visits	
		Pediatrics Clinic	Obgyn Clinic
Week 1	Monday	32	27
	Tuesday	29	13
	Wednesday	36	25
	Thursday	27	19
	Friday	25	15
	Saturday	8	2
	Sunday	3	4
Week 2	Monday	33	28
	Tuesday	26	16
	Wednesday	37	24
	Thursday	23	17
	Friday	19	21
	Saturday	4	2
	Sunday	3	4
Week 3	Monday	37	23
	Tuesday	22	24
	Wednesday	32	28
	Thursday	21	12
	Friday	18	19
	Saturday	2	3
	Sunday	1	2
Week 4	Monday	35	29
	Tuesday	28	15
	Wednesday	33	27
	Thursday	26	23
	Friday	27	21
	Saturday	3	2
	Sunday	4	1

From these two clinics, it can be seen that outpatient visits at RSIA Muhammadiyah Kota Probolinggo are particularly high every week, especially on Mondays and Wednesdays. This accumulation of patients can lead to long queues and cause discomfort for patients waiting in the waiting area. Queues have a significant impact on patient satisfaction [12]. Long waiting times can reduce patient comfort and influence patients' future decisions when choosing healthcare services [6]. To improve the quality of patient services, an effective queuing system has a positive impact on service quality and patient satisfaction [11].

The majority of patients at RSIA Muhammadiyah Kota Probolinggo are pregnant women and children. Children and pregnant women have more vulnerable immune systems, which makes them more susceptible to illness or infection. During the Covid-19 pandemic, pregnant women must be extra cautious of the risks when exposed to the virus, as pregnancy increases susceptibility to viral infections [2]. The immune system of pregnant women undergoes many changes, making them more affected by certain respiratory infections [14]. The Covid-19 pandemic has also required social distancing measures, where patients must maintain a distance of 1–2 meters when interacting with others to prevent the spread of the virus. Given these issues, RSIA Muhammadiyah Kota Probolinggo urgently needs remote services that can help patients receive care quickly and in real time.

One effort to facilitate hospital services is through the use of telemedicine. Telemedicine makes it easier for patients to access care and treatment, whether they are

at the hospital, at home, at work, or traveling [8]. Clinical teleconsultation is part of telemedicine. Clinical teleconsultation refers to healthcare services based on clinical consultations conducted remotely to assist doctors in diagnosing and providing medical advice or treatment recommendations for patients. Clinical teleconsultations can be carried out by doctors and patients through written, voice, or video communication. Teleconsultation makes it easier for patients to receive medical services even when they are located far from the hospital.

2. Materials and Methods

This research is a study aimed at developing a web-based clinical teleconsultation application for maternal and child health at RSIA Muhammadiyah Kota Probolinggo, using the Waterfall system development method. The Waterfall system development method is considered suitable for developing web-based systems [10]. The research site is RSIA Muhammadiyah Kota Probolinggo, located at Jl. Raya Panglima Sudirman No.65, Kebonsari Kulon, Kanigaran District, Probolinggo City, East Java 67214.

The system development model applied is the Waterfall model, which is a software development method carried out through a series of sequential stages. The process begins with requirements analysis, followed by design, coding, testing, and maintenance of the product [13]. This system development model is appropriate for building web-based systems.

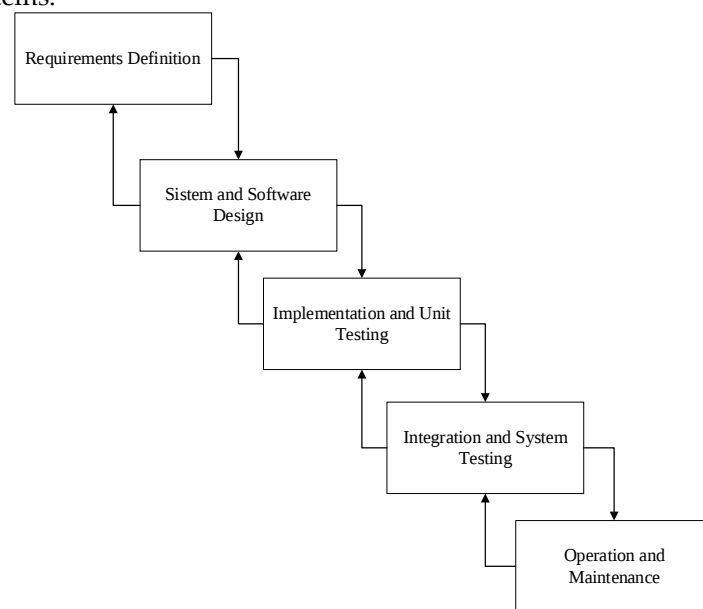


Figure 1. Waterfall Stages

Stages of the Waterfall System Development Model :

1) Requirements Definition

At this stage, developers communicate services, constraints, and system objectives based on the results of user consultations, which are then detailed and formulated into system specifications. Software requirements are gathered through direct data collection via observation of research subjects (observation), conducting interviews, and asking structured questions to informants, which support the design of inputs and outputs [4].

2) System and Software Design

In this stage, the design phase is carried out to assist in defining the information system to be developed, which is designed comprehensively. This includes the design of DFDs (Data Flow Diagrams) and ERDs (Entity Relationship Diagrams).

3) Implementation and Unit Testing

This stage involves the development of software in the form of program modules or units. The system is developed by integrating several modules using programming languages such as PHP, MySQL, and the CodeIgniter framework.

4) Integration and System Testing

At this stage, individual units or modules are integrated and tested as a complete system to ensure their compliance with software requirements. The fully developed system is tested to verify its functionality using the black-box testing method. This testing aims to minimize errors and ensure the output meets user expectations [16].

5) Operation and Maintenance

In this stage, the system is installed and operated as a whole. Maintenance includes correcting errors that were not detected in the previous stages, improving system performance, and upgrading services according to new user needs.

The research began by identifying problems faced by the hospital during the Covid-19 pandemic, particularly the high number of patient visits and the vulnerability of certain patient groups. To address this issue, a solution was proposed in the form of designing and developing a clinical teleconsultation system for maternal and child health at RSIA Muhammadiyah Kota Probolinggo. The development process adopted the Waterfall system development method, which includes a series of structured and sequential phases. The stages of this research are illustrated in Figure 2.

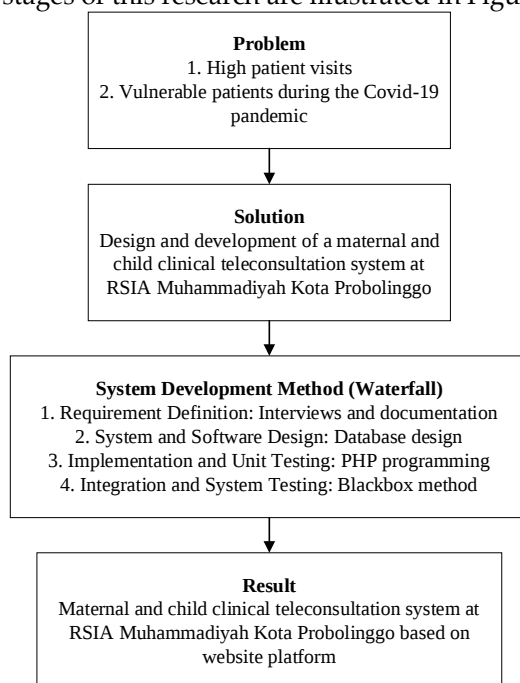


Figure 2. Research Stages

3. Results

3.1. Requirement Definition

This stage involves the collection and analysis of user and system requirements. The high number of patient visits at RSIA Muhammadiyah Kota Probolinggo often leads to long queues as patients wait for outpatient examinations. This situation causes discomfort due to extended waiting times. Based on this condition, the hospital requires a teleconsultation system to help patients receive remote services in real time. Real-time

technology enables patients and healthcare providers to interact simultaneously. It facilitates audio and video communication [5].

In the development of this teleconsultation system, several features were included, such as patient registration, consultations via live chat and video call, and report generation. System users include medical records staff, doctors, patients, and pharmacists. Medical records staff can log in to the website and access the teleconsultation system, which allows them to add, edit, and delete data related to users, doctors, medications, and diagnoses. They can also verify patients who register for consultations and print service and prescription reports according to hospital needs. Doctors can conduct consultations with patients via live chat and video call, provide diagnoses, and issue prescriptions. Patients can register for consultations, print consultation confirmations, and receive treatment recommendations and prescriptions through the live chat or video call with doctors. After the consultation ends, patients can print the prescription provided by the doctor. Pharmacists can close the consultation session once the medication is dispensed.

3.2. System and Software Design

At this stage, the system is planned and designed to determine the required hardware and software components. This phase involves creating a comprehensive description of the overall system framework [1]. It includes the preparation of system design documents consisting of DFDs (Data Flow Diagrams) and ERDs (Entity Relationship Diagrams).

3.2.1. DFD (Data Flow Diagram)

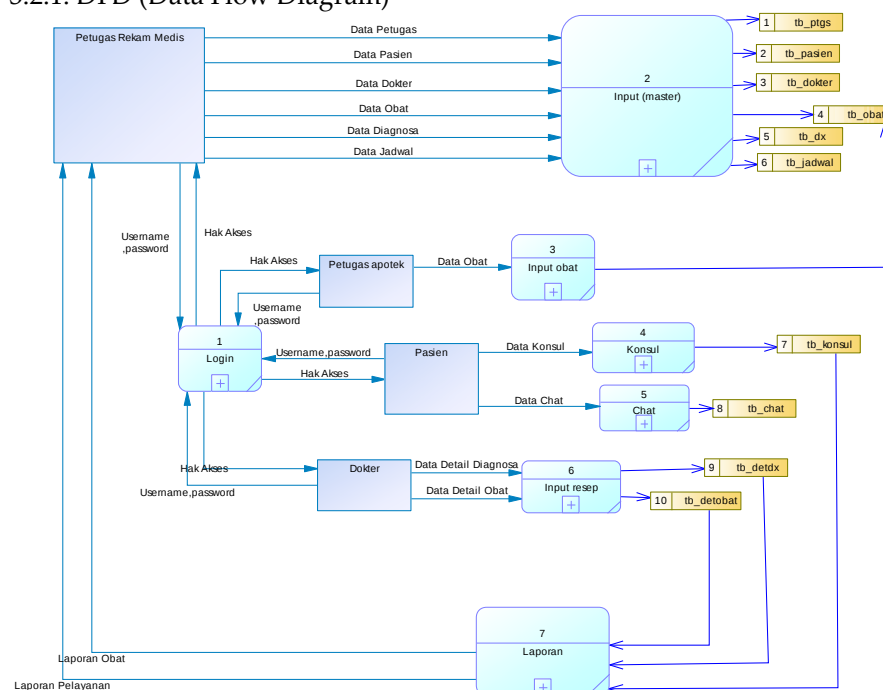


Figure 3. Data Flow Diagram (DFD) Design

Based on the DFD diagram above, there are seven processes identified, namely: login, master data input, medication input, consultation transactions, chat process, prescription input, and reporting. The medical records officer has direct access to master data, which includes staff data, patient data, doctor data, medication data, diagnosis data, and scheduling data. Patients have access to perform consultations and engage in chat. Doctors have access to input prescriptions by retrieving detailed diagnosis data and medication details. Pharmacists have access to medication data.

3.2.1. ERD (Entity Relationship Diagram)

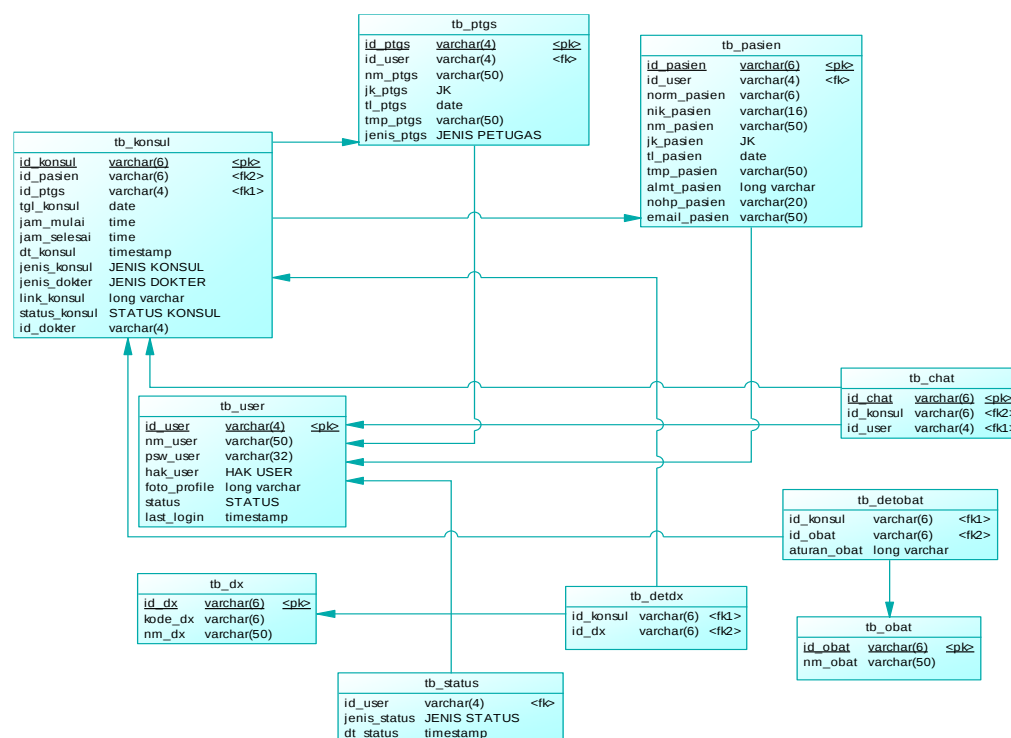


Figure 4. Entity Relationship Diagram (ERD)

The diagram above represents the Entity Relationship Diagram (ERD) of the clinical teleconsultation system for maternal and child health at RSIA Muhammadiyah Kota Probolinggo. The ERD consists of ten entities: user, patient, consultation, staff, chat, status, diagnosis, diagnosis detail, medication, and medication detail. There are eleven relationships depicted, which include: the relationship between patient and consultation, staff and consultation, user and patient, user and staff, user and chat, user and status, consultation and chat, consultation and diagnosis detail, consultation and medication detail, diagnosis and diagnosis detail, as well as medication and medication detail.

3.3. Implementation and Unit Testing

Implementation is the stage where the overall system design is transformed into program code. The resulting code consists of modules that are integrated into a unified system [7]. This research has successfully developed a web-based Clinical Teleconsultation System for Maternal and Child Health at RSIA Muhammadiyah Kota Probolinggo. The implementation stage involves building the system according to the design using the PHP and MySQL programming languages. The following section presents the design and development results of the web-based Clinical Teleconsultation System for Maternal and Child Health at RSIA Muhammadiyah Kota Probolinggo, which includes the following features:

A. Menu Data Pasien

The patient data menu is a form containing a list of patients who have been registered in the maternal and child clinical teleconsultation system. This form includes several columns such as ID, medical record number, national identity number (NIK), name, gender, date of birth, place of birth, address, phone number, email, user ID, and options. The options column contains two buttons: Edit and Delete. Access to the patient data menu is restricted to the administrator, specifically the medical records officer. The interface of the patient data menu is shown in Figure 5 below:

No.	Id	No RM	NIK	Nama	Jenis Kelamin	Tanggal Lahir	Tempat Lahir	Alamat	No HP	Email
1.	A00001	000001	23145223333331	Nada	perempuan	2019-03-14	Probolinggo	Probolinggo	087776564321	nad@gmail.co
2.	A00002	000002	1234543212345687	yunus	laki-laki	1990-02-04	Probolinggo	Desa Jorong	084567876324	myunus@gmail.c
3.	A00003	000003	1234334200098790	risa	perempuan	1993-03-01	Surabaya	Desa Jatigan	087654231456	risa@gmail.co
4.	A00004	000004	1234567889977777	Nadia	laki-laki	2000-01-01	Malang	Desa Wonosari	082345167829	nadia@gmail.cc
5.	A00005	000005	2341561234543213	nana	perempuan	2012-05-25	Jakarta	Desa Jantiasih	087321456700	nana@gmail.co

Figure 5. Patient Data Menu Display

B. Menu Data Diagnosa

No.	Id	Kode ICD	Nama Diagnosa	Option
1.	D00001	L23.6	Allergi pada kulit	 
2.	D00002	K35.8	Appendicitis	 
3.	D00003	F84.0	ASD	 
4.	D00004	J45.9	Astma Attack	 
5.	D00005	K62.5	Bleeding rectum dan anus	 
6.	D00006	D68.9	Bleeding tendency	 
7.	D00007	J21.9	Bronchiolitis	 
8.	D00008	J20.9	Bronchitis	 
9.	D00009	J18.0	Broncopneumonia	 
10.	D00010	K02.9	Caries gigi	 

Figure 6. Diagnosis Data Menu Display

The diagnosis data menu is a form that contains a list of diagnoses registered in the maternal and child clinical teleconsultation system. This form includes several columns, namely ID, ICD code, name, and an options column. The options column provides two buttons: Edit and Delete. Access to the diagnosis data is restricted to administrators, specifically the medical records staff.

C. Menu Konsultasi

The consultation menu (Figure 7) is a form that displays a list of consultations registered in the maternal and child clinical teleconsultation system. This form includes several columns, namely consultation ID, patient name, consultation date, start time, end time, staff, type of consultation, consultation status, action, and an options column. The options column provides two buttons: Edit and Delete.

No.	Id Konsul	Nama Pasien	Tanggal Konsul	Jam Mulai	Jam Selesai	Petugas	Jenis Konsul	Jenis Dokter	Nama Dokter	Status Konsul	aksi
1.	K00001	yunus	2023-09-18	15:13:00	16:10:00	Donny Josias	chat	dokter kandungan	Donny Josias	Selesai	[icon]
2.	K00002	Nada	2023-09-28	17:04:00	18:04:00	Eliyana	chat	dokter kandungan	Donny Josias	Selesai	[icon]
3.	K00003	Nada	2023-09-28	19:06:00	19:06:00	Donny Josias	chat	dokter kandungan	Donny Josias	Selesai	[icon]
4.	K00006	Nada	2023-08-30	12:00:00	13:00:00	Eliyana	chat	dokter kandungan	Donny Josias	Menunggu Pembayaran	[icon]
5.	K00007	Nada	2023-09-29	14:00:00	15:00:00	Donny Josias	chat	dokter kandungan	Donny Josias	Selesai	[icon]
6.	K00009	nana	2023-11-18	08:00:00	09:00:00	ika	chat	dokter anak	ika	Selesai	[icon]
7.	K00010	nana	2023-11-18	14:00:00	15:00:00	Eliyana	chat	dokter anak	ika	Selesai	[icon]
8.	K00011	nana	2023-11-12	12:00:00	13:00:00	Eliyana	chat	dokter	Donny	Selesai	[icon]

Figure 7. Consultation Menu Display

D. Tampilan Live Chat

Figure 8. Consultation Menu Display

The figure 8 above shows the live chat form interface, which enables real-time communication between patients and doctors. Patients can initiate live chat sessions with doctors according to the date and time they have previously scheduled.

E. Menu Laporan Pelayanan

The service report menu (Figure 9) displays a list of consultations for each patient who has completed a consultation. The service report form includes several fields, namely consultation ID, patient name, consultation date, staff, type of consultation, and consultation status. Access to the service report form is limited to medical records staff as administrators. The medical records staff can also search for service reports based on a specific consultation date. Additionally, the service report can be printed in PDF format.

No.	Id Konsul	Nama Pasien	Tanggal Konsul	Petugas	Jenis Konsul	Status Konsul
1.	K00001	yunus	2023-09-18	Donny Josias	chat	Selesai
2.	K00002	Nada	2023-09-28	Eliyana	chat	Selesai
3.	K00003	Nada	2023-09-28	Donny Josias	chat	Selesai
4.	K00006	Nada	2023-08-30	Eliyana	chat	Menunggu Pembayaran
5.	K00007	Nada	2023-09-29	Donny Josias	chat	Selesai
6.	K00009	nana	2023-11-18	ika	chat	Selesai
7.	K00010	nana	2023-11-18	Eliyana	chat	Selesai
8.	K00011	nana	2023-11-19	Eliyana	chat	Selesai
9.	K00012	nana	2023-11-19	Eliyana	chat	Konfirmasi Pembayaran

Figure 9. Service Report Menu Display

3.4. Integration and System Testing

At the stage of system integration and testing, the teleconsultation system was tested using the Blackbox method, which aims to evaluate whether the system's functionalities conform to the specified requirements. This testing verifies whether the system operates according to its intended functions and meets user expectations, ensuring that each function performs accurately and reliably [9].

Table 2. System Testing Plan

No	User	Testing Module	Description	Testing Type
1.	Medical Records Staff, Doctors, Pharmacists	Login Page	Perform login to access the system	Blackbox
2.	Patient	Registration Page	Perform registration for new patients	Blackbox
3.	Medical Records Staff	Master Data Page	Process master data within the system	Blackbox
4.	Doctor	Consultation Page	Process consultation services	Blackbox
5.	Doctor, Patient	Live Chat Page	Process the chat page between doctor and patient	Blackbox
6.	Dokter, pasien	Video Call Page	Process video meeting between doctor and patient	Blackbox
7.	Medical Records Staff	Service Report Page	Generate service report in PDF format	Blackbox
8.	Medical Records Staff	Prescription Report Page	Generate prescription report in PDF format	Blackbox

After conducting the testing procedures described in Table 1, the results of the clinical teleconsultation system testing for maternal and child health at RSIA Muhammadiyah Kota Probolinggo are presented and summarized in Table 3 as follows.

Table 3. System Testing Results

No	User	Testing Module	Testing Procedure	Expected Result	Test Result
1.	Medical Records Staff, Doctors, Patients, Pharmacists	Login Page	Enter username and password to log in	Display the main menu	Passed
2.	Patient	Registration Page	Fill out the registration form	Display registration data	Passed
3.	Medical Records Staff	Master Data Page	1. Add master data 2. Edit data 3. Delete data	1. Display newly added data 2. Display updated data 3. Display data has been deleted	Passed
4.	Doctor	Consultation Page	Register a consultation	Display registered consultation data	Passed
5.	Doctor, Patient	Live Chat Page	Send and receive messages in the chat column	Display sent and received chat messages	Passed
6.	Doctor, Patient	Video Call Page	Initiate video call by clicking the icon in the action menu	Redirected to Google Meet and able to conduct video consultation	Passed
7.	Medical Records Staff	Service Report Page	1. Display service report data stored in the system 2. Print the report	1. Service report data displayed 2. Printed report generated in PDF format	Passed
8.	Medical Records Staff	Prescription Report Page	1. Display medication report data stored in the system 2. Print the report	1. Prescription report data displayed 2. Printed report generated in PDF format	Passed

4. Conclusions

Based on the results and discussion of this research related to the clinical teleconsultation system for maternal and child health at RSIA Muhammadiyah Kota Probolinggo, several conclusions can be drawn. First, the requirement definition stage was carried out by analyzing system needs through interviews, observations, and documentation to design and develop a web-based clinical teleconsultation system. Second, the system and software design stage involved the design and development of the system using the waterfall method and modeling tools such as data flow diagrams and entity relationship diagrams, aimed at improving online consultation services. Third, the implementation and unit testing stage was performed by coding the system based on the designed model using PHP and MySQL to support service quality enhancement. Finally, in the integration and system testing stage, the system was tested using the black-box method to evaluate its functionality, and the results showed that the developed teleconsultation system functioned properly.

References

- [1]. Wahid, "Analisis Metode Waterfall Untuk Pengembangan Sistem Informasi," *ResearchGate*, 2020. [Online]. Available: <https://www.researchgate.net/publication/346397070>
- [2]. N. Aisyiyah, A. Waluyo, and A. Muttaqin, "Pemanfaatan Lembar Skoring COVID-19 pada Ibu Hamil oleh Praktik Bidan Mandiri di Masa Pandemi COVID-19," *Kesehatan dan Kebidanan STIKes Mitra RIA Husada*, vol. 11, no. 1, 2022.
- [3]. E. Apriliyana, K. B. P. St, I. G. P. D. Pranata, N. L. P. T. Maharani, and S. Negeri, "Pemanfaatan Teknologi Digital dalam Bidang Kesehatan di Era 4.0 untuk Mewujudkan Generasi Indonesia yang Sehat," 2021.
- [4]. H. E. Darono, "Penerapan Metode Waterfall pada Sistem Pelayanan Berobat Balai Pemeliharaan Kesehatan Medifarma Berbasis Desktop," *Jurnal*, vol. 17, no. 2, 2019.
- [5]. R. Fadhila, T. Afriani, M. Magister, K. Fakultas, and I. Keperawatan, "Penerapan Telenursing dalam Pelayanan Kesehatan: Literature Review," *Jurnal Keperawatan Abdurrah*, vol. 3, no. 2, 2020.
- [6]. M. Fadhli, D. Nurmalasari, and M. Akbar, "Penggunaan Metode FIFO pada Real-Time Monitoring Antrian Pendaftaran Pasien Puskesmas Berbasis Web," *Jurnal Komputer Terapan*, vol. 9, no. 1, pp. 39–49, 2023, doi: 10.35143/jkt.v9i1.5915.
- [7]. H. F. Fiqa, R. P. Pradana, M. Hanif, and R. G. Septiansyah, "Digitalisasi Layanan Kesehatan Desa Grujungan Melalui Pengembangan E-Posyandu menggunakan Metode SDLC-Waterfall," *INISTA: Journal of Informatics Information System Software Engineering and Applications*, vol. 5, no. 1, pp. 43–57, 2022, doi: 10.20895/inista.v5i1.891.
- [8]. R. Indira et al., "Telemedicine sebagai Strategi Pelayanan Rumah Sakit pada Era Pandemi COVID-19," 2022.
- [9]. I. D. Lesmono, "Rancang Bangun Sistem Informasi Penjualan Sepatu Berbasis Website dengan Metode Waterfall," *Jurnal Swabumi*, vol. 6, no. 1, 2018. [Online]. Available: <http://www.ejournal.unsa.ac.id/diunduh:19->
- [10]. D. Puspitasari, "Sistem Informasi Perpustakaan Sekolah Berbasis Web," *Jurnal Pilar Nusa Mandiri*, vol. XII, no. 2, 2016.
- [11]. T. Rahmaddian and Irwadi, "Pengaruh Kualitas Pelayanan Apotek terhadap Tingkat Kepuasan Pasien Rawat Jalan di Puskesmas X Kota Padang," *Jurnal Kesehatan Akper Kesdam II Sriwijaya Palembang*, vol. 12, no. 1, 2023.
- [12]. E. Rama Archanna, "Pengaruh Sistem Antrian dan Kualitas Pelayanan terhadap Kepuasan Pasien BPJS di Rumah Sakit Ibnu Sina," vol. 3, 2023.
- [13]. M. C. Roziqin, M. S. Noor, A. Iskandar, and A. Yuliantika, "Implementation of REST API in Web Service System for Medical Resume Provision," *International Journal of Hi-Tech in Information and Communication Technology*, vol. 1, no. 1, 2023, doi: 10.25047/ijhitech.v1i1.4046.
- [14]. E. Selviyanti et al., "Model of Developing Key Performance Indicator to Increase the Quality of Education During the Covid-19 Pandemic," *Journal of Physics: Conference Series*, vol. 1832, no. 1, 2021, doi: 10.1088/1742-6596/1832/1/012030.
- [15]. A. Yani, "Pemanfaatan Teknologi dalam Bidang Kesehatan Masyarakat," *PROMOTIF: Jurnal Kesehatan Masyarakat*, vol. 8, no. 1, 2018. [Online]. Available: <http://jurnal.unismuhpalu.ac.id/index.php/PJKM>
- [16]. A. N. Yasinta, S. Sumarno, C. Taurusta, and Y. Findawati, "Development of a Website-Based Online Queue Information System for Health Services," *Indonesian Journal of Innovation Studies*, vol. 24, 2023, doi: 10.21070/ijins.v22i.928.