Medical Specialists Information System to Support Decision Making in Establishing Priorities of Financial Aid for Medical Specialist Education Cost in Indonesia

[1]Besral and [2]Yenny Sulistyowati
[1]University of Indonesia, Jakarta, Indonesia
[2]Ministry of Health Republic of Indonesia, Jakarta, Indonesia

Abstract: Medical specialists are distributed unequally in Indonesia. Scholarship Program of Medical Specialist (PPDS) is one way to equal the distribution. This study aims to developed decision support system for medical specialist scholarship and re-placement distribution at the hospital where lack of specialists. The decision support system for medical specialist scholarship and placement distribution was developed by using the System Development Life Cycle (SDLC) Method. This system is a complement of the online registration system for Scholarship Program of Medical Specialist (PPDS). The determination of the list of the hospital where lack of specialists and available scholarship program of medical specialist are displayed in the online registration form option. The result of this study is a database of medical specialist needs in Indonesian government hospitals in year 2013 as many as 3,888 medical specialists. High priority provinces for medical specialist are Maluku, Bengkulu, Maluku Utara, Nusa Tenggara Timur, Sulawesi Barat and Kalimantan Selatan. Advised to a prospective medical specialist for immediate access this system to know a kind of specialization and hospitals that lack of medical specialist then register as soon as possible.

Key words: Information system, decision support systems, medical specialists, determination, Maluku Utara

INTRODUCTION

Human resources is a major component in a country's health system. Without human resources as motor, the other components of National Health System (SKN) are unable to function, vice versa. In year 2012, SKN focused on development and utilitation of healt human resources to guarantee availability and distribution of health human resources.

The government has the authority of distribution and placement of health workers as stated in Health Law Number 36 year 2009. The problem is unequal distribution. Medical specialists are part of very limited and sparsely distributed health workers. According to the registry of Indonesian Medical Council (KKI) in 2011 there were 19.841 medical specialists in Indonesia but 70% of them were in Java Island whereas only 15% in Eastern Indonesia, especially in relatively richer provinces like Sulawesi Selatan, Bali, Kalimantan Timur and Sulawesi Utara.

On 2008, the Health Minister made Health Minister Regulation Number 535/MENKES/PER/VI/2008 about Education Program of Medical and Dental Specialists (PPDS and PPDGS) to accelerate improvement of specialist quality. The program aimed to fulfil the need for medical and dental specialists in government hospitals. In 2007, there were only 5.050 specialists. In Strategic Plan 2010-2014 Ministry of Health decide to add and improve human resources in Indonesian health facilities by improving their ability through continuous education in the form of PPDS and PPDGS.

An indicator of success of PPDS and PPDGS programs is budget spent in aiding to finance PPDS and PPDGS each year for 1.040 doctors and dentists but unfortunately the target is not yet achieved. All of motivation, organizational support and development of the health system by District Health Committee affected the development at the "high" level (Pengwichaianad and Bouphan, 2014). About <75% passed administration requirements due to lack of information socialization about the need of medical specialists to all potential PPDS candidates in Indonesia. Many of them do not know which hospitals need medical specialists.

That is why, we need to develop decision support system to assist us to count how many medical specialists needed and to decide on Health Ministry of Indonesia's priorities in financial assistance for medical specialists education cost that in turn may aid potential PPDS candidates in deciding which hospital location and which medical specialistics to choose in order for the health ministry may contribute in financial aid.

Corresponding Author: Besral, University of Indonesia, Jakarta, Indonesia

This research is aimed at developing decision support system to establish Health Ministry of Indonesia's priorities of financial aid for medical specialist education cost based on which specialty is needed in hospitals and how many. Another goal of this research it to identify medical specialists needed by province by municipality and by hospital in turn we can identify priority province that lacks medical specialists.

Medical specialists are medical doctors that have undergone medical specialist education program. In Indonesia, there are >30 specialty. Medical specialists will work in secondary and tertiary health services in hospitals. Medical Specialist Education Program (PPDS) is an education program to train doctors and dentists to be specialists. The duration varies with average 8 semesters. The program is available in medical faculties in state universities in cooperation with teaching hospitals.

Decision Support System (DSS) has a very important role to assist in decision making process in an organization. The decision makers must be supported by correct and recent data to make strategic decisions. DSS is defined as an information system to assist mid level managers in semi-structured decision making to be more effective by using available data analysis models.

MATERIALS AND METHODS

System development methode use incremental and itterative system prototyping model of System Development Life Cycle (SDLC) Method by using qualitative study methode through intense interviews with management levels, data processing level and end user level. According to Valacich *et al.* (2011) SDLC framework is the most common system applied in information system development. The steps in SDLC are planning and selection, analysis, design and implementation and SDLC operation.

System design is done by integrating host to host between databases. The system is a complement of existing online PPDS registration system. Program model used is PHP with MySql database system. System development consists of four stages, i.e., planning, analysis, design and implementation.

Calculation of medical specialists needed is based on standards of basic and supporting medical specialists in general hospitals in Indonesia according to hospital classification mentioned in Indonesian Health Minister Regulation number 340/MENKES/PER/III/2010 about hospital classification. Example of calculation of basic medical specialist are as shown in Table 1.

Table 1: Minimum [**]number of basic specialist needed according to type of hospital

Basic specialist type	Hospital type			
	A	B	C	D
Internist	6	3	2	1[*]
Pediatrics	6	3	2	1[*]
Surgery	6	3	2	1[*]
Obstetricts and ginecology	6	3	2	1[*]

[*] At least 2 out of 4 type of specialist available; [**] Example limited only for 4 basic specialist

RESULTS AND DISCUSSION

Health ministry's health human resources continuous education program is managed by Pustanserdik SDMK, according to health minister's decision number 1144 year 2010. Considering Indonesia has a vast area the education management needs interconnected network support from each element to synchronize and harmonize continuous education aid program, especially coordination between central government and provincial government to run an effective and efficient program. To help in understanding the existing system, the will explain it in Fig. 1.

Figure 1 describes online PPDS registration. The actors are website administrator, Pusat BPPSDMK administrator, province health department administrator, medical and/or dental faculty administrator, applicant and participant. An applicant registers online during registration period, then system administrator sends user ID and password to the applicant's email in order for the applicant to login to a private page (3.a). In the private page, applicant will fill the Consorsium Health Science (CHS) form (3). After the required data are submitted, the system will confirm whether the data is complete. Then the applicant print the documents from the system and send the printout to the committee in the local province health department.

Province administrator verifies applicant's data by comparing printout with data on system. If everything is confirmed the applicant passes province administration requirements (4). Verified printout is sent to central committee in BPPSDMK kemenkes.

Central administrator re-verify the applicant's data by comparing province verified data with the data available in the system and other requirements as witten in ministry of health's regulations. If the data checks out, the applicant passes central administration verification. If the applicant passes academic test, he or she become a participant of medical and dental specialist education financial aid program (5 and 6).

The participant login to participant private page and renew supporting data required by the central committee to cash in financial aid, e.g., bank account number and confirmation from central committee secretariat (7.a).
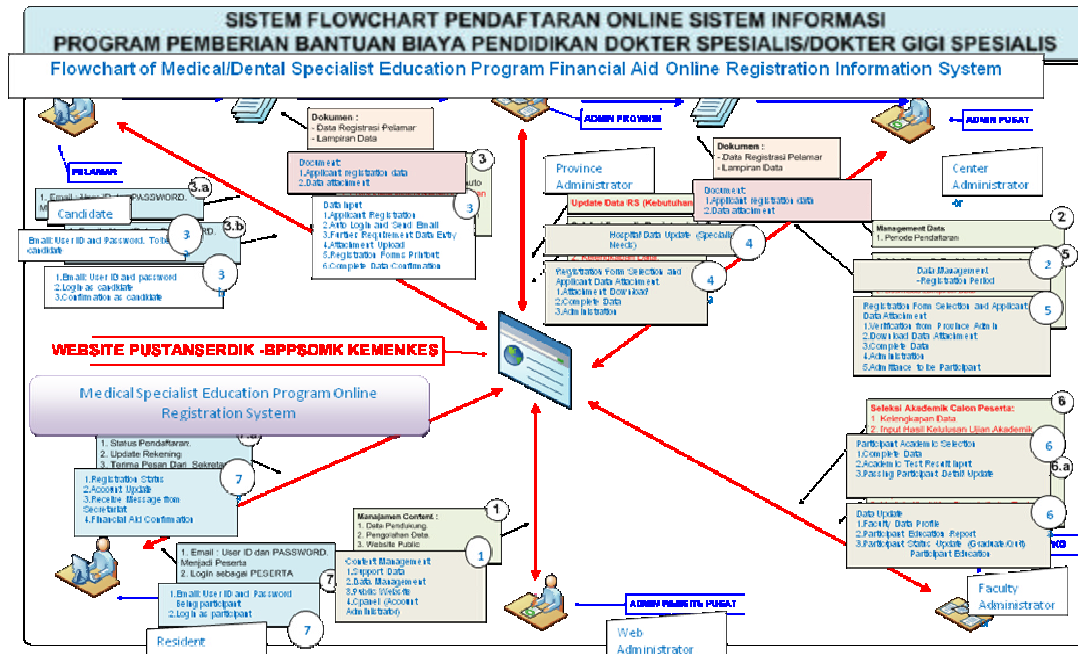
Fig. 1: Online PPDS registration process

Medical specialist planning is one of the tasks of Center of Planning and Utilitzation of Health Human Resources (Pusren-Gun SDM Kes). Before the system is developed, these information was not yet effectively used by users. This system will integrate it with online PPDS registration system in order for the candidates to choose their specialisation and the ministry of health will be able to monitor the specialist program graduates to ensure hospitals' need of medical specialists is fulfilled.

System design is aimed to fulfil system users' needs and give clear description and framework to all stakeholders. Medical specialist information system is a decision support system to establish priorities of financial aid for medical specialist education cost in Indonesia.

According to Jogiyanto, decision support system defined as an information system to assist midlevel manager to more effectively process structured decision making by using analytic models and available data. Generally, the aim of DSS are as follows:

- Assist midlevel manager in decision making
- Assist or support without replacing decision making management
- Improve effectivity of management decision making

In medical specialist information system there are two source entities that are center of planning and utilitzation of health human resources (Pusren-Gun SDM Kes) and center of standardization, certification and continuing education of health human resources (Pustanserdik SDM Kes). Pusren-Gun SDM Kes supply the data of total medical specialists available and their specialties, hospital classifications according to Minister of Health's Regulation number 340 year 2010 and data of hospitals in each municipality/town. Pustanserdik SDM Kes supply personal data of PPDS participants and graduates. The system user is top manager in Pusrengun SDM Kes and Pustanserdik SDM Kes and PPDS candidates as seen on Fig. 2.

A benefit of computerized information system is the availability of database which is a group of data interconnected and commonly saved in certain media in order for easy reuse and can be used by >1 application program without interdependency to each other.

Medical specialists information system is web based and sent to users through the world wide web by using web browser or web based software. Programming language used is PHP language that may connect ot MySQL database. Data input may be done through interface to save the data in database and at the same time will show the desired display.

Output design of medical specialists information system consists of public area and executive port that may be accessed only by users with ID and password. In public area, the menu has home, announcement, law and regulations, dashboard and reports by system, i.e:
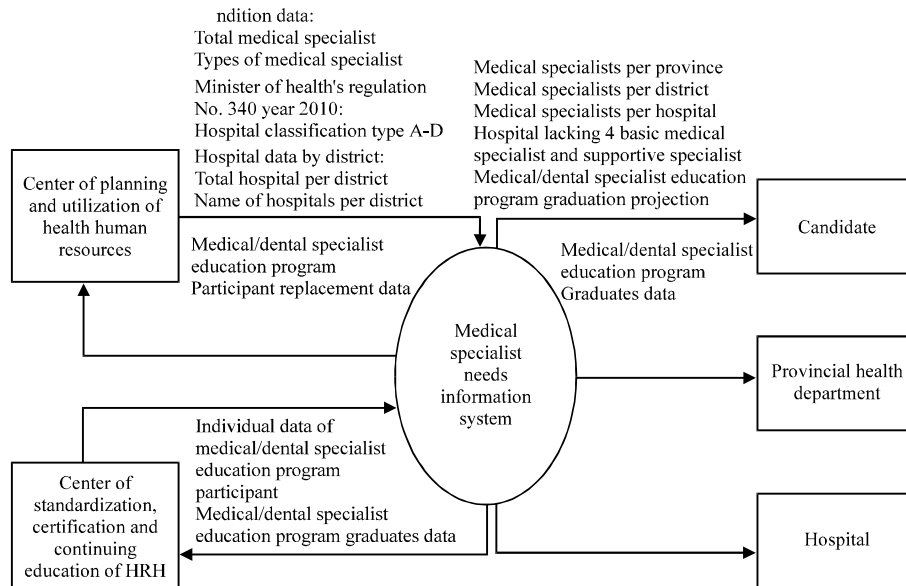
Fig. 2: Medical specialists information system context diagram

Table 2: Medical specialists needs by province in 2013

Provinces	Standard	Available	Needs (n)	Needs (%)
Jawa Timur	1260	844	416	33.0
Jawa Barat	928	608	320	34.5
Jawa Tengah	980	696	284	29.0
Sumatera Utara	612	361	251	41.0
Sulawesi Selatan	560	348	212	37.9
DKI Jakarta	600	409	191	31.8
Kalimantan Timur	308	172	136	44.2
Sumatera Selatan	344	209	135	39.2
Nanggroe Aceh Darussalam	372	242	130	34.9
Nusa Tenggara Timur	200	76	124	62.0
Kalimantan Selatan	240	117	123	51.3
Sumatera Barat	276	170	106	38.4
Papua	212	112	100	47.2
Bali	252	156	96	38.1
Kalimantan Barat	196	104	92	46.9
Riau	244	154	90	36.9
Maluku	132	44	88	66.7
Pusat	136	48	88	64.7
Sulawesi Utara	176	92	84	47.7
D.I. Yogyakarta	220	138	82	37.3
Banten	228	146	82	36.0
Bengkulu	124	44	80	64.5
Sulawesi Tenggara	136	70	66	48.5
Sulawesi Tengah	160	101	59	36.9
Kepulauan Riau	140	82	58	41.4
Kalimantan Tengah	144	88	56	38.9
Maluku Utara	84	31	53	63.1
Lampung	176	128	48	27.3
Jambi	148	106	42	28.4
Gorontalo	88	52	36	40.9
Nusa Tenggara Barat	124	92	32	25.8
Papua Barat	80	53	27	33.8
Sulawesi Barat	36	15	21	58.3
Kepulauan Bangka Belitung	56	42	14	25.0
Total	9244	6150	3822	38.3

- Specialistics need map
- Total medical specialists needed in each hospital by municipality and province (situation, minimum standard, over and under supply)

Table 3: Medical specialists needed by hospital type in 2013

Medical specialists	Type of hospitals				
	A	B	C	D	Total
No. of hospital	33	174	344	313	864
Basic specialist	312	494	992	649	2447
Additional specialist	132	534	709	NA	1375
Total	444	1028	1701	649	3822

NA = Not Applicable

- The hospitals that lack basic and supporting medical specialists
- Graduates data and their locations (those who received education financial aid)
- Graduation projection
- Priority provinces to receive medical specialists education financial aid

The need of medical specialists by province: In year 2013, there is a deficit of 3.822 medical specialists. Provinces with the most needs (over 100 medical specialists) are Jawa Timur, Jawa Barat, Jawa Tengah, Sumatera Utara, Sulawesi Selatan, DKI Jakarta, Kalimantan Timur, Sumatera Selatan, Nanggroe Aceh Darussalam, Nusa Tenggara Timur, Kalimantan Selatan, Sumatera Barat and Papua as seen on Table 2.

Medical specialists needs can also see by hospital type. Class C hospitals lack most medical specialists (1701 doctors) followed by class B hospitals (1028 doctors) as seen on Table 3.

Statistics of medical specialists needed can be seen in each level; nationally by province by municipality/town and hospital. For example on Table 4 (H). Boejasin

Table 4: The needs of medical specialists in H. Boejasin Pelaihari General Hospital (RSUD H Boesasin Pelaihari; Kode RS: 6301013; Kelas RS: C; TT: 140 BOR: 69, 93)

| Pelayanan spesialistik	Standar	Tersedia	Kurang	Lebih	Keterangan
Ilmu Bedah (sp. B)	2	1	1	0	1 org PPDS angk 2009, IUIUS 2014
Ilmu Kesehatan Anak (sp. A)	2	1	1	0	1 org PPDS angk 2010, IUIUS 2014
Ilmu Penyakit Dalam (sp. PD)	2	1	1	0	
Obstetri dan Ginekologi (sp. OG)	2	2	0	0	
Anestesiologi (sp. An)	1	0	1	0	
Patology Klinik (sp. PK)	1	0	1	0	
Radiology (sp. Rad)	1	0	1	0	
Rehabilitasi Medik (sp. RM)	1	0	1	0	
Ilmu Kesehatan THI (sp. THT)	0	0	0	0	
Ilmu Penyakit Jantung (sp. JP)	0	0	0	0	
Ilmu Penyakit Mata (sp. M)	0	0	0	0	
Ilmu Penyakit Paru (sp. P)	0	0	0	0	
Ilmu Penyakit Saraf (sp. S)	0	0	0	0	
Patologi Anatomi (sp. PA)	0	0	0	0	
Psikiatri (sp. KJ)	0	0	0	0	
Jumlah	12	5	7	0	
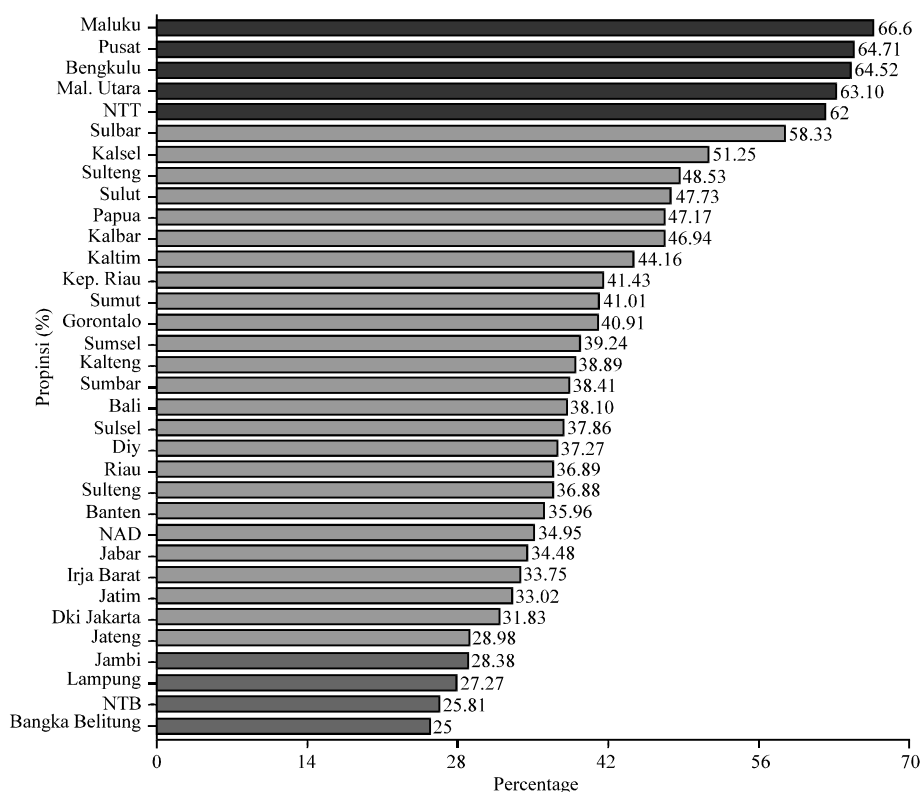
Fig. 3: Priority provinces that lack medical specialists

Pelaihari hospital in Tanah Laut Municipality, Kalimantan Selatan Province, needs 7 specialists, i.e., surgery, pediatrics, internal medicine, anesthesiology, clinical patology, medical record and radiology. In description, column written that for surgery and pediatrics specialists, each one person, there are already candidates for that position. The candidates are undergoing PPDS program and projected to graduate in 2014. It means when they graduates in 2014 the needs for surgery and pediatrics specialists will be fulfilled.

Deciding priority province: Province priority is based on the most deficiency of medical specialists compared to minimum standard. Percentage of deficiency in one province is deficiency divided with minimun standard times 100%. The results can be seen on Fig. 3.

Priority provinces that lack medical specialists display the areas with the most deficiency of medical specialists. The information can be used by PPDS candidates to decide replacement location of PPDS

graduates and elevate their chances of receiving financial aid from the ministry of health. According to medical specialists data in 2013 the priority provinces for medical specialists replacement with >50% deficiency are: Maluku, hospitals of Ministry of Health, Bengkulu, Maluku Utara, Nusa Tenggara Timur, Sulawesi Barat and Kalimantan Selatan.

Financial aid priority is for medical specialists deficient hospitals. The priorities are in descending order:

- Four basic specialties: pediatrics, obstetrics and gynaecolgy, internal medicine and surgery
- Supporting specialties: anaesthesiology, radiology, medical record, clinical pathology and anatomic pathology
- Other specialties are not priorities except on special hospitals, e.g., government orhopedics, mental and lung hospital

On dashboard there is a recapitulation of basic and supporting medical specialists deficient hospitals. The data is in graphic form in order to make the data easier to understand by PPDS candidates that in turn help them in deciding their specialties. Hospitals with the most medical specialists deficiency are on top positions. The candidates are expected to select the most deficient.

Graduation projection: Graduation projection show the prediction of graduates in each year. Input data is from participants of online registratio, consists of enrollment year and standard education program duration for each specialties. They varies according to a standard made by Indonesian Medical Council (KKI).

Graduation projection may predict how many medical specialists will receive financial aid from the ministry of health and the deficiency in the future. This projection is with the assumption all participants graduate on time and exclusive of other factors like study leave, dropping out, transfer, late graduation, etc.

The role of province health department: Deciding the need of medical and dental specialists, beside the need according to hospital classification, the local government must take into consideration:

- Facilities, infrastructure and equipment available for medical specialist service
- Hospital development plan regarding improvement of classification and specialistic services
- Increase of medical specialists workload
- Construction of new hospitals

Province health department contribute in deciding replacement of PPDS graduates. If the graduates are not yet approved by province health department then they may not work in the designated hospitals.

So far there are no system to ensure PPDS graduates to work in the hospitals designated when they first applied. But, now with this decision making system the options are locked so the graduates must work in the designated hospitals.

Nevertheless province health departments have the authority to change the data including replacement data. So, strong commitment is needed from province health department to replace graduates according to needs.

System advantages and disadvantages: The advantages of medical specialists information system to support decision making in establishing priorities of financial aid for medical specialists education cost compared to the old system is this system provide the latest information of medical specialists needs that is renewed automatically by the system. PPDS applicants may find the information of medical specialists needs to assist in choosing their specialties, so they may recieve financial aid for PPDS education program.

The other advantage is that the administrators in province health department and in the ministry of health more easily do the selection process of financial aid recipients. Before, the process was done manually whereas now, it is done by the system. And the top management may know if there is an applicant that does not match the priority.

Province health departments have the authority to change the data including replacement data. So, strong commitment is needed from province health department to replace graduates according to needs. With this system there is a prediction of how many year needed to fulfil medical specialists needs in Indonesia because graduation projections are automatically calculated by the system.

This system complements existing PPDS online registration system, so there is no need for additional budget for operational and maintenance cost. Hardware, software and information system management support are already available. Almost all units are connected to the internet and have adequate computers and printers. According to Dennis *et al.* (2010) technical, economical and organizational feasibilities are important stages in information system development that will decide whether this information system will be able to continue or not.

Beside the advantages mentioned above, there are disadvantages that need to be addressed to get maximum result. One disadvantage is the entities use non standard data code. This information system need to be integrated host to host so data can easily be converted.

The system is designed integrated interentity because according to McLeod (1995) a system is a group of elements integrated to achieve a common goal. If the entities are integrated and use standard data coding then the data will be automatically updated.

CONCLUSION

Medical specialists information system to support decision making in establishing priorities of financial aid for medical specialists education cost is developed. The system complements existing ppds online registration system in order to make it easier in selection and replacement. Hospital and specialties options are displayed on online registration form. The system has database of medical specialists needs in governement hospitals according to types of hospital by province by municipalitiy/town and by hospital. It is calculated that in 2013 there is a deficiency of 3.888 basic and supporting medical specialists. Six provinces with the most deficiency (>50%) are Maluku, Bengkulu, Maluku Utara, Nusa Tenggara Timur, Sulawesi Barat and Kalimantan Selatan.

RECOMMENDATIONS

Considering there are still deficiencies of medical specialists in all provinces of Indonesia, it is suggested to PPDS candidates to access this system online to know which specialities and hospitals that are inadequate and promptly register to receive financial aid from the ministry of health.

This system need to be socialized more in ministry of health, province and municipality/town health departments and government hospitals so the PPDS future candidates may know the procedures and register to receive financial aid.

It is suggested to the ministry of health always update the data and information and integrate host to host in implementation of the system in the field.

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