




Monitoring and Controlling System to Improve Health Services in Diabetes Mellitus: Research and Development Study

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Abstract

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BACKGROUND: Diabetes mellitus (DM) is a chronic disease caused by the inability of the pancreas to produce insulin or the body cannot use the insulin it produces effectively. Pekalongan City is one of the cities in Indonesia with a high prevalence of DM. The number of DM sufferers is caused by heredity, unhealthy lifestyle.

AIM: The aim of the study was to create a website-based service system (e-health) that can assist the community in conducting consultation and monitoring activities for people with DM.

METHODS: The method used is research and development where data and information are obtained by conducting observations, interviews and sampling both to health consultants, DM sufferers and the people of Pekalongan City. Consultants or health teams include doctors, nutritionists, psychologists and nurses. The number of people with DM was 40 respondents.

RESULTS: The number of DM sufferers in Pekalongan City was 12,132 people consisting of 100 people with type-1 DM and 12,032 type-2 DM. A total of 66.7% of respondents experienced DM from heredity and 33.3% due to lifestyle and diet. As many as 48% of respondents experienced DM for <1 year, 32% between 1 and 3 years, 4% between 3 and 5 years, and 16% more than 5 years. Most (65%) respondents need online services, 10.3% really need it, 13.8% do not need it, and 10.3% do not need it. Most of the respondents needed consultation as much (56.7%), 10% essential, 13.3% less necessary, and 20% not necessary. Most require consultation with a team of health workers, as much as 62.5%, 15.6% very necessary, and 21.9% less necessary.

CONCLUSION: Web-based health information system (e-health) can provide easy access for DM sufferers needed in education, consultation and monitoring, so as to reduce the number of DM sufferers in Pekalongan City.

Introduction

Diabetes mellitus (DM) is a chronic disease caused by the inability of the pancreas to produce insulin or the body cannot use the insulin it produces effectively [1]. The global prevalence of diabetes is estimated to increase, from 4% in 1995 to 5.4% in 2025. For this reason, the government needs to take policies to mitigate DM disease [2]. Pekalongan City, is one of the cities with a fairly high prevalence of DM, in 2019, there were 6,369 cases and an increase in 2020, as many as 12,132 case Pekalongan City, is one of the cities with a fairly high prevalence of DM, in 2019, there were 6369 cases and an increase in 2020, as many as 12,132 case [3]. This is a concern in planning development in the health sector to minimize or suppress the growth of DM in the people of Pekalongan City.

The number of DM sufferers is caused by several factors, such as: Heredity, obesity, lifestyle, wrong diet, drugs, and lack of physical activity, smoking, and stress [4], [5]. With the large number of existing patients, there is no system that can assist the

community in conducting consultation and monitoring activities for DM sufferers because the recording still uses a control card that is obtained when the patient performs an examination or controls other than that people are not very familiar with DM disease from an early age so that the number of sufferers is increasing every year.

DM [6] is a health disorder caused by increased blood sugar levels due to insulin deficiency/insulin resistance and metabolic disorders. DM is a condition in which the sugar content in the blood exceeds normal and tends to be high. Diabetes is a metabolic disease that can affect anyone. In principle, the cause of DM is the disruption of the body's ability to use glucose into cells. The normal body is able to break down the sugars and carbohydrates you eat into a special sugar called glucose. Glucose is fuel for cells in the body. To get glucose into cells, insulin is needed. In people with diabetes, the body does not have insulin (Type 1) diabetes [7] or the insulin is inadequate (Type 2) [8].

Diabetes treatment can be done based on the type of DM. Treatment of type 1 DM is usually by administering insulin, by injection through the

skin into fat tissue (usually in abdominal fat tissue) or oral antidiabetic drugs. Type 2 diabetes can be controlled with weight management, nutrition, and exercise [9], [10], [11]. Usually, this type develops more rapidly, so anti-diabetic drugs are often needed.

However, only few DM sufferers dare to consult or complain if they do not understand and there are problems during the examination or control. Whereas. Complaint management is important for a health institution because through patient complaints it can be used as information to improve the quality of health services provided. Based on the Law of the Republic of Indonesia No. 25 of 2009 concerning Public Services [12], the government in this case the service provider bureaucracy has an obligation to develop service management [13] which is able to guarantee all citizens be able to access public services without exception.

According to [14] that complaint management is a stage of how to the receiver, process, respond and report complaints and use them to improve services and decision making. While the indicators used to see complaint management in order to produce customer satisfaction with handling complaints according to Davidow [15], there are six dimensions, namely: Timeliness, facilitation, redress, apology, credibility, and attentiveness.

Another thing that the government needs to do in controlling the number of people with DM is monitoring. According to Hayurani H, Hartanti FD [16], the patient monitoring and controlling system are able to produce information about endemic diseases, see the spread of patients and health-care facilities through location maps, view patient visualization charts, as well as complete data collection such as patient data, hospitals, health centers, medical centers, doctors, and drugstore.

Based on the results of the research conducted, a website-based e-health service system is needed that can help and educate [17], [18] DM patients about DM disease, its symptoms, and how to treat it, patients can also control [19] by how to conduct consultations and web-based online questions and answers [20], [21] without having to pay for a consultation or monitoring [22], [23], [24] of the illness so that preventive measures can be taken. With this system, it is expected to be able to provide online services, education, and prevention and reduce DM sufferers in Pekalongan City.

Methods

The research was conducted using the research and development method [25] so as to be able to produce certain products and test the effectiveness

of these products. The design development procedures carried out in this study are as shown in Figure 1.

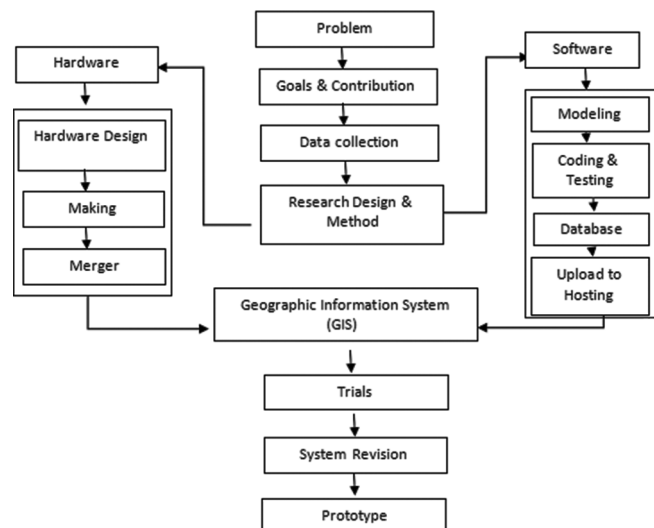


Figure 1: Research and development research design research

Research stages

Survey and data collection

Data collection methods used in this study include: (1) Observation, namely, by collecting data and information on sufferers and their distribution of DM in the city of Pekalongan through the City Health Office. (2) Interview, namely through question and answer activities (interviews) with health consultants consisting of doctors, psychologists, nurses, pharmacies, and others so that they can provide data and information about DM as well as ask for their willingness to be an online consultant for DM sufferers and the community. (3) Sampling, namely, collecting data and information by taking samples in 4 sub-districts in Pekalongan and conducting questions and answers directly to DM sufferers.

Sample was carried out by purposive sampling with consideration of initial studies or assessments. In addition, this research takes into consideration the benefits and knowledge of respondents about DM and information technology into consideration. Respondents' criteria include: (1) DM patients who are registered at the Pekalongan City Health Office with complete addresses, (2) Minimum education of Undergraduate background, (3) Enable to operate mobile communication and Information technology and (4) willing to become respondents.

Data processing

The data that have been obtained are then processed and stored in a MySQL database, the goal is to make a description of the data that have been obtained and display it in a good form, namely in the form of descriptions, images, videos, from, and statistics so that people can more easily get an overview of DM at once. Conduct consultation and monitoring.

Software development

The software development [23] used in this study refers to the method of developing a multimedia system with the following stages: (1) Communication: At this stage, communication will be carried out with a Health consultant who will provide a detailed description of DM disease and the application needs to be developed. (2) Planning (Estimating, Scheduling, and Tracking): This is the planning stage that explains the estimation of technical tasks to be carried out, the risks that can occur, the resources needed to create the system, the work products to be produced, and the work scheduled to be performed. Will be implemented, and tracking the process of working on the system. (3) Modeling: This modeling process will translate the requirements into a software design that can be estimated before coding is made. This process focuses on data structure design, software architecture, interface representation, and procedural (algorithm) details. This stage will produce a document called software requirements. (4) Construction: This is the process of making coding or coding. It is the translation of a design into a computer-recognizable language. The software used is PHP, Mysql, Bootstrap, Framework. This stage is a real stage in working on software. (5) Deployment: This stage is the last in software development. After conducting communication, analysis, design, and coding, the finished system is used by the user. Then the software that has been made must be maintained regularly. This stage will produce a document called software requirements. (4) Construction: This is the process of making coding or coding. It is the translation of a design into a computer-recognizable language. The software used is PHP, Mysql, Bootstrap, and Framework. This stage is a real stage in working on software (Figures 2-5).

Testing

Testing is done by the black-box testing method. The black-box testing technique allows obtaining a set of input conditions that fully utilizes all the functional requirements for a program. Some types of errors that can be identified are incorrect or missing functions, interface errors, data structure errors (database access), performance errors, and initialization and program end errors [23]. Testing is also carried out by users who are directly related to the system, namely an administrator and a visitor. The administrator also represents the operator of the community health centers or the health office because the administrator has the right to access the operator of the community health centers or the health office.

Results

The data collection process was carried out in this study by conducting interviews with Doctors,

Nurses, Nutritionists, and Psychologists in the city of Pekalongan as well as by conducting a survey to the field by taking data on DM patients through the Health Office in the city of Pekalongan obtained data on the distribution of DM in 2020 as in Table 1.

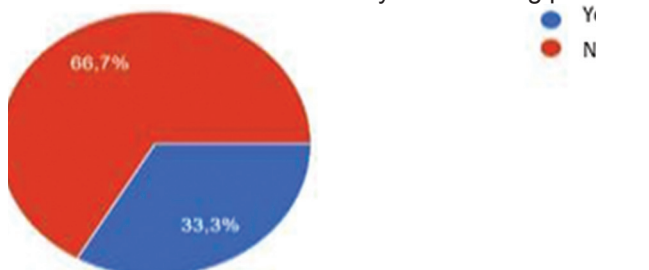
Table 1: Data on diabetes mellitus patients in Pekalongan City in 2020

Community health centers	Type DM		Total
	DM Type-1	DM Type-2	
Bendan	0	2210	2210
Tirto	4	1031	1035
Kramatsari	29	733	762
Medono	0	719	719
Kusumabangsa	6	1294	1300
Dukuh	6	472	478
Krapyak Kidul	0	869	869
Noyontaan	0	1076	1076
Klego	44	959	1003
Tondano	0	745	745
Sokorejo	11	1191	1202
Pekalongan Selatan	0	930	930
Jenggot	0	1015	1015
Buaran	0	823	823
Jumlah	100	12.032	12.132

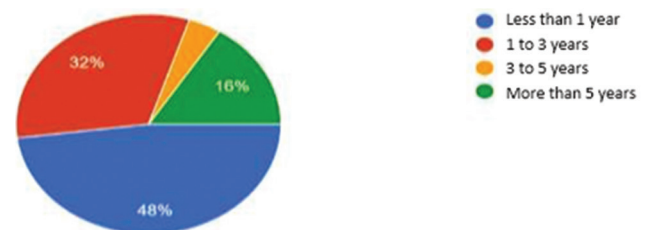
Source: Pekalongan City Health Service Data, 2020. DM: Diabetes mellitus.

The results of the research conducted have produced data obtained by conducting interviews with DM sufferers as many as 40 respondents with several questions including:

1. Based on the source of DM, where the data obtained that 66.7% came from heredity and 33.3% came from lifestyle and eating patterns.



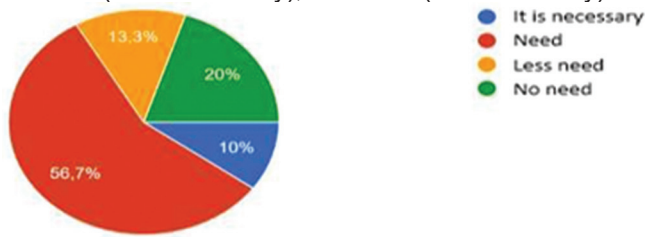
2. Based on the initial time of DM, the data obtained were 48% (< 1 year), 32% (1–3 years), 4% (3–5 years), and 16% (> 5 years).



3. Based on Online Service Needs, where data obtained that 65% (necessary), 10.3% (very necessary), 13.8% (less necessary), and 10.3% (not necessary).



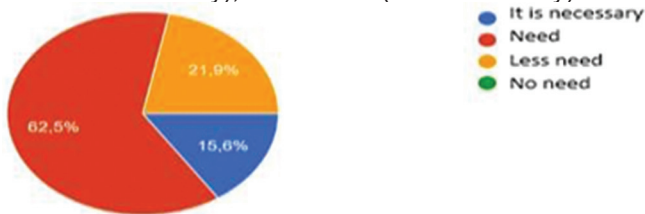
4. Based on the need to conduct online consultations, the data obtained are 56.7% (necessary), 10% (very necessary), 13.3% (less necessary), and 20% (not necessary).



need for the use of information technology in providing services to DM patients, a website-based consultation and monitoring system for DM sufferers is generated with various features, including:

Front end view, this feature displays the features that exist in the system

5. Based on the need to conduct online consultations with health consultants (doctors, nurses, psychologists, pharmacists), data obtained that 62.5% (necessary), 15.6% (very necessary), and 21.9% (less necessary).



Registration

This menu contains the procedures for the user to be able to register/register before holding a consultation with the existing health consultant team according to their needs and monitoring the illness they are suffering from.

Patient profile

This feature contains biodata of patients who have registered, patient profiles are confidential/private and only those who know the username and password and only admins can open and find out the patient's biodata.

Discussion

Based on the results of observations, interviews, and data sampling carried out as well as the

Health consultant team

This feature contains information on existing health workers consisting of doctors, nurses, nutritionists, psychologists. Users can choose who they

The screenshot displays the 'e-Monitoring' website interface. It features a navigation bar with options like 'BERANDA', 'DIABETES MILITUS', 'KONSULTAN KAMI', 'GRAFIK', 'GALERI', 'VIDEO', and 'HUBUNGI KAMI'. The main content area is divided into three sections:

- BAHAN MAKANAN BAGI PENYANDANG DM:** A table listing recommended and non-recommended foods for diabetes patients.
- ANJURAN MAKANAN RATA-RATA SATU HARI ORANG DEWASA MENURUT GOLONGAN UMUR:** A table providing average daily food intake recommendations for different age groups (Laki-laki and Perempuan).
- Kenalilah KENCING MANIS (DIABETES MELLITUS) Sebelum Anda Mengalaminya:** A colorful poster with illustrations of a person eating, drinking, and using a toilet, with text in Indonesian.

This section shows a search bar with the placeholder text 'Masukkan Topic yang anda cari disini...' and a green 'Search' button. Below it is a consultation card titled 'Konsultan Kami' with the following details:

- Pppppppppp, S.Kep, Ns** (Perawat) with email ppppppp@gmail.com
- Dr. Aaaaaaaa** (Dokter Umum) with email aaaaaa@umsl.pnm

Figure 2: The features that exist in the system

Registrasi / Pendaftaran Users

Syarat dan Ketentuan

"Dengan mengisi formulir registrasi ini, Saya menyatakan bersedia berpartisipasi dalam proses konseling & sukarela tanpa ada paksaan dan atau untuk melakukan rangkaian proses konseling psikologis online. Dalam kegiatan ini, Psikolog Klinis berkewajiban menjelaskan :

- 1) Proses rinci tentang kegiatan yang akan dilangsungkan merupakan bagian proses penerapan konseling ;
- 2) Tujuan konseling online ini adalah mengenal lebih dalam klien dengan segala issue yang terkait dengan ;
- 3) Identitas diri akan dirahasiakan dari pihak mana pun juga sesuai dengan kode etik Psikologi."

Nama Lengkap
 No KTP / NIK
 Jenis Kelamin Laki-laki Perempuan
 Tempat Lahir
 Tanggal Lahir
 Status
 Tipe Diabetes
 Alamat
 No Telpun
 Alamat Email
 Keanggotaan BPJS
 Username
 Password
 Confirm Password
 Foto No file chosen
 Allowed file : gif, jpg, png, jpeg

Figure 3: The procedures for the user to be able to register/register before holding a consultation with the existing health consultant team

Profile pasien

PENTING! Pastikan data anda dibawah ini s jawabkan jika nanti ada masalah. Terima k



Username pasien1
 Password xxxxxxxxxxxx
 Nama Depan Wwwwwww
 Nama Belakang
 Alamat Email wwww@gmail.com
 No Telpun 123456789
 Jenis Kelamin xxxxxxxx
 Alamat Lengkap xxxxxxxx
 Tempat Lahir xxxxxxxx
 Tanggal Lahir 00-00-0000
 Status xxxxxxxx
 Agama xxxxxxxx
 Perangkat Daerah

Figure 4: Biodata of patients who have registered

will consult with by selecting/pressing on one of the desired consultant teams.

Apa yang dimaksud dengan Penyakit Diabetes Mellitus ?

Diabetes mellitus (DM) didefinisikan sebagai suatu penyakit atau gangguan metabolisme yang ditandai dengan tingginya kadar gula darah disertai dengan gangguan metabolisme sebagai akibat insufisiensi fungsi insulin. Insufisiensi fungsi insulin dapat disebabkan o produksi insulin oleh sel-sel beta Langerhans kelenjar pankreas, atau disebabkan oleh tubuh terhadap insulin (IMHO)...

Tanda atau gejala apa saja yang perlu diketahui?

Diabetes seringkali muncul tanpa gejala. Namun demikian ada beberapa gejala yang ha kemungkinan diabetes. Gejala tipikal yang sering dirasakan penderita diabetes antara li kecil), polidipsia (sering haus), dan polifagia (banyak makan/ mudah lapar). Selain itu s pengingatan kabur, koordinasi gerak anggota tubuh terganggu, kesemutan pada tangan, seringkali sangat mengganggu...

Apa penyebab Penyakit Diabetes Mellitus

Diabetes Mellitus

Konsultansi Kami

- Pppppppppp, S.Kep, Ns**
Perawat
ppppppp@gmail.com
- Dr. Aaaaaaaa**
Dokter Umum
aaaaa@gmail.com
- Yyyyyyyyyy, SPi, MPSI**
Psikolog
yyyyyy@gmail.com
- Xxxxxxxxxx, SST, MSI**
Ahli Gizi
xxxxx@gmail.com
- Zzzzzzzzzz**
Konsultansi Gizi
zzzzzz@gmail.com

Figure 5: Information on existing health workers

Conclusion

Therefore, with the research carried out, it is necessary to have good communication and cooperation between the Pekalongan city government, stakeholders, and the community, especially patients in addressing the problem of DM, it is hoped that the existence of a web-based health information system (e-health) can provide easy access for sufferers. DM in providing education, consulting, and monitoring services so as to reduce the number of DM sufferers in the city of Pekalongan.

Ethics approval and consent to participate

This research has received a recommendation from the Pekalongan City Regional Development Planning Agency No: 070/280/VII/2921 and received approval from the Health Research Ethics Committee of the University of Pekalongan No: 079/B.02.01/KEPK/VII/2021. In addition, all respondents in this study have expressed informed consent.

Acknowledgments

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Pekalongan University Ethics Committee (UNIKAL) to recommend research this research as well as all respondents who have provided the data.

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